WASHINGTON

PACIFIC NORTHWEST AGRICULTURAL SAFETY AND HEALTH CENTER

ANNUAL REPORT
FISCAL YEAR 2005

(October 1, 2004 to September 30, 2005)

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Annual Report for Fiscal Year 2005

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I. EXECUTIVE SUMMARY

The Pacific Northwest Agriculture Safety and Health (PNASH) Center serves Alaska, Idaho, Oregon, and Washington in reducing occupational disease and injury among agricultural operators, workers, and their families. In recognition of the importance of all agricultural industries to the Northwest, our scope of work includes farming, fishing, and forestry industries. The PNASH Center's emphasis is on injury and illness prevention and health promotion. Our approach is to:

- Work in partnership with employers, workers, agencies and other research and service organizations
- Develop innovative research and intervention programs to find solutions
- Take solutions to the workplace through training, outreach, and participatory research

Calendar Year 2005 was the fourth year of this five-year program cycle and marked the beginning of three new, two-year, projects.

- **Prevention 2**: An Incentive Intervention Program to Encourage Ergonomic Behavior in Latino Farm Workers
- **Education 3**: Fluorescent Tracer Component for Hands-on Pesticide Handler Training
- **Education 4:** Communication of Pesticide Health Risks for Children of Agricultural Families

Each of these projects saw great progress over the last year in developing initial materials and field-testing with their target audience. The following report describes their accomplishments.

PNASH two five-year research projects continuing for another two years:

- **Research 1**: Identification and Prevention of Injuries in NW Orchards
- **Research 2**: Workplace Determinants of Take Home Pesticide Exposure

These projects are now in their final year. They have accomplished their major aims and work is now being directed at completing data analysis and refining their resulting intervention tools.

The faculty and staff of the PNASH Center are pleased to have fulfilled our Year 4 research, prevention, and education project objectives. Equally, we take pride in the receipt of 7 new project awards and the partnerships we've launched throughout the Northwest, with national agencies and among the agricultural centers.

A. CENTER ACCOMPLISHMENTS FOR FY 2005

1. Development of a "Smart" Orchard Ladder.

R1: Identification and Prevention of Injuries in NW Orchards

The Orchard Injury project has now completed its 4th year and has accomplished most of the intended aims, including the development of an engineering intervention to prevent the most common causes of injuries in the orchard, ladders. The "smart ladder," senses the position, weight, center of gravity and weight shift of the worker. There is now a working model of the invention that PNASH is applying to licensure. Patenting of the ladder will open the ladder to commercial development, which could facilitate its use, beyond its primary purpose for orchard worker training, to other industries.

2. Pesticide Take-Home Pathway Intervention Field-testing and Preliminary Results.

R2: Workplace Determinants of Take Home Pesticide Exposure

This project has now concluded 3 years of consecutive field work and is currently conducting the final analysis to characterize the take home exposure pathway and evaluate interventions to reduce children's exposures to pesticides. This analysis points to results that could prevent pesticides taken home. The following preliminary results were revealed from data compilation and analysis that took place in Year 4.

The 2003 baseline study investigated the concentration of pesticide residues in the commuter vehicles and homes agricultural workers of three occupational groups of agricultural workers, pesticide handlers and apple thinners. Both the handler and thinners had significantly more pesticide residues in house dust than the controls for all three pesticides, except thinners for chlorpyrifos. Pesticide concentrations in house dust were not significantly different between the thinners and applicators. Vehicle dust was found to be a significant predictor of house dust concentrations for all three pesticides and leaving the vehicle window rolled down was found to be a significant predictor of vehicle pesticide concentrations for both azinphosmethyl and phosmet.

The 2004 study developed and tested interventions (work boot storage bin and commute vehicle vacuuming) to minimize the take home of pesticide residues. The first step in analyzing the data was to develop a method to calculate exposure opportunity and a cumulative exposure metric for each subject. This method calculates exposure opportunity based a detailed analysis of orchard records for daily work crew activities and pesticide application, as well as, published data on the transfer of pesticides, apple orchard workers and dislodgeable foliar residues. A non-parametric analysis of the cumulative exposure metric showed that for azinphosmethyl both intervention groups were not different from the control group for phosmet the boot bin group intervention was different from the control and for chlorpyrifos both interventions were different

from the controls. As exposure opportunity can impact the take home exposure, the individual exposure metrics are now being incorporated into further analysis of the intervention effectiveness.

In June and July 2005, the vehicle vacuuming intervention was tested with agricultural workers who were picking cherries. At the end of the study period, each subject was interviewed and a vehicle and house dust sample was collected. This year, the workers' only exposure opportunity for azinphosmethyl was during cherry picking. In addition to the potential for a more consistent exposure opportunity amongst the study participants, exposure opportunity will be calculated based on the cherry leaf dislodgeable foliar residues collected during the study. We also piloted an investigation into the commute vehicle as a vector for the movement of pesticides residues from orchard to home using surface wipe samples from vehicle windows and investigated pesticide exposure to children of study subjects based on hand wipe samples.

3. Fluorescent Tracer Hands-on Training for Pesticide Applicators.
Edu3: Fluorescent Tracer Component for Hands-on Pesticide Handler Training
This project transfers a research tool used to assess dermal exposure during pesticide handling to a tool for training pesticide handlers. The dramatic visualization of the fluorescent tracer (FT) demonstrates 'contamination' during training and gives handlers insight as to where and how pesticide contamination occurs. At the end of FY 2005, a draft of the FT training curricula (Spanish) was in-use with the Washington State Department of Agriculture's (WSDA) Hands-on Pesticide Training program. This program trains approximately 200 Hispanic pesticide handlers each year. In addition, elements of the training (i.e., PPE decontamination) are used in other educational presentations such as at pesticide recertification classes and industry events.

4. First Annual Ag Safety Day.
Agricultural Communication, Outreach and Education Program.
In Year 4, PNASH brokered a new event, the annual Ag Safety Day. Ag Safety Day is a Washington Governor’s Safety and Health Conference that is primarily hosted by the Washington State Department of Labor and Industries. PNASH served as co-sponsor along with other regional organizations such as the Washington Farm Bureau, Washington State University, and the Washington Department of Agriculture.

Ag Safety Day provides agricultural employers and their workers with a one-day forum to review, discuss, and educate each other on safety and health issues in the Northwest. Sessions are held in both Spanish and English. Ag Safety Day is an ideal venue to transfer PNASH research findings to an audience that can implement our education and prevention strategies.

The first annual Ag Safety Day was held in Yakima, Washington, on March 9, 2005. 227 producers at management and supervisory levels were trained in routes of pesticide

exposure, pesticide decontamination strategies and the Washington State Cholinesterase Monitoring Rule. Much of the information presented drew from the research and expertise of faculty from the PNASH Center. Attendees included: growers, industry representatives, farm workers, applicators, handlers, and health and safety professionals.

PNASH presence and participation at Ag Safety Day improved cooperation, collaborative effort, and understanding between researchers and the agricultural community, and fortified grower and applicator knowledge of the benefits of cholinesterase monitoring.

5. New Partnerships.

In review of Year 4 PNASH accomplishments, standout achievements were the working partnerships between PNASH with extensions, government agencies, employers, worker organizations, health care providers, and other researchers. Across projects a spirit of collaboration is seen at a level where partners significantly contributed to the development and implementation of the project. We have learned through participatory research models used in some of our community-based projects, that active participation of key partners improves the final product and can further the placement of educational and intervention tools in the hands of educators, employers, health care providers and workers. (See section VI: Collaboration).

6. New Project Awards.

A variety of new projects were awarded funds in Year 4:

- (WA State, 2-year) Fluorescent Tracer Technique for Hands-on Pesticide Applicator Training: Development and Evaluation.
- (WA State, 2-year) Communication of Pesticide Health Risks to Ag Producers, Workers and their Families.
- (WA State, 2-year) Improving and Simplifying Cholinesterase Monitoring in Washington State.
- (EPA, 5-year) Pesticide Effects: Integration into Health Care Provider Curricula.
- (NIH through ID Mountain States Group, 4-year) Idaho Partnership for Hispanic Health.
- (NIOSH through ERC, 1-year) Identification of Risk Factors from Pesticide Over-exposure among applicators in Washington State.
- (NIOSH through ERC, 1-year) Evaluation of Vehicle Vacuuming Intervention for cherry Pickers Workplace Exposure Determinants of Take Home Exposure.
- (NIOSH, 1-year) Automating Work Exposure Questionnaire for Subjects with Low Literacy Skills.
- (NIOSH, 1-year) NIOSH Agricultural Center Tractor Safety Initiative: Communications for Partnerships and Promotion.

B. REGIONAL ACTIVITIES

1. States Served by Center:

Alaska, Idaho, Oregon, Washington

2. States with Center Activity for FY 2005:

Alaska, Idaho, Oregon, Washington

II. REPORT ON THE OUTREACH PROGRAM

The PNASH Center outreach program was originally conducted through the 3-year project, Educ1: Agricultural Health and Safety Communication and Education. In Years 4 and 5, these activities are continued under the Agricultural Communication, Outreach, and Education Program (ACOEP).

This project has an overall goal to develop, disseminate, and evaluate agricultural safety and health information to agricultural workers, their families, and others in professions who work with this topic. Information was selected from Center research, prevention and intervention, and education and outreach projects, as well as materials generated on a national level. Specific aims include:
Aim 1. Partner with the Agricultural Health and Safety Center at UC Davis to sponsor an annual Western Regional Conference
Aim 2. Conduct workshops based on the research priorities established in the Center's Hazard Priority Ranking process for northwest farming and forestry
Aim 3. Provide professional education in collaboration with the University of Washington's Northwest Center for Occupational Health
Aim 4. Maintain and revise the PNASH Web page
Aim 5. Disseminate information, including professional and non-professional presentations, newsletters, and other informational materials

PROJECT ACTIVITIES / ACCOMPLISHMENTS
Following are PNASH's activities and accomplishments under each of the project's stated aims.

Aim 1. Partner with the Agricultural Health and Safety Center at UC Davis to sponsor an annual Western Regional Conference.
PNASH continues its partnership with the UC Davis Western Center. In Fall of 2004 the planning committee began program development for the September 2005 Western Agricultural Safety and Health Conference. On announcement of NIOSH's intention for the Ag Centers' competitive renewal to be due in September 2005, it was decided to postpone the conference for one year. Also, in Fall of 2004, proceedings were distributed by the PNASH Center for the September 2004 conference, Cultivating a Sustainable Agricultural Workplace.

The September 2005 conference theme was selected, Research to Practice (r2p). A draft agenda was developed by the planning committee and a conference grant application was submitted by the Western Center and resulted in an award. Further development of the program is currently underway.

Aim 2. Conduct workshops based on the research priorities established in the Center's Hazard Priority Ranking process for northwest farming and forestry.

On July 7, 2005 PNASH hosted a meeting of regional stakeholder advisors. The goal of the stakeholder meeting was to gather ideas and information from advisors for planning and development of communication and outreach strategies, and research and prevention activities. The meeting agenda contained 1) overview of the role of a PNASH advisor, 2) new project updates, 3) a facilitated review of the Center's Web site, and 4) an overview of the upcoming Center renewal and discussion on priority topics for our renewal application proposals.

The attendee roster included: growers, owners, worker advocates, labor representatives, and health care providers. The meeting created an open forum for stakeholders to express concerns on specific hazard areas in agriculture. Their input was gathered and noted for integration and implementation into future projects.

Aim 3. Provide professional education in collaboration with the University of Washington's Northwest Center for Occupational Health

In Year 4, PNASH brokered a new event, the annual Ag Safety Day. Ag Safety Day is a Washington Governor's Safety and Health Conference that is primarily hosted by the Washington State Department of Labor and Industries. PNASH served as co-sponsor along with other regional organizations such as the Washington Farm Bureau, Washington State University, and the Washington Department of Agriculture.

This annual event was the result of PNASH's concern that the general industry event, Washington Governor's Safety and Health Conference, did not adequately engage or address the agricultural industry. In a partnership with agricultural industry leaders a new event was proposed to the Washington State Department of Labor and Industries.

Ag Safety Day provides agricultural employers and their workers with a one-day forum to review, discuss, and educate each other on safety and health issues in the Northwest. Sessions are held in both Spanish and English. Ag Safety Day is an ideal venue to transfer PNASH research findings to an audience that can implement our education and prevention strategies.

The first annual Ag Safety Day was held in Yakima, Washington, on March 9, 2005. 227 producers at management and supervisory levels were trained in routes of pesticide exposure, pesticide decontamination strategies and the Washington State Cholinesterase Monitoring Rule. Much of the information presented was drawn from the research and expertise of faculty from the PNASH Center. Attendees included: growers, industry representatives, farm workers, applicators, handlers, and health and safety professionals. In recognition of the education value of the conference, participants received a certificate of completion and professional credit for 1) Pesticide Recertification, 2) Industrial Hygiene, 3) Sanitarians, 4) Safety, 5) Nursing, and 6) Medicine.

The specific roles of the PNASH Center were: 1) Helen Murphy, PNASH Center Outreach Director, was a member of the planning committee; 2) Matt Keifer, PNASH Co-Director,

presented on cholinesterase monitoring; 3) Other key faculty, staff and students were in attendance; 4) PNASH displayed an educational booth and distributed health and safety materials.

PNASH presence and participation at Ag Safety Day improved cooperation, collaborative effort, and understanding between researchers and the agricultural community and fortified grower and applicator knowledge of the benefits of cholinesterase monitoring.

Aim 4. Maintain and revise Center Web page
PNASH Web site: http://depts.washington.edu/pnash/.

The PNASH Center web site has seen increased use in the past year. The site averages 866 visits per month. US commercial, independents, and US educational made a strong show as the main source of users. Interest was focused on the PNASH educational and research pages as well as materials gathered through outreach activities such as the proceedings from Western Regional Agriculture Safety and Health Conference: Cultivating a Sustainable Agricultural Workplace, a National Agricultural Tractor Safety Initiative resource page, and the PNASH Center Forestland Worker newsletter. Updates to the site include new Spanish language resources, government and industry related links, updated project information, and access to research article abstracts.

The PNASH Centers graphic resources library has expanded to include detailed digital photographs from the Workplace Determinants of Take Home Pesticide Exposure, Fluorescent Tracer Component for Hands-on Pesticide Handler Training and Evaluation, Identification and Prevention of Injuries in Northwest Orchards projects, and regional agricultural landscape shots from the Yakima Valley. Illustrations were developed for semi-literate individuals on the Children's Pesticide Exposure and Take Home Pesticide Exposure projects to explain results and preventions and for use in pesticide exposure questionnaires. Scientific posters were created to educate and inform the public during various meetings and conferences.

Aim 5. Disseminate information, including professional and non-professional presentations, newsletters, and other informational materials.
Educational information was disseminated primarily through presentations, educational exhibits, newsletters, article placement and direct mailings in response to inquiries. In 2005 PNASH refined its outreach information dissemination strategy in terms of target audience, material format, and dissemination routes. A newly funded education project starting in Year 4 should further define the information sources used by agricultural employers and workers.

Major events are an important route for information dissemination. In 2005, PNASH faculty and staff presented as speakers, poster presenters and through educational displays at:

- Ag Expo
- Western Migrant Stream Forum, January 27-29, 2005.
- Ag Safety Day

The PNASH Center's primary newsletters include the quarterly dissemination of the NIOSH Ag Centers' *Ag Connections* with inserts specific to PNASH and the annual distribution of the *Northwest Forestland Worker Safety* newsletter. For each issue of *Ag Connections*, PNASH contributes an article related to the theme of the newsletter. In addition, we insert a page with information specific to the PNASH Center and region. *Ag Connections* is directly distributed to over 500 key Northwest stakeholders, this database of contacts is updated quarterly. In Year 4, 77 new key stakeholders were added to the contact database.

In January 2005, the *Northwest Forestland Worker Safety* newsletter was sent to over 400 key players in safety and logging in the Northwest. We developed educational articles on the new Danger Tree Guidelines, dangers of treating stumps with herbicides, a new climbing saddle, and changes in wildland firefighting regulations. In addition, the newsletter shared recent activities in the region, injury and fatality statistics, and a calendar of upcoming safety events.

In September of 2005, we submitted PNASH-developed educational materials to the National Agricultural Safety Database. All 15 submissions were accepted and are currently ported. These include:
Conferences Proceedings:
- Cultivating a Sustainable Agricultural Workplace, September 12 - 14, 2004, McMenamins Edgefield Troutdale, Oregon.
- Pesticide Safety, Health, and Medicine, February 19, 2004, Yakima, WA.

Fact Sheets/Booklets:
- Body Map: Signs and Symptoms of Pesticide Poisoning (English and Spanish).
- Cholinesterase Monitoring - The Basics.
- Icons Help Determine More Accurate Worker History.
- Musculoskeletal Risk in Packing Houses.
- National Agricultural Tractor Safety Initiative.
- Occupational Research Agenda for Northwest Forestlands.
- 2005 Forest Worker Safety Review.
- Occupational Research Agenda for Northwest Farming.
- Organophosphate-Carbamate Disruption of electrical Nerve Impulse Transmission (English and Spanish).
- Organophosphates and the Risk Cup.
- Pesticide Exposure and Children.
- Protecting our Children from Pesticides.
- Protecting Yourself and Your Workers from Poison Oak and Ivy (booklet and poster in English and Spanish).

The staff of the communication and education project also assisted project investigators with the dissemination of information on their project and products—these are listed in the report on these projects. For specific listings of this education project's presentations, materials, meetings, displays and other information dissemination products, see the products section below.

PROGRAM PRODUCTS

1. Presentations:

Fenske R, Murphy H. Pacific Northwest Agricultural Safety and Health Center. Washington State University Extension Administration, Pullman, Washington, December 2004.

Murphy H, Borges O. Presented a training session on signs and symptoms of pesticide poisoning, Western Migrant Stream Forum, San Diego, January 27-29, 2005.

Keifer M. Running a Cholinesterase Program: The Biology and Physiology of Cholinesterase (Spanish and English). Ag Safety Day, Yakima, Washington, March 9, 2005.

Murphy H. Best Practices in Outreach to Special Populations. Alaska Primary Care Association Conference, Anchorage, Alaska, May 24-25, 2005.

2. Publications

c. Fact Sheets / Brochures / Technical Publications:

Fact sheet: Pesticide Signs and Symptoms Body Chart (English and Spanish).

Fact sheet: Current Projects (revision 6/05).

Fact sheet: Bridging the Literacy Divide.

Research Summary: Children's Exposure to Pesticides through their Diets. (English and Spanish).

d. Other Publications:

Web site: Pacific Northwest Agricultural Safety and Health Center, http://depts.washington.edu/pnash/.

Web site: Environmental Justice, at http://depts.washington.edu/envhlth/.

Power Point Presentation: Developing Outreach Materials for Semi-Literate Populations, http://depts.washington.edu/pnash/literacy.php.

3. Education / Training / Outreach

b. Short Courses:

Ag Safety Day, Yakima, Washington, March 9, 2004.

c. Hazard Surveys / Consultations:

Consultations

Murphy H. Conducted phone meetings with key stakeholders and agencies (bi-monthly).

Murphy H. Consulted with the Washington Department of Health on new pesticide website.

Murphy H. Consulted with the Food Justice Alliance and Bellingham to help them develop a community based farm worker survey, Bellingham, Washington.

Murphy H. Consulted with Washington State University and Washington State Depart. of Agriculture on an evaluation program for hands-on pesticide applicator training program.

Murphy H, Negrete M. Farmworker Health Outreach Seminars to meet local promotoras and start the development of a network, Pasco, Washington.

Negrete M. UW Community Partnership Advisory Board – Yakima Region (bi-annual).

Hazard Survey

El Proyecto Bienestar farm worker community survey, Summer 2005.

d. News Letters:
Northwest Forest Worker Review, January 2005.

Ag Connections

- Vol 3, No 1. (Spring). Article: Story Telling: Driving the Safety Message Home, Insert: Workplace Solutions to Improve the Health and Safety of Orchard Workers and Their Families.
- Vol 3, No 2. (Fall). Article: Outreach and Education in the Northwest, Insert: Bridging the Literacy Divide.

f. Other:
Proceedings: Western Regional Conference – Cultivating a Sustainable Agriculture Workplace. Compact Disk and Web formats.

Educational Calendar: Co-sponsorship of 2005 calendars based on North American Guidelines for Children's Agricultural Tasks. Distributed to 1000 Northwest Farm Families.

Exhibit: Ag Expo, Spokane, Washington, January 11-14. 2005.

Exhibit: Ag Safety Day, Yakima, Washington, March 9, 2005.

4. Conferences / Meetings Sponsored:
Ag Safety Day, Yakima, Washington, March 9, 2005.

PNASH Stakeholder Meeting: Cholinesterase Monitoring Service Projects for Washington, March 9, 2005.

PNASH Stakeholder Advisory Committee Meeting, Yakima, Washington, June 2005.

5. Other Products:
Planning Committee: Murphy, H. Ag Safety Day, Yakima, Washington, March 9, 2005.

Planning Committee: Murphy, H. Western Migrant Stream Forum, San Diego, California, January 27-29, 2005.

Planning Committee: Murphy, H. Sustainable Agriculture, Communities & Environments in the Pacific Northwest, Richland, WA, May 18-20, 2005.

Planning Committee: Harrington, H, Murphy H. Western Agricultural Safety and Health Conference – Research to Practice, September 2006.

Planning Committee: Murphy, H. Western Migrant Stream Forum, Portland, Oregon, January 2006.

Murphy H. Attended Washington State Horticultural Association Meeting, Yakima, Washington, December 2004.

Resource Library: Integration of collection of pesticide materials from the Washington Public Health Lab.

Graphic Library: Expansion of photo and illustration collection.

B. CENTER PROJECT REPORTS

ONGOING PROJECTS

NEW PROJECTS

A. PROJECT TITLE

R1: Identification and Prevention of Injuries in NW Orchards

B. PROJECT OFFICER(s)

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C. PROJECT DESCRIPTION

The primary goal of this study is to reduce occupational injuries among workers in the tree fruit industry. This project explores and characterizes the array of factors that contribute to the occurrence of injury of orchard workers and will develop, implement, and evaluate several technical interventions that are based on these identified factors. Specific aims are to:

1. Determine the most common types of reported and unreported injuries and near misses among orchard workers through interviews with orchard managers, orchard owners, health and safety personnel, and an examination of worker compensation data.
2. Prioritize the injuries and risk conditions that lead to injuries among orchard workers.

3. Use this information to develop targeted interventions aimed at reducing the frequency of risk conditions that lead to injury.
4. Develop sensor-based devices for ladders that can both monitor the occurrence of risk conditions and be adapted to warn workers of the condition.
5. Use sensor devices to evaluate the effectiveness and the cost-benefit of the interventions.

D. PROJECT START AND END DATES: October 1, 2001 – September 30, 2006

E. PROJECT ACTIVITIES / ACCOMPLISHMENTS

This project was designed to collect and compare data on deciduous tree fruit injuries from three population sources: worker compensation data, key informants, and worker interviews. Information from these sources guided the development of a larger worker questionnaire that prioritized issues related to injuries in the deciduous tree fruit workplace. Guided by information from these sources, a sensor-equipped ladder was designed to help characterize and control injuries by warning workers about risk situations. Phase 1: worker compensation, key informant, and worker interviews have been completed. Ladder design was completed in February 2005. Testing of the instrumented ladder followed and was completed in June 2005. The project is largely on track to be completed as planned. Some delay has been encountered in adapting some sensors to the typical orchard ladder.

Claims were categorized by key word search on several data fields and the data were analyzed by cause of injury in terms of frequency, severity, and cost. Of the 13,068 claims reviewed from this time period, 4,020 (30.8%) were found to have been ladder-related injuries. Additionally ladder-related claims accounted for nearly half (48%) of all compensable claims (e.g. claims involving time loss, disability, or loss of earning power, in addition to medical expenses). Claims related to ladders were not only the most frequent, but were also the most expensive as a group in terms of medical aid, time loss, and other costs. On a per claim basis, ladder-related injuries were among the most severe and costly reported injuries. Other common causes of injury among claims were branches and vegetation, structure and material, and ground-related injuries.

Data from claims were insufficient to identify the exact mechanism of injury, that is to say, how exactly the injury came about. Broader statements of cause were included with claims which suggested mechanisms such as “fell from,” “fell upon,” “struck by,” etc. but could not allow sufficient detail to focus on a specific engineering-based intervention. Based on the information collected from the summarized ladder injuries, we believe that continued work on interventions that focus on ladder safety is justified.

Worker Interviews

The data analysis of the orchard worker interviews has been completed. This qualitative study was designed to examine the factors that contribute to occupational risks related to orchard work. Twenty-five Hispanic orchard workers were interviewed. The most common type of accident (reported by 60% of participants) was falling from a ladder. An additional

12% reported a near miss that involved a ladder. Thus a total of 72% of participants reported either an accident or near miss involving a ladder. Ladder falls were related to the shifting weight of produce causing the workers to be unbalanced; slippery steps from rain, snow, or fruit residue; ladder being hit by a tractor; and catching feet in the rungs of the ladder. The second most common type of accident was getting poked by branches and other objects. Other types of accidents included falling on slippery ground, getting hit by falling debris, being cut with shears, and tripping over wires or other objects in the orchard.

A total of 20 participants (80%) indicated that they sustained an injury while working in the orchards. The nature of these injuries varied, but the most common were strains and sprains, broken bones, eye injuries, and cuts and abrasions. Some workers reported, "slicing their skin" on the sharp steps of ladder. Eye injuries often resulted from falling debris or protruding or rebounding branches.

Three broad categories of factors that contribute to the occurrence of injury were:

- Knowledge, attitudes, and behaviors, which included the following themes: having choices; feeling disrespected, behavioral influences (experience and training, assigning blame), and feelings of vulnerability
- Work-related factors included: relationship with boss (being treated fairly, employer demands, communication styles), quality and availability of equipment, accessing resources (water, sanitation facilities) and pay and pace of work
- Factors external to work included: environmental conditions (weather, condition of terrain) and regulatory issues (worker protection standard, ladder regulation, immigration laws)

When an injury occurs, workers often do not report it; and even if they do report it, they may not get compensated. Misunderstandings and misinformation often affects workers' actions following an injury. For example, some workers indicated that there were challenges related to *being believed* (i.e., "If no one sees you, they don't believe you" and "Out of shame, one doesn't even go get it looked at.") and *delayed symptoms*: "Sometimes one can get hurt badly, but it's not until the next day that it starts to hurt." More details about these issues are included in a manuscript, which has been submitted for publication.

The findings from this study provide a poignant though troubling glimpse into the day-to-day lives of Hispanic orchard workers. The candid responses of the participants reveal that, for the most part, they are aware that risks are associated with their work; however, for the reasons stated, they have limited ability to avoid occupational injuries and illnesses. It is clear from these workers' comments that a multitude of factors increase worker's risk for injury; and that accidents in the orchards cannot be attributed to any single cause.

Although numerous factors affecting the occurrence of work-related injuries were identified in this study, the full contribution of these factors needs further exploration. The next phase of this study consists of a detailed survey, which is intended to quantify and

prioritize the factors that workers identified in this study. Additionally, it asks detailed questions about ladder incidents. The survey was used to guide a structured interview with nearly 200 Hispanic orchard workers. We are currently in the process of completing data entry and analyzing the data from these interviews. It is anticipated that this phase of the study will provide much more detailed information about injuries and their contributing factors. This information can then be used to develop more appropriate interventions.

Key Informant Analysis

An analysis of key informant interviews has been completed and a draft manuscript has been developed. The data point out the professionals who frequently deal with farm workers and farm worker injuries identify musculoskeletal and eye injuries as the major group of problems faced by workers. Ladders were consistently identified as a major cause of injuries. Lack of protective equipment was also identified as important. Several other factors identified as having an important bearing on the frequency of injuries included:

- Worker characteristics and responsibilities
- Employer factors
- "Inevitable nature" of agricultural injuries
- Economic, cultural and political factors

The key informant analysis also identified important contradictions within and between key information reports. These contradictions potentially represent important points of access for safety teaching through attempts at resolution of dissonance.

Triangulation

The data obtained from these three sources are presently being brought together to identify key issues in orchard work that lead to the high rate of injuries. One clear theme emerges from all three sources of information. Ladders appear to be a major source of injuries in orchard work. This was an expected outcome and became apparent early on in this project. The investigators were confident enough from early data returns and preliminary information that engineers were included in the project and exploration of methods for improving ladder safety were begun in the first year of the study.

One task that remains to be accomplished is a formal process of data triangulation. The informal process that has considered the data gathered from the three data sources clearly pointed to the ladders as a primary cause of injury in the orchard industry. We have asked workers to prioritize the issues we found in our various sources of data. The data collection for this process has been completed. Data analysis is completed and a manuscript is in preparation. An abstract has been submitted and accepted on this topic for the APHA national conference in December 2005. The project will continue to explore methods for triangulating this information in the next year. At least one manuscript will come of these efforts before the project's end.

Making Orchard Ladders Safer

NOTE: PATENT PENDING, PLEASE DO NOT DISTRIBUTE THIS REPORT

Work on the engineering aspects of improving the safety of orchard ladders continued. The first cause (not necessarily the most common but among the most important) of ladder injuries identified by the respondents was weight shifting causing the worker to lose balance and fall. We continue to work on designing an orchard ladder that can sense the position, weight, center of gravity and weight shift of the worker. Dr. Kal Kapur (Professor, Engineering) and graduate student Qiangmei Feng (Ph.D, Engineering) and Heather Barr (MS, Environmental and Occupational Health Sciences) continued their work on assembling components and adapting them to an orchard ladder. Assistance regarding design component options, such as data loggers and load cell choices, was provided by Dr. Peter Johnson (Assistant Professor, Department of Environmental and Occupational Health Sciences). The modifications included three primary instrumentation options:

- Sensors attached to ladder rungs to indicate location of the worker on the ladder.
- Load cells on ladder feet to determine total weight, changes in weight, and direction of shift.
- Goniometer (angle meter) to determine ladder leg spread and ladder base dimensions.

Strain sensors were attached to ladder rungs and were able to detect the presence of a person on the individual steps. Testing of the assembled equipment demonstrated that the sensors were able to detect the presence of workers, but preamplifiers were necessary to increase signal strength and a “tattle-tail” data logger was purchased for data logging from the various sensors. Some difficulty in isolating signals to single steps has been encountered. Modifications in the strain gauge placement or the inclusion of specific mechanical activators were made in response to these difficulties. Assistance from the University of Washington Marine Engineering Consulting Service has been obtained with the intention of exploring designs that can isolate worker position more effectively.

In Year 3 an outside consultant assisted us in developing stability models for three legged ladders. This led to the development of the white paper, which characterizes the forces on the ladder that could lead to instability. With this model in hand we identified the sensor data that would be needed to identify activities and conditions which would lead to unstable situations. In Year 4, Heather Barr tested the theoretical model against the sensor measurements from the fully instrumented ladder. Ms. Barr developed a working spreadsheet in which parameters such as weight, height and ladder base width can be changed and vectors for various ladder activities can be calculated. Initial tests of the ladder were performed by Ms. Barr in a laboratory setting. She presented her work, including a working model of the ladder, at her thesis defense in June 2005.

Mr. Claudio Osses-Henriquez (graduate student in Civil and Environmental Engineering)

will be continuing Ms. Barr's work in Year 5. Current work involves increasing the sturdiness of the ladder for use in the field, decreasing the cost of the ladder and field testing the ladder with workers in orchards. Field-testing is expected to be completed by July 2006.

F. PROJECT PRODUCTS

1. Presentations:

Barr H. Identification and Prevention of Injuries in NW Orchards: Analysis of Survey-based Worker Interviews on Risks and Hazards. MS Thesis Presentation. May 2005, Seattle, Washington.

2. Publications

a. Peer Reviewed Journal:

Salazar M, Keifer K, Negrete M, Estrada E, Snyder K. Occupational Risk among Orchard Workers: A Descriptive Study. Family & Community Health. 2005, Jul-Sep:28(3)239-52.

b. Fact Sheets / Brochures / Technical Publications:

Fact sheet: Workplace Solutions to Improve the Health and Safety of Orchard Workers and Their Families.

c. Other Publications:

Swenson E. Improving the Health and Safety of Northwest Orchard Workers and Their Families. SPHCM's Spotlight on Research, Issue 19: Winter 2005.

Barr, H. Characterizing the Performance of the "Smart" Tripod Orchard Ladder. University of Washington Masters of Science Thesis, June 2005.

4. Other Products:

Model: "Smart" Tripod Orchard Ladder.

Application for patent of smart ladder design.

G. STATES THE PROJECT WAS ACTIVE IN

Washington

A. PROJECT TITLE

R2: Workplace Determinants of Take Home Pesticide Exposure

B. PROJECT OFFICER(s)

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C. PROJECT DESCRIPTION

Children of agricultural producers and workers can be exposed to pesticides and other agricultural chemicals if workplace chemicals are inadvertently brought into the residential environment. The purpose of this research is to prevent or reduce take home pesticide exposure among agricultural workers and their families in Northwest farming communities. This project will also result in new methods for the characterization of the take home exposure pathway, and for interventions to reduce children's exposures to pesticides. The specific aims of the project are to:

- Conduct vehicle and household dust sampling in a group of orchard workers and a reference group to determine the extent to which the take home exposure pathway contributes to residential pesticide residue levels.
- Conduct interviews with workers and managers, and conduct worksite walkthrough evaluations to identify the primary workplace determinants of the take home exposure pathway.
- Conduct an intervention at all study sites for which take home exposure is determined to be a significant contributor to residential pesticide residues.
- Evaluate the intervention by re-sampling vehicle and house dust of workers, and by review of worksite facilities and procedures.

D. PROJECT START AND END DATES: October 1, 2001 – September 30, 2006

E. PROJECT ACTIVITIES / ACCOMPLISHMENTS

2003 Baseline Study

The 2003 baseline study investigated the concentration of pesticide residues in the commute vehicles and homes agricultural workers (n=46) of three occupational groups of agricultural workers, pesticide handlers (16) and apple thinners (15) at a conventional tree fruit orchard and workers (15) at an organic apple orchard. The dust samples had been analyzed for three organophosphate pesticides, azinphosmethyl, phosmet, and chlorpyrifos, used in the conventional orchard. Participants were also interviewed about

work practices, hygiene facilities, work clothes and boots, pesticide safety training, and for handlers, personal protective equipment.

To test for differences between occupations for pesticide concentrations in both the vehicle and house dust, a one-way analysis of variance followed by pair wise T-test comparisons with a Bonferroni correction was used. One-way analysis of variance showed the average pesticide concentrations for the three pesticides was significantly different between occupational groups for vehicle ($p<0.001$) and house ($p<0.001$) dust. For all three pesticides in vehicle dust, the handler and thinner groups were each significantly different from the controls and from each other ($p<0.001$ with a Bonforreni of correction $p=0.05/3=0.017$). For house dust, the handler and thinners were significantly different ($p<0.017$) from the controls for all three pesticides, except thinners for chlorpyrifos. Pesticide concentrations in house dust were not significantly different between the thinners and applicators.

Linear regression was used to predict pesticide levels of house dust from vehicle dust, as well as pesticide levels in house and vehicle dust from occupational group and questionnaire variables. The vehicle dust was found to be a significant predictor of house dust concentrations for all three pesticides ($p<0.01$). Leaving the vehicle window rolled down was found to be a significant predictor of vehicle pesticide concentrations for both azinphosmethyl and phosmet.

2004 Intervention Study

In 2004, two interventions were evaluated with the thinners to see if they reduced pesticide dust concentrations in the vehicle and home. One was the boot bin, a plastic storage box in which thinners could store their work boots. The other was vehicle vacuuming, where thinners vacuum their vehicles once a week before leaving work. A third thinner group did not participate in an intervention served as the control group. Given the nature of the work practices and pesticide usage at the orchard during 2004, we found we could not assume that the different work crews, and therefore study participants, had equal pesticide exposure opportunities. This year in particular, the OP pesticides azinphosmethyl and phosmet were only applied in spot locations as needed and azinphosmethyl was not applied in the traditional cover spray over the entire orchard. At times, work crews performed work activities other than apple thinning, which could have the potential for differential contact with pesticide residues.

Daily estimated exposure potential (EE, mg/day) and a cumulative exposure metric was calculated for each study subject based on a detailed analysis of the work crew activities and the pesticide application records the. The EE potential was calculated based on the

- **transfer coefficient** (**TC** cm^2/hr) in EPA job tasks-apple studies,
- **day fraction** (**TF** 0.0-1.0) from work crew records,
- **dislodgeable foliar residue** (**DFR** ug/cm^2) from application records and the literature
- **average shift duration** (**s** 9hr/day)

EE = TC * TF * DFR * s

After evaluating all the thinner work activities, we found that 98% of the person days were spent with high contact with foliage. In addition to thinning, these activities included loosing and cleaning apples, summer pruning, and lifting, tying and lowering branches. Lower contact activities included propping, moving bins, weeding, scouting, and irrigation. A non-parametric analysis was used to compare the cumulative exposure metrics for each intervention group to the control group. For azinphosmethyl, both the boot bin and vacuum groups were not significantly different from the control group (Table 1). However for chlorpyrifos, both interventions were significantly different from controls. The vacuum intervention was not different from the control for phosmet, but for the boot bin it was. To account for individual differences in exposure opportunity amongst the study subjects, the calculated cumulative exposure metric for each subject will be used in the analysis of the 2004 boot bin and car vacuum interventions.

Table 1. Non-parametric analysis of cumulative exposure metric: intervention group vs. control

		Azinphosmethyl			Phosmet			Chlorpyrifos		
Groups compared	Sample size	Median (mg)	p-value	Mean rank	Median (mg)	p-value	Mean rank	Median (mg)	p-value	Mean rank
Boot bin	20	67.79	.291	18.60	502.70	<0.001	28.40	14.27	.018	16.15
Control	20	87.33		22.40	244.16		12.60	16.87		24.85
Vacuum	23	154.93	.212	19.45	37.35	.462	23.50	9.02	.041	26.20
Control	20	87.33		24.22	244.16		20.70	16.87		18.35

Kruskal-Wallis 2-tailed test (SPSS 13.0 Software)

2005 Intervention Study

In 2005 we had the opportunity to evaluate the vehicle vacuuming intervention with agricultural workers who were picking cherries. These workers normally thin apples at the orchard, but for three weeks pick cherries. The workers only exposure opportunity for azinphosmethyl was during cherry picking, because this was the only part of the orchard were it was applied in 2005. This situation provided the potential for more consistent exposure opportunity for all the study participants. In addition, we will be able to directly measure the DFR for azinphosmethyl. We piloted a further investigation into the vehicle as a vector for the movement of pesticides residues from the orchard into the home by collected surface wipe samples from vehicle windows. We also collected hand wipe samples from children of the study subjects to investigate possible children's exposure.

Forty-three cherry pickers participated in the study during June and July of 2005. Study volunteers were randomly assigned to either the intervention (21) or the control (22) group. After vacuuming their vehicles once or twice a week for at least four weeks, each study

participant was interviewed, and a dust sample was collected from their commuter vehicle and from their home. During cherry picking, we collected 20 cherry leaf punch samples for DFR calculations, eight vehicle window wipe samples, and eight child hand wipe samples. Laboratory analysis for all samples and data entry is completed. We are currently analyzing the data. Orchard records for pesticide application and crew assignments will also be used to determine exposure opportunity. In year five we will complete the data analysis for the project.

F. PROJECT PRODUCTS

1. Presentations:

Ceballos D, Fenske RA, Galvin K, Tchong M. Pesticide Exposure Opportunity for Tree Fruit Thinners. University of Washington, Department of Environmental and Occupational Health Sciences PhD Laboratory Rotation

Fenske RA. How Can We Improve the Accuracy of Children's Measurement Data. EPA's Workshop on the Analysis of Children's Measurement Data. Research Triangle Park, North Carolina, September 27, 2005.

2. Publications

a. Peer Reviewed Journal:

Fenske R, Bradman A, Whyatt R, Wolff M, Barr D. Lessons Learned for the Assessment of Children's Pesticide Exposure: Critical Sampling and Analytical Isses for Future Studies. Environmental Health Perspectives 2005,113(10).

b. Fact Sheets / Brochures / Technical Publications:

Fact sheet: PNASH Pesticide Take Home Studies.

Fact sheet: Workplace Solutions to Improve the Health and Safety of Orchard Workers and their Families.

Fact sheet: Information about the 2003 and 2004 Take Home Study Results Question/answer format study results for study participants, management and the orchard community.

Research Summary: PNASH Pesticide Take Home Studies. (English and Spanish).

c. Other

Manuscript in preparation: Fenske RA, Lu C, Negrete M, Powers KM, Galvin K. Transmission of Agricultural Workplace Chemicals to Commuter Vehicles and Residences among Pesticide Handlers and Field Workers in Washington State. In preparation.

Manuscript in preparation: Ceballos D, Fenske RA, Galvin K, Tchong MI. Pesticide Exposure Opportunity for Tree Fruit Thinners.

3. Education / Training / Outreach

b. Short Courses:

EPA's Workshop on the Analysis of Children's Measurement Data. Research Triangle Park, North Carolina, September 27, 2005.

f. Other:

Sent 2003 and 2004 participants letters which contained their individual results for house and vehicle dust test. Included factsheet regarding the study.

4. Conferences / Meetings Sponsored:

Galvin K, Negrete M, Tchong M. Presented preliminary results of the Pesticide Take Home Study to worksite managers, Tri-Cities, Washington, June 2005.
Tchong M, Negrete M. Presented 2003 and 2004 study results to work place health and safety committee, Tri-Cities, Washington, September 2005.
Community meeting. To answer questions from community on their personal and group results (meeting held after personal results distributed in a letter).

g. Other Products:

Recruitment Script (Revised)
Consent Form: Agricultural Workers Intervention (Spanish and English)- (Revised)
Car Vacuuming Intervention- Instructions (Spanish and English)
Interview Instructions
Approach Script – Parent's Permission for Child Hand Wipes (Spanish and English)
Parent Permission form – Hand Wipes (Spanish and English)
Child Oral Consent Script – Hand Wipes (Spanish and English)
SOP 1: Site and Subject Recruitment (Revised)
SOP 4: Dislodgeable Foliar Residue (DFR) Sampling
SOP6: Surface Wipe Sampling (car windows)
SOP7: Dislodgeable Foliar Residue (DFR) Field Spikes
SOP9: Hand Wipe Sampling
Protocol: Personal Safety and Welfare (field crew)
Protocol: 2-Propanol Handling (field crew)
Posters: Study results (illustrated format)

G. STATES THE PROJECT WAS ACTIVE IN

Washington

A. PROJECT TITLE

Prev1: An Incentive Intervention Program to Encourage Ergonomic Behavior in Latino Farm Workers.

B. PROJECT OFFICER(s)

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C. PROJECT DESCRIPTION

This is an intervention research program. The objective is to motivate ergonomic behavior as part of a training program for migrant and seasonal packing house workers in eastern Washington. The program will 1) employ a videotape of a Spanish one-act ergonomic play and best practices training techniques, 2) develop a post video training program using occupational therapy trained students, 3) deliver the program at packing house worksites to train approximately 350 workers, 4) offer certificates of completion as a motivational incentive as well as a fotonovela and Lifting Louie pamphlet as reinforcement, and 5) evaluate the effectiveness of the training program and certificates to encourage ergonomically safe workplace practices including behavior change.

D. **PROJECT START AND END DATES:** October 1, 2004 to September 30, 2006

E. PROJECT ACTIVITIES / ACCOMPLISHMENTS

Year 4 marked the first year of this project. Early in the year, the PNASH Center and the EWU Center for Farm Safety and Health developed the instrument to determine the efficacy of training (pre-post training questionnaires). This training program was largely based on ergonomic component of the earlier project, Hispanic Theater for Agricultural Worker Safety. The questionnaires were field-tested and revised accordingly.

Occupational therapists from the Washington State Department of Labor and Industries and Eastern Washington University designed the observation checklist, post-video training exercises and materials. These corresponded with the ergonomic educational elements of videotaped play that was presented in the training program. The checklist was field tested and revised to insure clarity. Inter-rater reliability was greater that 75%.

The Eastern Washington University occupational therapist and Project Manager provided a full-day of training to the study data collectors. Data collectors included an exercise physiology student and four bilingual students. The training covered basic anatomy and lifting body mechanics, the observational checklist, inter-rater reliability testing, administering the pre and post test questionnaires, and how to conduct the classroom ergonomic exercises after the video.

To recruit participants, the Washington Growers League, Washington Tree Fruit Commission, Growers Clearing House and Washington State Department of Agriculture were contacted as well as 55 warehouses directly. Recruitment took place through Year 4, with personal phone calls and site visits.

Three fruit packing houses were scheduled for training sessions for a total of 275 participants. Of these, 220 participants completed the follow-up observation post-test sessions and received the certificate of completion. The final year, Year 5, will be devoted to data analysis and dissemination of the study results to study participants, packing house employers and to agricultural safety and health audiences.

F. PROJECT PRODUCTS

3. Education / Training / Outreach

a. Training Seminars:

Conducted ergonomic training session for participant warehouse employees, Washington (3 trainings).

f. Other:

Curriculum: Packing house ergonomic training.

5. Other Products:

One-act telenovela ergonomic play (Spanish) - (VHS/DVD).

Pre-post Ergonomic Behavior Observation checklist.

Pre-post Questionnaire (Spanish and English).

Certificates for course completion.

G. STATES THE PROJECT WAS ACTIVE IN

Washington

A. PROJECT TITLE

Edu3: Fluorescent Tracer Component for Hands-on Pesticide Handler Training

B. PROJECT OFFICER(s)

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C. PROJECT DESCRIPTION

The primary goal of this education project is to transfer a research tool for assessing pesticide exposure—the fluorescent tracer (FT) technique—into hands-on pesticide handler training programs in Washington State. The long-term objective of this work is to improve pesticide handler training by nationwide dissemination of a hands-on educational curriculum that incorporates the FT technique. We are working closely with Washington State Department of Agriculture (WSDA) pesticide safety educators and Washington State University (WSU) Cooperative Extension faculty to adapt an existing curriculum to include a FT component. In this component, FT dye will be put in the simulated pesticide used by handlers in class to demonstrate proper and improper procedures related to mixing and loading, cleanup, and use of personal protective equipment (PPE). Handlers will receive immediate feedback by viewing any 'contamination' when the FT dye is illuminated with longwave ultraviolet lamps. The FT hands-on component produced at the end of this project will be appropriate for training both licensed and unlicensed pesticide handlers. Specific aims are:

1. Develop a FT training component as part of a hands-on training recertification course for licensed handlers.
2. Evaluate the FT training component for licensed handlers and finalize this component based on the evaluation.
3. Adapt the FT training component for use with unlicensed handlers.
4. Evaluate the FT training component for unlicensed handlers and finalize this component based on the evaluation.
5. Produce, disseminate, and monitor the FT component for hands-on pesticide handler training manual for pesticide safety educators in Spanish and English, by making these materials available in print and web-based formats.

The tracer components in the training are being evaluated by comparing the pre and post training evaluations for handlers in classes that use tracers and those that do not. Evaluations are being administered using individual audio tape recordings in Spanish of the

questions and an icon (illustration) based answer sheet to meet the dual challenges of with a study population whose first language is predominately Spanish and the may have limited written Spanish literacy.

At the completion of this project we hope to work directly with other centers in the NIOSH Agricultural Centers Program and with the national Cooperative Extension Service to disseminate these training materials and assist in the establishment of hands-on training programs throughout the U.S.

D. PROJECT START AND END DATES: October 1, 2004 to September 30, 2006

E. PROJECT ACTIVITIES / ACCOMPLISHMENTS

This project is designed improve pesticide handler training by developing and evaluating training components using fluorescent tracer. FT provides the pesticide handlers with immediate illustration of potential pesticide contamination during hands-on training. The FT training components developed during this project will be compiled into a manual for pesticide safety educators. It will be available in Spanish and English both in print and on the web. During year 2, we completed the licensed handler training focus group, development of FT training components, development of the evaluation with audiotape and icon answer sheet, pilot-testing of the training and evaluation, and evaluation of the training during a pesticide handler recertification course. We are on track to adapt the FT training component for use with a hands-on training class for unlicensed handlers, evaluate this component during the WSDA's Hands-on Pesticide Training, and produce the FT manual.

Fluorescent tracer training component for licensed handler recertification course

To help select the pesticide safety messages and practices to be illustrated with the FT, we held a focus group of licensed pesticide safety handlers and relied on the expertise of the WSDA pesticide safety educators to recruit participants. Eight licensed handlers participated in the focus group lead by a peer facilitator (licensed pesticide handler). After compiling a list of pesticide safety and handling practices, participants selected four practices for each of the following questions.

A. Which practices that were the hardest to do or follow?
B. Which practices that were the easiest to communicate or explain to other handlers?
C. Which practices that were the hardest to communicate or explain to other handlers?

Of the 30 pesticide handling and safety practices listed, 11 (37 %) received at least two ‘hard to’ vote (hard to do/follow or communicate/explain). These practices are listed in Table 1.

Table 1. Licensed Handler Focus group:
Pesticide Safety Practices Receiving Two or More 'hard to' Votes

number of votes[a]	pesticide safety or handling practices that were either hard to do/follow or communicate/explain
8	Clearing or collecting spills
7	--
6	Reading the label to correctly choose the PPE
	Correct order for mixing pesticides
5	--
4	Dangerous residues
3	Cleaning application equipment
	Using PPE
	Triple wash
2	Cleaning PPE
	Washing work clothes
	Calibrating
	Not taking pesticides for home use

[a]The eight focus group participants could vote up to four different pesticide practices that were hard to door follow and four that were hard to communicate or explain.

Initially five different safety messages with a specific practices were selected based on the needs of WSDA pesticide training program and the following criteria a) showing 'contamination' (fluorescence) clearly, b) providing a good contrast between proper and improper handling practices, c) producing repeatable and reliable results, d) setting cleaning up easily, and e) fitting well with the training scenarios used by WSDA hands-on curricula. WSDA collaborators, expressed a need for decontamination training (personal, PPE, and application equipment) as well as addressing the issues how handlers could urinate when they were in the orchards without having to remove their PPE and of handlers wearing cloth baseball style caps while applying pesticides. Five FT were modules were initially selected:
1a. Application equipment decontamination
1b. Unplugging spray nozzles
2a. Urinating when wearing PPE
3. Decontaminating PPE
3b. Baseball Caps

Questions were developed for evaluating knowledge and behavior related to the content of each module. The pre and post evaluations questions and icon answer sheets were qualitatively validated by pesticide safety educators and licensed handlers and tested for reliability during the pilot training class (8 students). The baseball cap module was dropped because it did not produce repeatable and reliable results during the training session. Based on the results of the pilot training, the training curricula and the evaluation questions were modified for the four remaining modules.

Twenty-four pesticide handlers participated in the recertification class. Twelve handlers were in a training group that used the tracer and twelve were in the group that received the same training except that tracer was not used. No difference was found between the tracer and non-tracer groups on the pre training evaluation for both the knowledge and behavior total score (p= 0.49 and 0.66, respectively Mann-Whitney U test.), No statistically significant difference was found for either the knowledge or behavior questions (p=.72 and 0.79, respectively) when looking at the total change (total change = number correct answers on the post evaluation - number correct answers on the pre evaluation). However, in the non-tracer group a few subjects had fewer correct answers on the post evaluation then the pre evaluation for both the knowledge and behavior questions. This did not occur during for the tracer group. (Fig 1a and 1b).

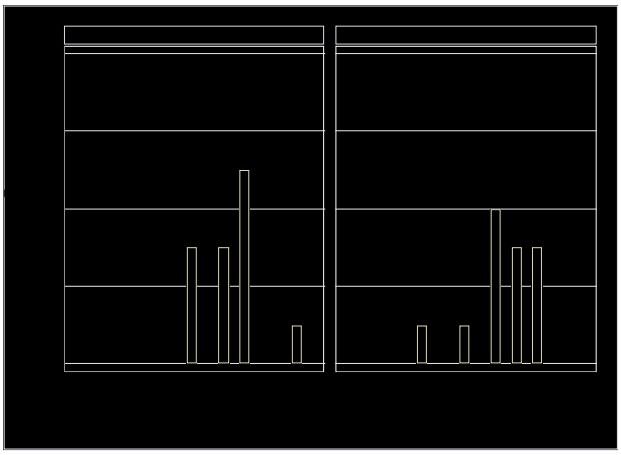

Figure 1a. Frequency of evaluation change scores knowledge questions.
(total change knowledge = number post correct answers – number pre correct answers)

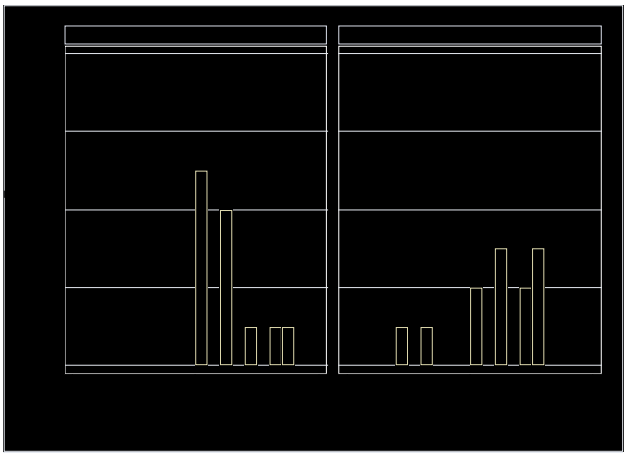

Figure 1b. Frequency of evaluation change scores for behavior questions
(total change behavior = number post correct answers – number pre correct answers)

In year 2, the FT training curricula and evaluation questions will be modified for use with the WSDA Agriculture's Hands-on Pesticide Training course based on the year 1 results and the needs of the training course. Additional demographic information will be collected to assist in the interpretation of the results. The updated evaluation tool will be tested for validity and reliability. The FT training modules will be tested during four classes with a larger total population (approximately 200 students) any differences between the tracer and non-tracer groups will be more easily detected. In addition to the FT training modules evaluated in this study, the FT manual will be enhanced with other ways for pesticide safety training. The print and web based manual will be available in Spanish and English.

G. PROJECT PRODUCTS

2. Publications

c. Fact Sheets / Brochures / Technical Publications:

Fact sheet: Fluorescent Tracer Technique for Pesticide Handler Training. An information sheet on using FT in training for growers, managers, and pesticide safety educators.

Fact Sheet: Mixing Instructions for Fluorescent Tracer Scenarios (Recipe for using the FT Tinopal CBS-X ™ during the hands-on training).

3. Education / Training / Outreach

a. Training Seminars:

Two pesticide handler recertification courses, the first pilot training in February involved eight licensed pesticide handlers. The revised training occurred in March with 24 participants.

f. Other:

Training curricula for the following four training modules using FT

1a Application Equipment Decontamination
1b Unplugging spray Nozzles
2 Urinating while wearing PPE
3 Decontaminating PPE

Pre and post evaluation scripts (Spanish and English).

Pre and post icon answer sheets (Spanish).

Decontamination training materials for pesticide handlers.

Audiotape and icon based evaluation tools.

4. Conferences / Meetings Sponsored:

Partner Meeting: Preliminary results from the 2005 evaluation of the hands on training with Fluorescent Tracer Components were presented and discussed at WSDA and Ag Extension, Ellensburg, Washington, June 2005.

5. Other Products:

Consent Information Form – Focus group (Spanish and English)

Consent Information Form – Training (Spanish and English)

Oral Consent Script – Training (Spanish and English)

G. STATES THE PROJECT WAS ACTIVE IN

Washington

A. PROJECT TITLE

Edu4: Communication of Health Risks for Children of Agricultural Families

B. PROJECT OFFICER

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C. PROJECT DESCRIPTION

The overall objective of this project is to translate and communicate current scientific information regarding health risks of pesticides to farmers, farmworkers, and their families, with special emphasis on high-use chemicals such as the OP pesticides. Our group has a long history in the area of pesticide health risks for handlers and farmworkers. Pesticide spray drift, the worker take-home pathway, and the neurodevelopmental effects of OP pesticides are also the subject of active research in our program. Substantial uncertainty surrounds these findings regarding health risks, and the relevance of this information to producers and workers. We hope to synthesize this information and translate it into relevant and culturally appropriate public health messages for agricultural communities in Washington State. Specific aims are:

1. Conduct a needs assessment for pesticide health risk information among Washington farmers, farm workers, and their families in partnership with WSU Cooperative Extension, grower organizations and farm worker organizations; determine the type of questions to address and the best methods to disseminate the information (eg, brochure, articles, presentations, radio).
2. Develop and disseminate culturally appropriate and bi-lingual communication materials from current scientific information that serve the needs of agricultural producers and workers.
3. Sponsor technical sessions on risk communication at key conferences such as the WSU/UW Pesticide Issues Conference, the Migrant Stream Forum, and the WA State Horticultural Association.
4. Elicit feedback from the agricultural community regarding the usefulness and importance of the materials; revise materials accordingly.
5. Distribute final materials in partnership with WSU Cooperative Extension, grower organizations and farm worker organizations to the Washington State agricultural community through interactive activities, as well as in print and Web-based formats.

D. PROJECT START AND END DATES: October 1, 2004 to September 30, 2006

E. PROJECT ACTIVITIES / ACCOMPLISHMENTS

In order to develop appropriate risk communication materials for the health care providers that are in contact with agricultural workers, we conducted an informational needs

assessment. Key informant interviews were conducted with 23 physicians (52% Family Practitioners and 39% Pediatricians), 14 mid-level practitioner (9 Physicians Assistants and 5 Nurse Practitioners), and 12 Community Health Workers, 4 of which were program supervisors. The key findings were as follows:

- 51% of the providers had no previous training on pesticides.
- The largest group without previous training was mid-levels (64%).
- Only 2 physicians reported that pesticides were covered in their medical school or residency training.
- 61% do not feel comfortable handling patient's questions about pesticides.
- The majority of providers in all three disciplines had an interest in receiving more information on the effects of pesticide exposure in children (73%) and the neurodevelopmental problems of OP exposure (71%).
- More CHW's reported using pesticide information in their work (83%) compared to MLP's (64%) and physicians (35%).
- Mid-levels use pesticide information equally for clinical suspicion and patient education compared to physicians who use it most commonly for diagnostic purposes. But given training, this distribution changed for physicians. More physicians reported they would use it for anticipatory guidance (83%) than MLP's and CHW's (78% and 75%).
- More MLP's are asked ("frequently" or "sometimes") pesticide related questions by their agriculture working patient population (43%) compared to MDs (17%) and CHW's (33%). But in contrast, physicians were mentioned most frequently as the provider who would most likely discuss pesticide issues with their patients.
- Physicians and mid-level's turn first to the Poison Control Centers for pesticide information. The next best source for physicians in order of preference was the internet, then a colleague or expert in the community. An expert was chosen before the internet for mid-levels as well as community health workers. Perhaps because CHW's are not seeing treatment advice, they did not choose the Poison Control among their top three information sources.
- Conferences or workshops were mentioned as a preferred source of information by both Mid-level practitioners (conferences) and CHW's (popular education workshops).
- Physicians preferred web based training programs.
- All groups mentioned that they would use internet sites and written summary materials.
- Close to a third of the providers did not know where patients were getting their health information. But among those who felt they had some idea, the most common source was word of mouth. Radio and TV ranked second across all groups.
- Oral presentations and radio were considered the best means to reach farmworkers with pesticide information according to community health workers with the best ties within the community.

Other project accomplishments include an extensive literature review of the health effects of chronic pesticide exposure and analysis of pesticide use in Washington state by both crop and location.

F. PROJECT PRODUCTS

3. Education / Training / Outreach

c. Hazard Surveys / Consultations:

Key informants to help develop questionairre (9 interviews/consultations)

5. Other Products

Literature Review: Health effects of chronic pesticide exposure.
Survey: Needs assessment of key informants.
Analyzed state data on pesticide use by crop and location.
Manuscript in preparation describing survey of key informants described above.

G. STATES THE PROJECT WAS ACTIVE IN

Washington, Idaho, Oregon

IV. FEASIBILITY PROJECT REPORTS

There were no active feasibility projects in 2005.

V. SPECIFIC IMPROVEMENTS IN AGRICULTURAL SAFETY AND HEALTH THAT RESULTED FROM CENTER ACTIVITIES (RESEARCH TO PRACTICE)

1. Orchard Injury project's "Smart Ladder"

The Orchard Injury project has now completed its 4th year and has accomplished most of the intended aims, including the development of an engineering intervention to prevent the most common causes of injuries in the orchard, ladders. The "smart ladder," senses the position, weight, center of gravity and weight shift of the worker. There is now a working model of the invention that PNASH is applying to licensure. Patenting of the ladder will open the ladder to commercial development, which could facilitate its use, beyond its primary purpose for orchard worker training, to other industries.

2. Fluorescent Tracer Hands-on Training

This project transfers a research tool used to assess dermal exposure during pesticide handling to a tool for training pesticide handlers. The dramatic visualization of the fluorescent tracer (FT) demonstrates 'contamination' during training and gives handlers insight as to where and how pesticide contamination occurs. At the end of FY 2005, a draft of the FT training curricula (Spanish) was in-use with the Washington State Department of Agriculture's (WSDA) Hands-on Pesticide Training program. This program trains approximately 200 Hispanic pesticide handlers each year. In addition, elements of the training (i.e., PPE decontamination) are used in other educational presentations such as at pesticide recertification classes and industry events.

3. First Annual Washington State Governor's Ag Safety Day.

In Year 4, PNASH brokered a new event, the annual Ag Safety Day. Ag Safety Day is a Washington Governor's Safety and Health Conference that is primarily hosted by the Washington State Department of Labor and Industries. PNASH served as co-sponsor along with other regional organizations such as the Washington Farm Bureau, Washington State University, and the Washington Department of Agriculture.

Ag Safety Day provides agricultural employers and their workers with a one-day forum to review, discuss, and educate each other on safety and health issues in the Northwest. Sessions are held in both Spanish and English. Ag Safety Day is an ideal venue to transfer PNASH research findings to an audience that can implement our education and prevention strategies.

The first annual Ag Safety Day was held in Yakima, Washington, on March 9, 2005. 227 producers at management and supervisory levels were trained in routes of pesticide exposure, pesticide decontamination strategies and the Washington State Cholinesterase Monitoring Rule. Much of the information presented drew from the research and expertise of faculty from the PNASH Center. Attendees included: growers, industry representatives, farm workers, applicators, handlers, and health and safety professionals.

PNASH presence and participation at Ag Safety Day improved cooperation, collaborative effort, and understanding between researchers and the agricultural community, as well as fortifying grower and applicator knowledge of the benefits of cholinesterase monitoring.

VI. COLLABORATION

R1: Banner Engineering
UW Ergonomics Program
UW Community Health Nursing Program
UW Department of Civil and Environmental Engineering
UW Department of Industrial Engineering
UW Department of Pediatrics, UW Ergonomics Program
UW School of Fisheries
Washington State Department of Labor and Industries Region 5

R2: Participating Orchard Producer and worker community (confidential)

Prev2: Eastern Washington University, Occupational Therapy Department
Washington State Department of Labor and Industries
Washington Growers League
Washington Growers Clearing House
Washington State Department of Agriculture

Edu3: WSDA - Pesticide Management Division: Licensing and Education
- Margaret Tucker, Branch Manager, Certification and Training
- Flor Servin, Pesticide Safety Educator
- Ofelio Borges, Pesticide Safety Educator
Washington State Department of Labor and Industry
- Ramon Benavides, Safety and Health Consultant
Washington State University - Cooperative Extension
- Karen M. Lewis, Extension Faculty

Edu4: Northwest Regional Primary Care Association
UW Pediatric Environmental Health Specialty Unit
various Northwest farmworker clinics (confidential)

ACOEP: Agromedicine Consortium, California Institute for Rural Studies, UC Davis Center for Western Health and Safety, Columbia Legal Services, Eastern Washington University's Center for Farm Health and Safety, Heritage College, Northwest Community Action Center (NCAC), Idaho Mountain States Group, Northwest Community Education (NCEC) Center, Northwest Regional Primary Care Association, Farm Worker Pest Project, Oregon Health Sciences University, Oregon State University, Radio KDNA, The United Farm Workers Union, University of Oregon's Labor Education & Research Center, UW Northwest Center for Occupational Health and Safety, UW Office of Education Partnerships and Learning Technologies, Washington Farm Bureau,

Washington Growers Clearinghouse, Washington Growers League, Washington Farm Bureau, Washington State Migrant Council Health Start Program, Washington State Department of Agriculture, Washington State Department of Health, Washington State Department of Labor and Industries, Washington State University's Center for Sustaining Agricultural and Natural Resources, Washington State University's Cooperative Extension Service, Washington State University's Department of Sociology, Washington State University's Pesticide Education Program, Washington State University's Tree Fruit Research, Yakama Nation, Yakima Valley Community College, Yakima Valley Farm Workers Clinic (YVFWC), various Northwest farmworker clinics and agricultural employers (confidential)

Admin: Environmental Protection Agency
National Institute for Occupational Safety and Health (NOSH)
NIOSH Agricultural Centers
United States Department of Agriculture
University of Washington Center for Ecogenetics and Environmental Health
University of Washington Department of Environmental and Occupational Health Sciences
University of Washington Northwest Center for Occupational Safety and Health

APPENDIX A

I. TOTAL CENTER BUDGET FOR FY 2005

1. **Total NIOSH Expenditures: $ approximately 798,700 TC**
   (Final Year 4 expenditures will be reported in the Fiscal Status Report, December 2005.)

2. **In-Kind Contributions: $ 200,00 TC**
   (Estimated effort by students, faculty consultation, partners.)

3. **Other Outside Funding: $ 219,728** supplemental support of Year 4 NIOSH projects
   $ 603,639 in support of independent Ag S&H projects

II. CENTER PROJECTS / ACTIVITIES FOR FY 2005

1. **Ongoing Projects: 2**

2. **Projects Completed: None**

3. **New Projects: 3**

4. **Feasibility Projects: None**

III. CENTER INVESTIGATORS

1. **Scientific Investigators:** Faculty (6), Staff Researchers (7), Students (9)

2. **Program Support Staff:** 4

IV. CENTER PRODUCTS

1. **Presentations:**

R1: Barr H. Identification and Prevention of Injuries in NW Orchards: Analysis of Survey-based Worker Interviews on Risks and Hazards. MS Thesis Presentation. Seattle, Washington, May 2005,

R2: Ceballos D, Fenske RA, Galvin K, Tchong M. Pesticide Exposure Opportunity for Tree Fruit Thinners. University of Washington, Department of Environmental and Occupational Health Sciences PhD Laboratory Rotation.

R2: Fenske RA. How Can We Improve the Accuracy of Children's Measurement Data. EPA's Workshop on the Analysis of Children's Measurement Data. Research Triangle Park, North Carolina, September 27, 2005.

Fenske R, Murphy H. Pacific Northwest Agricultural Safety and Health Center. Washington State University Extension Administration, Pullman, Washington, December 2004.

Murphy H, Borges O. Presented a training session on signs and symptoms of pesticide poisoning,Western Migrant Stream Forum, San Diego, January 27-29, 2005.

Fenske R. Pacific Northwest Agricultural Safety and Health Center. Webinar: NIOSH Agricultural Centers, March 2, 2005.

Keifer M. Running a Cholinesterase Program: The Biology and Physiology of Cholinesterase (Spanish and English). Ag Safety Day, Yakima, Washington, March 9, 2005.

Murphy H. Best Practices in Outreach to Special Populations, Alaska Primary Care Association Conference, Anchorage, Alaska, May 24-25, 2005.

Crowe J, Keifer M. Poster describing El Proyecto Bienstar at the Third Annual Conference on Occupational and Environmental Health in the Americas, Costa Rica, February 6, 2005.

Swenson E, Reynolds S, Purschwitz M, et al. Preparing to Prevent Tractor Injuries and Fatalities with a National Tractor Safety Initiative. Poster presentation at National Institute for Farm Safety, Wintergreen, Vermont, June 2005.

Connex students. Yakima Community Occupational and Environmental Survey. Presented to El Projecto Bienstar CORE, Yakima, WA, August 2005.

2. Publications

a. Peer Reviewed Journal: 5

b. Fact Sheets / Brochures / Technical Publications: 23

c. Other Publications:

R1: Swenson E. Improving the Health and Safety of Northwest Orchard Workers and Their Families. *SPHCM's Spotlight on Research*, Issue 19: Winter 2005.

R1: Barr, H. Characterizing the Performance of the "Smart" Tripod Orchard Ladder. University of Washington Masters of Science Thesis, June 2005.

R2: Manuscript in preparation: Fenske RA, Lu C, Negrete M, Powers KM, Galvin K. Transmission of Agricultural Workplace Chemicals to Commuter Vehicles and Residences among Pesticide Handlers and Field Workers in Washington State. In preparation.

R2: Manuscript in preparation: Ceballos D, Fenske RA, Galvin K, Tchong MI. Pesticide Exposure Opportunity for Tree Fruit Thinners.

ACOEP: Web site: Pacific Northwest Agricultural Safety and Health Center, http://depts.washington.edu/pnash/.

ACOEP: Environmental Justice, at http://depts.washington.edu/envhlth/.

Power Point Presentation: Developing Outreach Materials for Semi-Literate Populations, http://depts.washington.edu/pnash/literacy.php.

Crowe, J. Key Informant Perception of Environmental and Occupational Risks for Agricultural Workers. University of Washington Masters of Public Health Thesis. Seattle, WA.

3. **Education / Training / Outreach**
   a. **Training Seminars:** 3
   b. **Short Courses:** 2
   c. **Hazard Surveys / Consultations:** 9
   d. **Academic Training:**
      In Academic Degree Programs: 6
      Graduated: 3
   e. **News Letters:** 3
   f. **Other:**

R2: Sent 2003 and 2004 participants letters which contained their individual results for house and vehicle dust test. Included factsheet regarding the study.
R2: Sent 2003 and 2004 participants letters which contained their individual results for house and vehicle dust test. Included factsheet regarding the study.
R2: Audiotape and icon based evaluation tools.
Prev 2: Curriculum: Packing house ergonomic training.
Educ 3: Training curricula for the following four training modules using FT

- 1a Application Equipment Decontamination
- 1b Unplugging spray Nozzles
- 2 Urinating while wearing PPE
- 3 Decontaminating PPE

Educ 3: Pre and post evaluation scripts (Spanish and English).
Educ 3: Pre and post icon answer sheets (Spanish).
Educ 3: Decontamination training materials for pesticide handlers.
ACOEP: Proceedings: Western Regional Conference – Cultivating a Sustainable Agriculture Workplace. Compact Disk and Web formats.

ACOEP: Educational Calendar: Co-sponsorship of 2005 calendars based on North American Guidelines for Children's Agricultural Tasks. Distributed to 1000 Northwest Farm Families.

ACOEP: Exhibit: Ag Expo, Spokane, Washington, January 11-14, 2005.

ACOEP: Exhibit: Ag Safety Day, Yakima, Washington, March 2005.
ACOEP: Exhibit: El Proyecto Bienstar featuring "Fiesta Familia" panel (Spanish and English), Washington State Migrant Council, Head Start Program, July 2005.
ACOEP: Curriculum: Crowe, J. Introduction to Field Research and Environmental Public Health

4. Conferences / Meetings Sponsored:

R2: Galvin K, Negrete M, Tchong M. Presented preliminary results of the Pesticide Take Home Study to worksite managers, Tri-Cities, Washington, June 2005.

R2: Tchong M, Negrete M. Presented 2003 and 2004 study results to work place health and safety committee, Tri-Cities, Washington, September 2005.

R2: Community meeting. To answer questions from community on their personal and group results (meeting held after personal results distributed in a letter).

PNASH Internal Planning Meetings (monthly)

PNASH Brown Bag Staff Meetings (monthly)

PNASH Lab Meetings (monthly)

El Proyecto Bientstar CORE Meeting (quarterly)

El Proyecto Bienstar Community Advisory Board (CAB) Meetings (first quarterly)

5. Other Products:

R1: Model: "Smart" Tripod Orchard Ladder.

R1: Application for patent of smart ladder design.
R2: Recruitment Script (Revised)
R2: Consent Form: Agricultural Workers Intervention (Spanish and English)- (Revised)
R2: Car Vacuuming Intervention- Instructions (Spanish and English)
R2: Interview Instructions
R2: Approach Script – Parent's Permission for Child Hand Wipes (Spanish and English)
R2: Parent Permission form – Hand Wipes (Spanish and English)
R2: Child Oral Consent Script – Hand Wipes (Spanish and English)
R2: SOP 1: Site and Subject Recruitment (Revised)
R2: SOP 4: Dislodgeable Foliar Residue (DFR) Sampling
R2: SOP6: Surface Wipe Sampling (car windows)
R2: SOP7: Dislodgeable Foliar Residue (DFR) Field Spikes
R2: SOP9: Hand Wipe Sampling
R2: Protocol: Personal Safety and Welfare (field crew)
R2: Protocol: 2-Propanol Handling (field crew)
Prev 2: One-act telenovela ergonomic play (Spanish) - (VHS/DVD).
Prev 2: Pre-post Ergonomic Behavior Observation checklist.
Prev 2: Pre-post Questionnaire (Spanish and English).
Prev 2: Certificates for course completion.
Educ 3: Literature Review: Health effects of chronic pesticide exposure.
Educ 3: Survey: Needs assessment of key informants.
Educ 3: Analyzed state data on pesticide use by crop and location.
Educ 3: Manuscript in preparation describing survey of key informants described above.
ACEOP: Posters: Study results (illustrated format)

ACEOP: Planning Committee: Murphy, H. Ag Safety Day, Yakima, Washington, March 9, 2005.
ACEOP: Planning Committee: Murphy, H. Western Migrant Stream Forum, San Diego, California, January 27-29, 2005.
ACEOP: Planning Committee: Murphy, H. Sustainable Agriculture, Communities & Environments in the Pacific Northwest, Richland, WA, May 18-20, 2005.
ACEOP: Planning Committee: Harrington, H, Murphy H. Western Agricultural Safety and Health Conference – Research to Practice, September 2006.
ACEOP: Planning Committee: Murphy, H. Western Migrant Stream Forum, Portland, Oregon, January 2006.
ACEOP: Murphy H. Attended Washington State Horticultural Association Meeting, Yakima, Washington, December 2004.
ACEOP: Resource Library: Integration of collection of pesticide materials from the Washington Public Health Lab.
ACEOP: Graphic Library: Expansion of photo and illustration collection.
ACEOP: Survey: To determine environmental and occupational issues of concern to Yakima Valley farmworkers and their families. (English and Spanish)
ACEOP: Invterview: Crowe, J, Connex students. El Proyecto Bienstar, Radio KDNA (Spanish), August 2005.
Fenske R. Ag Centers Directors Meeting, Lexington, Kentucky, December 2004.
Harrington, M. Agricultural Center Initiative Evaluation Meeting, Fort Collins, Colorado, February 2005.
Fenske R. Ag Centers Directors Meeting, Tyler, Texas, April 2005.
Fenske R, Harrington M. USDA NW Regional Farm Safety Meeting, May 2005.
Swenson E. Tractor Safety Initiative Meeting, Washington, DC, July 2005.
Keifer M. NIEHS Environmental Justice Program Investigators Conference, Talkeekna, Alaska, September 2005.
Tractor Safety Leadership Council Conference Calls (quarterly)
Agricultural Center Evaluation Conference Calls (quarterly)
Year 3 (FY2004) Annual Report.
Year 4 Progress Report and Year 5 Renewal Application.
PNASH E-Newsletter (bi-monthly)

V. ADMINISTRATIVE REPORT

In FY 2004 PNASH Center administration had several notable developments:

- 2005 Unobligated Funds
- Planning for Competitive Renewal Application
- Agricultural Centers Coordination
- New Project Awards
- Agricultural Center Evaluation
- Tractor Safety Initiative

2005 Unobligated Funds
From FY 2005 (Year 4), the PNASH Center has an estimated unobligated remaining balance of $798,700TC. This amount is less than the 25% remaining balance threshold mandated in our CDC/NIOSH cooperative agreement. This spending reflects each project's good adherence to their aims and timelines.

Planning for Competitive Renewal Application
PNASH's Internal Advisory Committee began planning the Center's next 5-year cycle in February of 2005. Early planning brainstormed theme and project ideas. In April, at a Center retreat, core faculty and staff presented and discussed project ideas. Over the summer, PNASH released a call for pre-proposals within the University of Washington and to investigators throughout the Northwest. Eleven pre-proposals were received, of which 9 qualified after review by the internal planning committee.

New Project Awards
A variety of new projects were awarded funds in Year 4:
- (WA State, 2-year) Fluorescent Tracer Technique for Hands-on Pesticide Applicator Training: Development and Evaluation.
- (WA State, 2-year) Communication of Pesticide Health Risks to Ag Producers, Workers and their Families.
- (WA State, 2-year) Improving and Simplifying Cholinesterase Monitoring in Washington State.
- (EPA, 5-year) Pesticide Effects: Integration into Health Care Provider Curricula.
- (NIH through ID Mountain States Group, 4-year) Idaho Partnership for Hispanic Health.
- (NIOSH through ERC, 1-year) Identification of Risk Factors fro Pesticide Over-exposure among applicators in Washington State.
- (NIOSH through ERC, 1-year) Evaluation of Vehicle Vacuming Intervention for cherry Pickers Workplace Exposure Determinants of Take Home Exposure.
- (NIOSH, 1-year) Automating Work Exposure Questionnaire for Subjects with Low Literacy Skills.
- (NIOSH, 1-year) NIOSH Agricultural Center Tractor Safety Initiative: Communications for Partnerships and Promotion.

Agricultural Centers Coordination
Dr. Richard Fenske, Director of the PNASH Center, continued to serve as the coordinating Director among the Agricultural Center Directors. The PNASH Center arranged and facilitated regular conference calls for the Directors and prepared for 2 annual meetings.

Agricultural Centers Evaluation
Marcy Harrington serves on the Agricultural Centers Evaluation project, a multisite cross-evaluation program evaluation effort conducted jointly by all the Agricultural Centers. In 2005 Ms. Harrington contributed by 1) reviewing the process and products of the previous cycle of evaluation, 2) participating in the joint center workshops led by the High Plains Center, and 3)

volunteering to serve in both pilot evaluation projects to measure the cross-center impact – these are for projects in high school agricultural safety education and professional education.

Participation in the cross-center impact evaluation of a high school agricultural safety curriculum, led to a new partnership. Previously, PNASH had served as a reviewer of an intradepartmental project, Working Teens: Agricultural Safety and Health. In 2005, PNASH partnered with the curriculum's developer, the Center for Ecogenetics and Environmental Health to conduct a one-year evaluation of the curriculum. The evaluation project will conduct pre and post knowledge tests of students as well as survey Ag In the Classroom instructors. Results of this project will be assessed along with other Ag Centers' high school aged curricula to determine overall impacts.

Tractor Safety Initiative

Year 4 began with submission of a multi-site, Agricultural Centers' proposal to further the Agricultural Center Tractor Safety Initiative (TSI). This 2-year project was funded to build capacity to launch a national public health campaign that would reduce tractor-related deaths and injuries. PNASH serves on the TSI Leadership Council and specific contributions for this period include testing community-based social marketing in the Northwest and the development of communication tools, including a database of potential partners and an Intranet site. This project involves an unprecedented collaboration among the Agricultural Centers and NIOSH.