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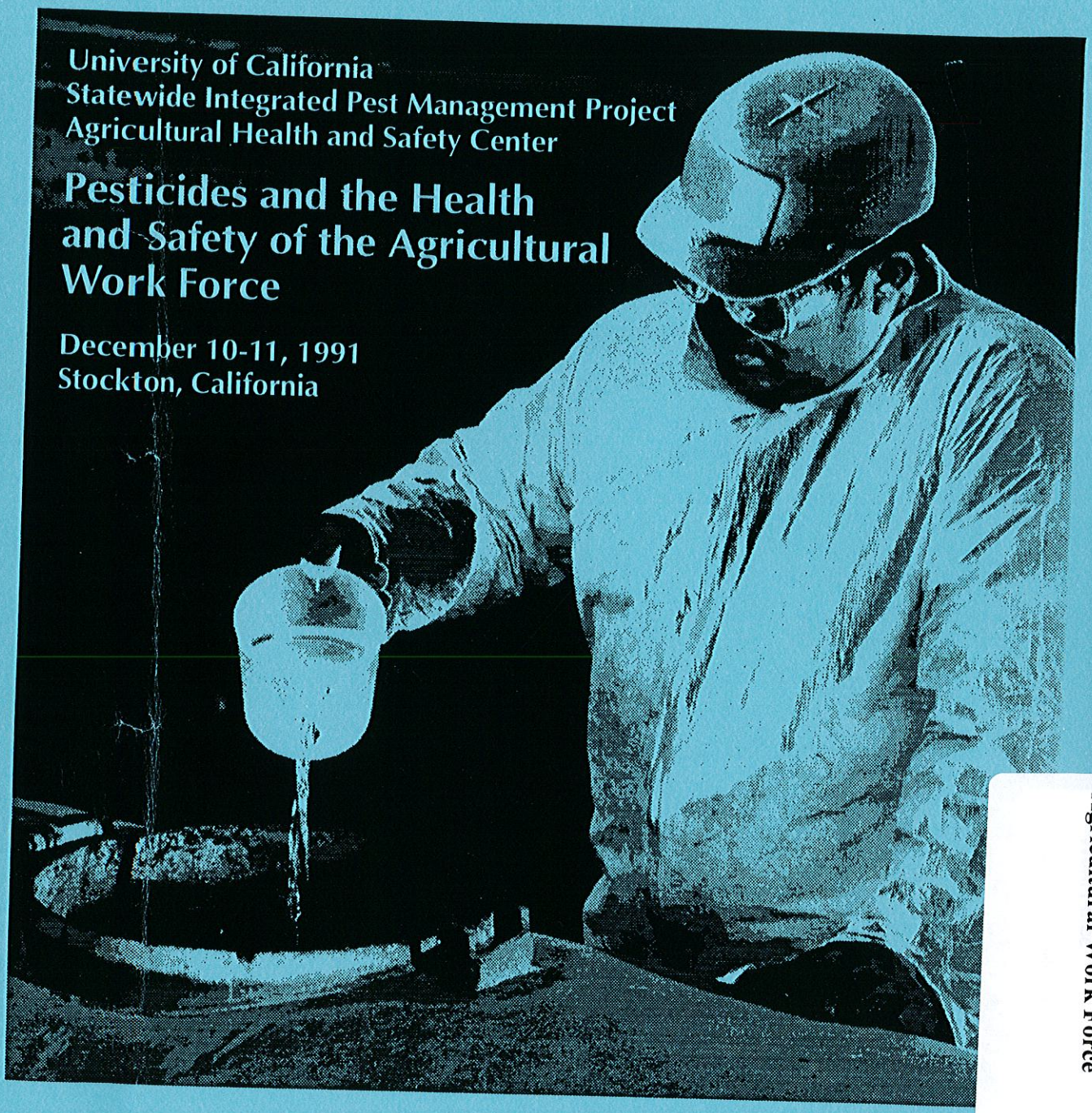

University of California
Statewide Integrated Pest Management Project
Agricultural Health and Safety Center

Pesticides and the Health and Safety of the Agricultural Work Force

December 10-11, 1991
Stockton, California

PESTICIDES AND THE HEALTH AND SAFETY OF THE AGRICULTURAL WORK FORCE

DECEMBER 10-11, 1991
STOCKTON HILTON

Tuesday, December 10, 1991

8:00 **Welcome** Gary Johnston, County Director, UC Cooperative Extension, Stockton

8:15 **Overview 'Pesticide health and safety issues'**
L. Tim Wallace, past CDFA Director, Professor, UC Agricultural Economics

8:30 **Keynote Speakers:**
Steven Book, Director, Office of Environmental Health Hazard Assessment
James Wells, Interim Director, California Department of Pesticide Regulation

9:20 **Panel Response: 'Needs and Concerns of the Agricultural Community'**
Moderator: L. Tim Wallace
Panelists:
Richard Matoian, Director, Governmental Relations, California Grape & Tree Fruit League
Don Villarejo, Executive Director, California Institute for Rural Studies
Kenneth Farrell, Vice President, UC Division of Agriculture & Natural Resources,

10:15 Break

10:35 **Panel Discussion: 'Promoting the Safe Use of Pesticides'**
Panelists:
Steve Sutter, Personnel Management Program, University of California **(moderator)**
Susan Cohen, Agricultural Commissioner, Solano County
Henry Buckwalter, Registration Specialist, Uniroyal Chemical Company
Ralph Lightstone, Attorney, California Rural Legal Assistance Foundation
Nicolas Escalante, Consul General, Mexican Consulate
Sharan Lanini, President, California Women for Agriculture

11:45 **Questions, Answers, Participant Commentaries.**

12:00 Lunch (provided)
Luncheon Speaker: Arnoldo Torres, Political Consultant, Torres & Torres

1:10 **Panel Discussion: 'Strategies for Source Reduction'**
Frank Zalom, Director, UC Statewide Integrated Pest Management Project **(moderator)**
Lawrie Mott, Scientist, Natural Resources Defense Council
William Liebhardt, Director, UC Sustainable Agriculture Research and Education Program
Linda Rudolph, California Occupational Health Program, California Department of Health Services
John Britton, Pest Control Advisor, IPM Practitioner, Farmer, Britton-Konnynenberg Farms

2:15 **Panel Discussion: 'Pesticide-Related Health Care Issues'**
Stephen McCurdy, UC Division of Occupational and Environmental Health **(moderator)**
David Goldsmith, UC Division of Occupational and Environmental Health
Arcadio Viveros, Executive Director, United Health Centers of the San Joaquin Valley
Salvador Sandoval, Physician, Merced Family Health Centers
Steve Thompson, Director, Assembly Office of Research
David Froba, Attorney, Froba, Freiling and Rockwell

3:20 Break

3:40 **Break-Out Groups**

#1 Promoting the Safe Use of Pesticides
Facilitator: James Meyers, University of California

#2 Strategies for Source Reduction
Facilitator: James Grieshop, University of California

#3 Pesticide-Related Health Care Issues
Facilitator: Merri Weinger, California Department of Health Services

5:00 Adjourn/break

5:15 Social Hour (Refreshments will be served)

Wednesday, December 11, 1991

8:00 **Welcome, Legislative Update**
Mary Jensen, Assistant Agricultural Commissioner, San Joaquin County
Rusty Areias, California State Assembly

8:40 **Review, Panel and Break-out Group Discussion Highlights**
Group Facilitators: James Meyers, James Grieshop, Merri Weinger

9:30 **Open Microphone: Questions, Answers, Comments**

10:00 Break

10:15 **Resume Break-out Groups**

12:00 Lunch (provided)
Luncheon Speaker: Marion Moses, Pesticide Education Center

1:10 **Resume and Conclude Break-out Groups**

3:15 Break

3:30 **Reports from Break-Out Groups: Findings, Recommendations for Action**

4:30 Adjourn

Presentation on
Panel Response of
'Needs and Concerns of the Agricultural Community'
by

Don Villarejo
Executive Director, California Institute for Rural Studies

Pesticide safety for farmworkers: What should be done?

In its cover story, a recent issue of *Newsweek* magazine contains the provocative statement that if education alone could be relied upon to change human behavior then we should have been able to eliminate everything from drugs and sexually-transmitted diseases to crime in the corporate suites. I think this comment on the limitations of education is especially true of occupational injury in California.

In such a well-informed group such as this I don't need to recall for you the very great extent of such injuries nor the associated expenses faced by most agricultural industry employers. Instead, I want to focus your attention on some factors not often discussed or, in many cases, simply ignored.

My first direct experience with the special difficulties associated with making the workplace safe for farmworkers in the context of intensive pesticide use was some 10 years ago. I refer to an incident that occurred on May 14, 1981, when Santiago Ruiz Quesada was run over by a tractor-disker rig on a farm located between Dixon and Davis. According to the only published newspaper account, Ruiz...

> "...tried to jump onto a moving tractor but missed and was crushed under the tire, then run over by the disking attachment."

Later that summer, in July, Annie Souter, a public health nurse, presented a pesticide safety educational workshop at a local farm labor camp using a Spanish language slide show we had prepared. After the presentation, one of the women in the session approached her. The woman took a crumpled copy of the news clipping regarding Ruiz' death from her purse and handed it to Anne saying, in Spanish, "It was pesticides." The woman claimed Ruiz had been working with pesticides at the time of the accident and was sick from them when he was run over.

Annie promptly notified the California Occupational Safety and Health Administration (CalOSHA) regarding this information, and it was discovered the official report of the incident had already been completed on June 16, 1981. That report was based on interviews with coworkers of the deceased at the job site. A company foreman had acted as Spanish-English interpreter. According to this report, Ruiz had been filling the hoppers of an applicator rig with aldicarb and...

> "...no violations of code are apparent."

In addition, the CalOSHA report stated that, upon consultation, California Department of Food and Agriculture (CDFA) personnel had indicated there was, in this case...

> "Little likelihood of Temik poisoning."

According to the CalOSHA investigation, Ruiz had been wearing goggles and coveralls, and had been provided with and was wearing a respirator. The report also stated he had been assigned the task of burning the empty packaging materials.

An independent report was completed on July 17, 1981, by the University of California – Davis Department of Community Health staff based on interviews of Ruiz' coworkers in their home by a native Spanish speaker. This report found that, immediately prior to accident, Ruiz had been observed by another worker to be...

> "...groggy, acting dizzy...He was lying unseen in the grassy path when the tractor/disker ran over him. It is not known whether the victim had fallen asleep on the path (and failed to be awakened by the noise of the approaching equipment) or had suffered acute loss of consciousness."

Although the original CalOSHA report was clear that no violations of code were identified, the fact that aldicarb exposure might be involved caused the Yolo County Coroner to seek to determine, in the course performing the autopsy, whether or not poisoning by aldicarb was a factor in the accident. The coroner's report and death certificate, filed on September 19, 1981, stated the cause of death to be...

> "1. Massive crushing chest injuries.
> 2. Acute toxic effects due to Temik."

The accompanying memo from the Chief Deputy Coroner stated Ruiz...

> "...was experiencing symptoms of Temik poisoning at the time he was crushed and such symptoms were a major contributing factor to the accident that killed him."

The coroner's finding implicating pesticides was publicly contested by CDFA staff and, amid considerable controversy, reaffirmed by the County Coroner. This controversy was at least partly fueled by the fact that Ruiz' body had been washed clean by the Coroner's staff before the autopsy was begun and his clothing was not properly stored in a closed container before being examined several weeks later.

While this new information was being developed, local and state agencies with jurisdiction made a coordinated review of the case facts. CalOSHA reopened its investigation. In the second round, coworkers of the deceased were interviewed by several parties, including native Spanish speakers who spoke with several individuals at their homes. The second CalOSHA report found Ruiz:

- had been wearing bedroom slippers
- had been working as an irrigator when the foreman called him away from irrigating to load pesticides

- had not been furnished goggles, a face mask, or protective clothing until he had completed loading one hopper and was loading a second,
- had not been properly instructed in the dangers of exposure to Temik.

According to the second CalOSHA report, Ruiz had been provided with a respirator, but had not been properly instructed in its use. He had been told by his foreman to...

"...be careful with the respirator because it cost $50."

Additional information developed in the second Cal-OSHA investigation suggested...

"...he was not provided with nor wearing appropriate foot protection. He was not fit tested, instructed in the use of Temik, or informed of its hazards."

On October 15, 1981, citations were issued by the California Department of Industrial Relations regarding the following alleged violations of state code:

"1. Adequate means were not provided to communicate to non-English speaking employees the hazards of working with insecticides.

2. The applicator loader was not wearing respiratory equipment approved for exposure to a hazardous substance, namely the smoke created by burning empty Temik containers.

3. Employees were not instructed in the need, use, sanitary care and limitations of respiratory equipment. There was no fit testing.

4. The applicator loader and the applicator driver were not instructed in the hazards of contact with the insecticide Temik.

5. The applicator loader was not wearing appropriate clothing for protection from the hazards of skin contact with the insecticide Temik.

6. The applicator was not wearing foot protection appropriate for exposure to the insecticide Temik.

7. A change room with clothing storage facilities, shower baths and lavatories with hot and cold running water were not provided for employees exposed to the hazards of the insecticide Temik."

The total civil penalty in this case was placed at $970.

What is remarkable about this story is the very great discrepancy between the first investigation and the later discoveries, and especially the happenstance of Anne Souter's meeting an anonymous informant at an educational meeting.

What have we learned in 10 years?

We now flash ahead nearly 10 years. I was invited to a staff meeting of the agricultural commissioner of one of California's most important agricultural counties, where I learned of the great difficulties the staff faces in attempting to enforce California's pesticide safety laws. Once in the field, I learned, staff frequently have great difficulty figuring out who is in charge. A farm labor crew leader, in all likelihood, is working, not for the grower, but for a labor contractor who is rarely accessible. Worse, while nearly all of the workers speak only Spanish, the commissioner's field staff in this particular county has minimal knowledge of Spanish.

Add to this situation the fact that:

- 95% of current California farmworkers were born in Mexico or Central America;
- the mean number of school years these workers have completed is just six;
- most workers are not aware of the provisions of California law regarding their health and safety;
- a majority of California farmworkers have annual earnings below the poverty level;
- workers must depend upon their employer to provide them with safety information, as well as with proper equipment.

Now add the following factors:

First, as reported by Means and Kearney in a comprehensive interview-based survey of the health status of Tulare County farmworkers, the majority of farmworkers who claimed to have been injured on the job by exposure to chemicals did not report their injury to their employer, nor did they seek medical attention from a physician. According to their findings...

> "... workers report the cost of medical care and an unwillingness to miss work are the main reasons they do not seek medical care for their problems caused by chemicals."

Second, in a situation of substantial labor surplus, many workers are fearful of their ability to continue to hold their job. Thus, direct criticism of the employer is frequently avoided.

Finally, most workers do not believe they have access to a sympathetic Spanish-speaking advocate, someone who they can turn to for advice or assistance without fear of that person informing the INS or other agency about their presence or criticisms.

From our point of view, strict enforcement of pesticide laws and education of workers about workplace hazards are extremely important and necessary, but they will only accomplish a portion of the task. The next step, of empowering workers to act on their own behalf, will be much more difficult, but just as necessary.

Presentation of
Panel Discussion on
'Needs and Concerns of the Agricultural Community'
by

Kenneth Farrell
Vice President, UC Division of Agriculture and Natural Resources

The University of California addresses agricultural worker safety concerns

The impact of agriculture on California life is indisputable.

Agriculture is California's number one industry, and California is the nation's leading agricultural state with 16% of all crop production in the United States. Farm production in California is 60% greater than the second leading state's output. The output of one county — Fresno — is greater than the total agricultural production of 25 states.

While productive, agriculture is a hazardous industry. In California, there are 22,000 non-fatal disabling injuries recorded in California agriculture each year. In addition, more than 2,000 agricultural, pesticide-related illnesses are reported each year, with possibly thousands more illnesses going unreported or unrecognizable.

Health hazards such as those posed by pesticides exist for all members of the California agricultural community, which is comprised of over 80,000 farms employing more than 750,000 farmworkers. These hazards are compounded by the cultural differences and language barriers that characterize this diverse farmworker population.

Despite the prevalent hazards that exist in agriculture, federal budget cuts have found more responsibility for agricultural occupational safety programming being shifted to the states. California's concurrent budget cuts have been felt throughout the state.

The UC Response

Budgetary constraints have impacted the University of California, as well. Across-the-board cuts in all UC programs at all campuses have resulted in staff reductions and the scaling back of services. Amid this economic adversity, however, UC has emerged as a leader in agricultural occupational health and safety in large part due to grants from regulatory, industry, and public interest sources.

Through a variety of programs, from day-to-day operational and mechanical hazards to long-term and chronic health effects, the University of California Division of Agriculture and Natural Resources (DANR) is seeking new ways to make California agriculture safer. In addition, the university is seeking to serve as a conduit of communication, bringing together the varied and sometimes divergent constituencies that comprise the California agricultural community.

University of California programs facing the challenge of improving the state's agricultural health and safety through pesticide use reduction and promotion of safer ways to use pesticides include:

The UC Statewide Integrated Pest Management Project

The UC Statewide Integrated Pest Management Project supports a wide variety of research projects that carry on the goal of improving California agricultural efficacy, while reducing the need for chemical solutions to pest management. Although it is impossible to put precise numbers on reduction of total pesticide use due to the IPM Project, it is clear the program has provided growers with many practical ways to reduce their reliance on pesticides and that growers have adopted many of these practices.

The UC IPM delivery systems, which includes area IPM advisors and cooperating county farm advisors, the publicly accessible IMPACT computer, the renown IPM publications, and educational programs for pest management professionals, has been instrumental in getting new pest management and pesticide safety information to users in rapid fashion.

Area IPM advisors serve the health and safety of California's agricultural work force by researching , adapting, and extending safe IPM techniques to specific field situations throughout the state. By training growers and PCAs to more effectively identify, monitor and manage pest problems, the advisors improve the efficacy of pest control activities and reduce the need for pesticide use.

The IPM publications group continues to be a national leader in the dissemination of information regarding safe, nonchemical pest management innovations, the application of which have a positive effect on agricultural worker health and safety. With twelve crop-specific manuals and two more in development, numerous specialized publications such as the new spray oils guide, and the invaluable UC Pest Management Guidelines, IPM publications are an important resource for growers and pest management professionals.

The IPM computer systems group also provides critical information to advisers and growers alike, allowing the IPM innovations to be implemented effectively. Databases available to growers and pest control advisors include the Pest Management Guidelines, UC-CDFA Pesticide Survey, Pesticide Registration, Meteorology, Monitoring and Degree-days, Pest and Plant Models, Alternatives to Pesticides, and many more.

Safe and precise pesticide application practices can reduce pesticide use as well as hazards, two important goals of integrated pest management. The Pesticide Education Program of the IPM Project organizes and sponsors programming to provide initial and continuing education required of pest management professionals and to train farmworkers in pesticide safety. In addition, the program develops study guides and safety-related publications targeting pesticides. This conference is a byproduct of increased efforts by the Pesticide Education Program to bring diverse interests together to address critical health and safety issues related to agricultural use of pesticides. In addition, the program is developing pesticide safety information for use by health professionals and community service organizations who work with the agricultural work force.

The UC Agricultural Health and Safety Center

The UC Agricultural Health and Safety Center at Davis brings together components of several existing programs into a united front addressing the health and safety issues that affect agriculture in California and other western states. The center addresses research, industrial hygiene and safety, outreach, and policy concerns through a collaboration of UC-based agricultural and academic research programs, extension programming, medical and toxicology staffs, engineering and educational experts, and state regulatory agency ties.

Of special note, the policy component of the center addresses agricultural health and safety from a legislative and regulatory perspective. This goal includes legislative briefings and efforts toward establishing effective farm labor laws.

The research component has seven projects currently under way. They include studies concerning farm family health, detection of pesticide exposure in workers, epidemiology of pesticide illnesses, redesign of agricultural tools, contact dermatitis in nursery workers, pesticide transfer in fabrics, and injury epidemiology.

The outreach component is comprised of six projects involving safety training, health and safety, information exchange, labor contractors, continuing medical education, and a study of farmworker health. Center outreach includes "social marketing" of farmworker health and safety methods and resources to agricultural employers in Fresno, Kings, Madera, and Tulare counties. Many of these projects have an emphasis on pesticides.

The industrial hygiene and safety component has responsibilities in exposure assessment and monitoring, and sample analysis.

The California Farm Safety Program

The California Farm Safety Program's goal is to promote safety and health concerns in the agricultural workplace. The program seeks to reduce injuries, occupational illnesses, and fatalities among agricultural workers in California through worksite modification and education. Issues addressed by the program include safe use of farm equipment, pesticide hazard awareness

and safety, safe use of shop tools, proper lifting and other hand work techniques, and general safety training for agriculture..

A collaborative outreach program has been implemented, including contributions from personnel of the Farm Safety Program, the UC IPM Project, and the UC-Davis Applied Behavioral Sciences Department. Safety training modules are being developed in English and Spanish, which will be available for use by farm owners and operators. These materials are intended to enhance the safety practices of those associated with agriculture.

The program offers a lending library resource that makes available English and Spanish training videos and films. A variety of safety subjects are covered by the library resources, with each production designed to assist in the development of safety programs tailored to the diverse needs of individual agricultural operations. In addition to the visual library, selected written materials are also available.

The program newsletter, *Occupational Safety and Health in Agriculture*, is available at no cost on a quarterly basis to all interested parties. The newsletter addresses current safety issues and reviews safety-related resource materials available through the program library.

The UC Agricultural Personnel Management Program

Decisions by which human resources are applied in agricultural production affect farmworker quality of life, employer business results, commodity pricing and quality, the environment, and rural society. The mission of the UC Agricultural Personnel Management Program (APMP) is to improve labor management decisions in California agriculture. In addition, APMP emphasis areas include analysis of farm labor issues for public administrators and lawmakers and to heighten agricultural worker awareness of public policies related to their employment.

An important component of the APMP is assisting farm management in making personnel management decisions that make California farms a safer place for workers. Faced with a fluid and increasing body of law relative to farm labor concerns, farm managers can easily be left unaware or confounded by these public policy decisions. An effort to alleviate the confusion and burden placed upon farmers by these new laws is provided in the APMP publication *Labor Management Laws in California*. The guide is a summary of what federal and state laws require, allow, and prohibit with respect to employment.

In response to new law requirements in the past year, APMP efforts included detailing opportunities presented in the Immigration Act of 1990 for reunification of of family members left with different legal statuses as a result of immigration reform in 1986. In addition, assistance in implementing a new state mandate requiring farms to have in place a structured, documented safety program was put forth by the APMP staff. Activities in promoting

awareness of this new responsibility to assist farmers in complying with it included development of reference publications, trade press articles and news releases, educational meetings, and technical support for safety-centered organizations.

Another recent impact on California agriculture addressed by the APMP staff has been the dramatic increase in the use of farm labor contractors (FLCs) by growers. FLCs provide 20% of all farm employment and a majority of fruit and vegetable harvest work in most regions of the state. FLCs are subject to federal, state, and local licensing requirements, as well as worker safety and other employment laws. Meetings were held in concert with cooperative extension and agricultural commissioner offices, as well as the state Employment Development Department.

The UC Sustainable Agriculture Research and Education Program

Since the passage of the California Sustainable Agriculture Research and Education Act in 1986, the UC Sustainable Agriculture Research and Education Program (SAREP) has been charged with finding ways of easing the transition to farm practices that maintain or enhance the natural resource base and profitability in tandem.

SAREP has three main responsibilities: 1) to fund competitive research for the development of more economically viable and environmentally sensitive agricultural practices and policies; 2) to develop and distribute this information to the agricultural community and the public; and 3) to coordinate the establishment of long-term research sites. Research efforts include reduction of petrochemical and fertilizer use; reduction of production costs; enhancement of environmental quality, food safety, and farmworker working conditions; the development of sustainable forestry policies; and an introduction of sustainable agricultural practices into an urban gardening program.

The UC Small Farm Program

The UC Small Farm Program consists of the Small Farm Center, numerous farm advisors, specialists, and other UC Cooperative Extension staff who assist in program activities. The program mission is to develop, extend, and bring about through educational means the use of research-based knowledge for the benefit of small scale farmers, their consumer clientele, and the natural and renewable resources they use.

The Small Farm Program works toward accomplishing this goal by integrating the expertise of numerous disciplines and subjects (e.g. pest management, soils and water, economics, sociology, engineering, marketing, crop production); by providing linkage between various DANR units and the numerous and varied small farm clientele; and by developing, collecting, and disseminating information through the Small Farm Center. All DANR advisors and specialists are expected to have some small farm responsibilities.

Small farm clientele are distinguished from traditional clientele on the basis of scale-specific problems or solutions, or method of education delivery. The clientele has traditionally been vegetable and fruit growers or marketers, but an increasing number are animal or natural resource oriented.

One of the top priorities of the program is multi-cultural outreach. The program has made its mark recently on the public service front, especially through activities aimed at assisting relatively new Southeast Asian immigrants. Activities in this effort have included bridging cultural and language gaps between Cambodian growers and county agricultural commissioners and developing chicken rearing facilities for Hmong refugees. Research efforts included food safety labeling and information delivery systems for sustainable agriculture.

UC Collaborative Efforts

University of California programs and researchers frequently work in collaboration with external groups not affiliated with the university, but with whom there exists a common goal of improving the health and safety of California agriculture. Some of these collaborating groups include:

AgSafe. AgSafe is a coalition of groups and organizations dedicated to the reduction of injuries, illness, and fatalities among those who live and work in California agriculture. The coalition is based on the need for improved communication and cooperation in the development of programs to reduce agricultural injury and illness.

AgSafe is incorporated as a non-profit educational corporation and operates under the leadership of an elected board of directors representing the varied sectors of California agriculture, including several University of California researchers, specialists, and professors. Reduction of occupational injuries is an identified common priority of the coalition.

AgSafe is also working to contribute to the effective and practical implementations of SB 198, which requires programs for worker safety training, hazard identification, and hazard abatement on farms.

FOSHE. The Farmworker Occupational Safety and Health Education (FOSHE) Program is a collaborative project of the Agricultural Workers Health Centers (AWHC), which links the support and resources of AWHC with the University Cooperative Extension and local farm bureaus. FOSHE addresses health and safety concerns affecting agricultural employers and employees.

Services provided to the agricultural community by FOSHE focus on health and safety training – including bilingual and bicultural education, consultation services, pesticide applicator seminars, training for health care professionals in agricultural health and safety issues, and public service announcements.

AWHC is a non-profit health care organization operating primary health care centers in San Joaquin, Yolo, and Solano counties. AWHC patients are predominantly low-income, minority farmworkers. An important component of the AWHC care program is health education.

APMA. The Agricultural Personnel Management Association is a service organization for human resource professionals working in the California agricultural community. The APMA is the sponsor of the annual California Agricultural Safety Exposition.

The goal of the APMA is to promote human resource expertise for individuals engaged in agri-business management. The organization offers meetings and workshops for agricultural human resource personnel and managers, as well as a collection resource materials.

Reducing pesticide use

One of the most important and far-reaching efforts undertaken by the University of California in addressing health and safety concerns of farmworkers and others working in agriculture has been the reduction of California agriculture's dependence on pesticides. Today, thanks in large part to university-sponsored research providing documented evidence that alternative methods will work within the growers' production systems, pesticide use in the state is on the decline. The result: A safer workplace for all who work in agriculture.

The UC Statewide Integrated Pest Management Project has led the way in sponsoring the research that made pesticide use reduction possible. Basing its efforts upon a goal of developing and promoting methods that allow California growers to reduce pesticide use, the IPM Project has sponsored over 150 research projects involving scientists from the Davis, Berkeley, and Riverside campuses, as well as the Kearney Agriculture Center in the San Joaquin Valley and the UC Cooperative Extension.

Pesticide reduction through IPM research has been achieved by development of:

- monitoring systems and treatment guidelines
- alternatives to pesticides

A major IPM effort in the reduction of pesticide use has involved developing practical monitoring guidelines and treatment thresholds to determine when pesticide applications are truly necessary. In the past, chemical treatments were an automatic response to the first appearance of a pest or timed to correspond to a particular stage in a crop growth cycle. These initial applications were followed by periodic supplementary applications.

For example, an IPM sampling program and treatment thresholds for cabbage aphids on brussels sprouts are responsible for reducing the number of seasonally applied insecticide sprays from seven to one in participating coastal fields. In the three years after introduction of a new IPM monitoring program to cotton growers in the San Joaquin Valley for use in their battle with spider mites, more than 84% of the growers were utilizing the program and realizing more than a 50 % reduction in their miticide use. Significant pesticide reduction has also been achieved by the more than 57% of Sacramento Valley tomato growers who use IPM decision guidelines for fruitworm.

On another front, the identification and introduction of alternatives to pesticides has had a major impact on California agriculture. Alternatives include cultural control, use of pheromone dispensers, and biological control methods.

Cultural controls include any modification of crop production practices that can reduce pest problems. These include water and canopy management, sanitation practices, development of resistant plant varieties, solarization, and cover crops, among others.

Reliance on these environmentally friendly techniques has contributed to the diminution of pesticide use. For instance, IPM-developed canopy management techniques used to manage botrytis bunch rot and for insect control have been adopted by more than 50% of the grape growers in the Napa/Sonoma/Mendocino wine region. This crop management technique is responsible for an estimated fungicide use reduction of more than 50%.

Research into the use of pheromones to disrupt mating of lepidopteran pests have literally borne fruit for California peach growers. Pheromone dispensers tied to tree branches inundate the air with female moth sex pheromone making it virtually impossible for the male moths to locate their mates. Testing and demonstration of inundation releases of pheromones by IPM researchers lead to the elimination of all insecticide applications for this major pest in many orchards, especially in the upper Sacramento Valley.

Biological controls are a key component of many IPM programs, providing additional mechanisms for reducing pesticide use. Biological controls include the use of predators, parasites, pathogens, competitors, or antagonists to manage pests. Over the past decade, the IPM Project has sponsored numerous applied research projects in this area, including research targeted at improving biological control of citrus insect pests, variegated leafhopper in grapes, greenhouse thrips in avocados, tomato fruitworm and southern green stink bug in tomatoes leafminers and other pests in glass house floriculture, spider mites on many crops, lygus in strawberries, and numerous pests in ornamentals, to name but a few.

Training those in contact with pesticides

When pesticide use is appropriate, as but one of the elements in an integrated approach toward crop management, it is imperative the chemicals selected are applied safely and effectively in accord with label directions. DANR programs and especially the Pesticide Education Program of the UC IPM Project, have led the way in educating and training California applicators and farmworkers through:

- training programs that impart safe and effective pesticide application information to applicators, and
- education and awareness programs that focus on farmworker health and safety concerns and help reduce exposure to and misuse of pesticides.

Safe and effective pesticide application practices that reduce hazards and overall pesticide use are the goal of initial training seminars, continuing education programs, and a study guide series for pest management professionals offered by the IPM Pesticide Education Program. Pesticide education opportunities range from the popular Statewide Pest Management Seminar series held each winter to hands-on applicator training and safety sessions. Recent programs aimed at training trainers to better teach pesticide safety has provided vital pesticide safety information to some 200 trainers with direct responsibility for educating over 22,000 applicators.

The IPM delivery system, noted earlier regarding dissemination of IPM research information, also plays a critical role in improved pesticide education. Area IPM advisors and cooperating county extension advisors and campus-based specialists are making great advances in sharing farmworker and applicator safety information. Recent efforts have included such diverse research and outreach programs as specialized training for newly-immigrated Southeast Asian growers and farmworkers, pesticide retention in textiles, and pesticide residue impact on fruit pickers.

Innovative efforts at bridging the cultural barriers that can prevent delivery of important health and safety information to non-English speaking farmworkers has been emphasized. The recent publication, *The Illustrated Guide to Pesticide Safety/El Uso Seguro de Pesticidas*, uses a comic-book format to take workers through each step of safe handling and application. Written in Spanish and English, the publication is available in both instructor's and worker's editions.

In addition, training videos on general pesticide safety and chronic health effects of pesticides are in development. A bingo-like "Loteria" game, styled after a popular Mexican pastime, is in final development for use after training workshops as a reinforcement and evaluation tool for health and safety concepts critical to farmworker well-being.

In tandem with the UC Davis Department of Agricultural Engineering, the IPM Project also is promoting general farm safety and the safe use of pesticides among agricultural workers and their employers.

Presentation on
Panel Discussion of
'Promoting the Safe Use of Pesticides'
by

Susan Cohen
Agricultural Commissioner, Solano County

The pesticide use and compliance process

Pesticide use regulatory program

I Private applicator certification

II Supplemental training and education
- A Use reporting/record keeping training (at certification)
  Prior to permit issuance
- B Pesticide safety training (special sessions) by community
  or industry request

III Inspections
- A Grower/applicator headquarters/storage
  Check training, medical supervision, application records
- B Presite, mix/load, application, equipment
  Check field applications for safety equipment, methods, etc.
- C Fieldworker safety

IV Audits
- A Pest Control Advisers (PCAs)
- B Pest control Operators (PCOs)
- C Pesticide dealers

V Illness/incident investigations
Check compliance with worker health and safety regulations and label

VI Enforcement
- A Noncompliance/letter of warning
- B Notice of violation
- C Condition permits
- D Office hearings
- E Agricultural civil penalties (Assembly Bill 1614)
- F Prepare case and refer to district attorney

I – Private applicator certification

All users of restricted pesticides must go through the EPA-approved certification process prior to issuance of permit. They must be able to understand the pesticide label, the worker health and safety regulations, and environmental concerns related to pesticide use.

II – Supplemental training and education

Prior to issuance of the permit, the department reviews recordkeeping requirements with users so that in the event of complaints, illnesses, etc., it will be possible to get accurate data for investigation. Agricultural applicators must keep a record of each use of every pesticide, including such information as date (and time, in situations where early reentry could cause a problem), location, chemical and quantity used, and applicator's name. Certain parts of the records are reported to the agricultural commissioner's office monthly on a specific form.

The department responds to requests from industry groups (Qualified Applicator Certificate holders, Qualified Applicator Licensees, Pesticide Applicator Professional Association, California Pest Control Advisors, etc.) and community groups (fire departments, health department, PG&E, etc.) to provide training sessions for pest control licensees and employees who may have occupational exposure (real or potential) to pesticides. The training usually focuses on hazard communication/training, safe handling, protective clothing and equipment, label interpretation, etc.

III – Inspections

At employer "headquarters," Inspections Grower/Pest Control Operator records – application records, employee training records –, and for agricultural production uses – employee insecticide exposure records and medical supervision records (which include a signed letter from a doctor who agrees to be the "medical supervisor" as defined in the Medical Supervision–Guidelines for Physicians, results of "baseline" blood tests, and the results of periodic blood tests to determine exposure levels for each employee) are checked for completeness and compliance with the California Code of Regulations on an annual basis using standardized forms.

During headquarters inspections, we also check pesticide storage areas for signs and safe containers (labels, no food containers, leaks, torn bags, etc.)

Preapplication site inspections are performed on at least 5% of proposed restricted pesticide applications to evaluate for safety to proximal dwellings, schools, and other populated areas, fieldworker crews, and susceptible crops. The Notice of Intent to apply will be denied if the application does not conform to permit conditions, pesticide label requirements, or environmental and safety considerations.

Once a proposed application has been approved, agricultural commissioner's staff inspect the mixing and loading of the pesticide(s). Much of the pesticide workers exposure occurs during this operation, since concentrated materials are being handled. Compliance with closed-mixing system requirements for highly toxic liquid materials is enforced, as well as applicable requirements for chemical resistant clothing, safety equipment, and respiratory protection. Training is checked through interviewing the employee regarding the chemical(s), washing facilities and procedures, and emergency medical care provisions. The commissioner's staff review chemical labels (required at the site) and laws and regulations on site, and use standardized inspection forms for these inspections.

The application itself is also inspected to assure the method used is appropriate to the crop and pest, and is not likely to cause drift or another unsafe condition for the applicator or the environment. Protective clothing and safety equipment, such as eye protection, is required and its use is enforced. The application can be halted if a hazard appears imminent. Safe equipment (no leaks, no clogged nozzles, working sight gauge (to prevent overfilling)) must be maintained during the job, and standardized inspection forms are used to document compliance.

Fieldworker safety inspections are done when workers are sent into fields that may have been treated with pesticides. Workers may be exposed to residues when engaged in harvesting, weeding, tying vines, pruning, or thinning operations, so compliance with worker health and safety regulations is checked through interviewing the field foreman and using a standardized inspection form. The foreman's knowledge of the field's pesticide application history is tested, as well as pesticide poisoning symptoms and what to do when a worker exhibits such symptoms. Washing and toilet facilities are inspected to assure compliance with worker health and safety regulations and the Health and Safety Code.

IV – Audits

Pest Control Advisers (PCAs) are individuals licensed by the state to make recommendations for pest control applications. They must register with the agricultural commissioner in each county where they intend to make recommendations. The recommendations made by these PCAs are audited by the commissioner's offices on a annual basis. We check to see that the specifics of the application (chemical, rate, location, conditions, etc.) are on the recommendation, as well as warnings of potential hazards. The number of days between the application and when unprotected workers may enter the field, as well as the number of days before harvest can occur, must be on the recommendation. The PCA must furnish a copy of the signed recommendation to the applicator or the operator of the property prior to the application. The PCA must certify they have considered alternative pest control measures and the recommendation is the most efficacious means of dealing with the pest.

Pest Control Operators (PCOs) are persons licensed by the state to operate a pest control business. These businesses must register annually with the agricultural commissioner's office and submit to a records inspection each year, during which we check application records for completeness and compliance with the requirements of the California Code of Regulations. As with growers who have employees who handle insecticides regularly, PCOs must have a letter from a doctor who has agreed to provide medical supervision, as well as the required blood test results. Other records inspected are employee training records for any employees who handle any pesticides, and the PCO's copy of the recommendation and permit when applicable.

Pesticide dealers are individuals who have obtained a license from the state to sell pesticides at a specific location. Our audits of these businesses are to determine that recordkeeping for the products sold is adequate. Pesticide dealers are required to have a copy of the permit for each restricted pesticide sold, or the operator identification number from nonrestricted pesticide sales. For certain other pesticides (such as federally restricted or Groundwater Protection List Chemicals), other forms are required to assure purchasers who produce agricultural commodities are on file with the agricultural commissioner, and their operations and records are subject to inspection.

V – Illness/incident investigations

Doctors treating workers who have had an injurious exposure to pesticides are required to report the illness. The agricultural commissioner's office is the agency that investigates the accident to determine whether the accident occurred as a result of failure to comply with label requirements or worker health and safety regulations. The reports compiled are reviewed by the California Department of Pesticide Regulation for use in determining whether changes may be needed in the regulations or in labeling to more adequately protect workers.

Complaints of misuse of or environmental damage from pesticides are also investigated. The goal of these investigations is to correct any situations that may lead to further incidents.

VI – Enforcement

If during an inspection, audit, or investigation, we find there has been a failure to comply with laws or regulations under our jurisdiction, we will note a "noncompliance" on the inspection form, issue a Letter of Warning, or a Notice of Violation. If the violation is serious and/or health-threatening, a civil penalty may be proposed.

Repeated noncompliance of a less serious nature (such as bookkeeping deficiencies) are usually handled with a written Notice of Violation, but the civil penalty may be used in certain situations. The Notice of Violation, as well as any noncompliance or Letters of Warning become part of the record of the person or licensee.

Another option available to the commissioner includes conditioning restricted materials permits to eliminate the possibility of problems. A permit might require the presence of a member of the commissioner's staff at the use site to ensure employees are provided with the appropriate protective gear or adequate washing facilities.

When inspection reports, Letters of Warning, and Notices of Violation are not effective at gaining compliance, an office hearing may be scheduled. At this time, the respondent is given an opportunity to explain why they have not been able to comply with laws and regulations, and the commissioner and/or their staff attempt to arrive at workable solutions to the problems.

In recent years, another enforcement option was made available to the county agricultural commissioners. Assembly Bill 1614 allowed commissioners to fine violators of the California Code of Regulations and the California Food and Agriculture Code. Fines may range from $50 to $500 per violation, and are levied after the respondent has been given the opportunity to be hard before and unbiased hearing officer. The hearing officer makes a decision in writing after hearing and evaluating the evidence. The respondent may appeal the decision.

In the rare situation where none of the aforementioned enforcement options is effective at gaining compliance, or when the violation is sufficiently serious, the case may be referred to the county district attorney, who prosecutes the case based upon evidence compiled by the agricultural commissioner's staff. A prison sentence and/or fine may result.

Presentation on
Panel Discussion of
'Promoting the Safe Use of Pesticides'
by

Henry G. Buckwalter, Jr.

Registration Specialist, Uniroyal Chemical Company

Worker safety: Something is working

Because worker safety is a moral and legal obligation, Uniroyal Chemical Company would like to share with you specific information relating to the proper handling of crop protection chemistries and appropriate hygiene procedures as they relate to minimal exposure pesticides.

Safety in the workplace is a vital concern at Uniroyal Chemical Company. We are pleased to participate and provide the workplace with this program and a supplemental reference book titled "WORK SAFE!," which is available in both Spanish and English. We encourage growers and their employees everywhere to use this information as a guide for developing a worker safety program tailored to their needs.

The California Department of Food and Agriculture (CDFA) has historically established regulations governing the use of crop protection chemistries that are designed to protect the worker. The objectives of the WORK SAFE! program are to:

- educate growers about the new CDFA regulations
- provide growers with the materials to educate their employees about propargite and other minimal exposure pesticides
- meet or exceed CDFA worker training requirements
- make it easier for growers to continue the safe use of propargite products

The Uniroyal WORK SAFE! program contains the following components toward implementation:

- WORK SAFE! notebook
- safety/hygiene posters
- safety guide for field workers
- laminated personal hygiene pocket cards
- re-entry signs
- WORK SAFE! logos on all propargite product advertisements
- worker safety video

In evaluating reported pesticide illnesses of 1989 versus 1990, our research has found an 88% reduction in propargite-related illnesses. Initial review of the 1991 illness report indicates a similar trend.

SOMETHING IS WORKING!

WORK SAFE MATERIAL ORDER FORM

Please send me the following Work Safe Materials which I can use to instruct my field workers:

_____ Instructional Work Safe Guide for Field Workers

_____ Laminated Work Safe Personal Hygiene Card

_____ Work Safe Personal Hygiene Poster

_____ General Pesticide Safety Poster

_____ Work Safe Training Video (English/Spanish)

_____ Field Worker Supervisor Work Safe Packet

Please send to:

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: _____

Crops Grown: _____

To receive your Work Safe material, please send order form to:

Worker Safety Binder
Uniroyal Chemical Company
9740 Scranton Rd.,
Suite 310
San Diego, CA 92121
or call 800-333-5923

Presentation of
Panel Discussion on
"Promoting the Safe Use of Pesticides
by

Ralph Lightstone
Attorney, California Rural Legal Assistance Foundation

Talking points: Worker protection standards

The basic approach to protecting pesticide handlers (mixers, loaders, and applicators) has been to allow continued use of the most toxic pesticides (acute and chronic hazards), while evolving stronger requirements for personal protective equipment, application gear, training, and monitoring.

The basic approach to protecting fieldworkers has been to establish quarantine periods (reentry intervals) to keep workers out of treated fields while residues remain acutely hazardous. The intervals have been lengthened when group poisonings demonstrated the quarantine was too short.

These standards remain too weak in many respects. They continue to evolve on a trial and error basis.

The evolution of the worker safety regulations should not be seen as an adequate approach to worker protection. The state should eliminate or phase out the use of highly toxic pesticides, and require substitution to the least hazardous pesticide or pest control method available. Reliance on personal protective equipment is the least reliable method to achieve safe working conditions.

Enforcement of standards.

Investigations of pesticide illnesses should not be narrowly focused on the determination of whether a law was violated. The investigation of illnesses that result from legal application are critical. These investigations can lead to a change in standards that will prevent numerous illnesses in the future.

Registration decisions are based on unrealistic expectations about the degree of compliance, which can be practically achieved in the field. Enforcement personnel should challenge false assumptions about the enforceability of proposed exposure reduction requirements, which are used to justify continued registration of highly hazardous pesticides.

Presentation of
Panel Discussion on
'Promoting the Safe Use of Pesticides'
by

Nicolas Escalante
Consul General, Mexican Consulate

Farmworkers have the right to a healthy life

If we accept the notion that the right to life and the right to health are two of the basic rights of any human being, we will have to accept that these rights are being violated every day in California by the illegal use of pesticides. As Consul of Mexico, I am interested in the violation of the rights of Mexicans. While these violations affect not only Mexicans but everyone, I will constrain myself to the nationals of my own country thereby keeping with my jurisdictional representation.

I will begin with a thesis in explaining the main task of my role as a consular officer – that task being the protection of the rights and interests of my country and its nationals in a given territory. Article VI of the United States–Mexico Convention on Consular Relations of 1942 grants the consuls of both countries the right to investigate those cases in which such rights are violated, and to present to the authorities of the host country requests for further investigation or remedy as is necessary in each case.

With that in mind, I will express a personal point of view while additionally stating that I feel very strongly it is the right of any Mexican not to be poisoned by pesticides while working or living near places where pesticides are in use. Therefore, the Consulate of Mexico in Sacramento has studied many cases in which people have suffered the effects of substances commonly used in agriculture, when that use is outside the regulations set by local, state, or federal governments.

In the past three and a half years, we have found many reasons that explain or pretend to explain the illegal use of pesticides or herbicides. The most important among them is ignorance by farmers and farmworkers of the potential damage to their health by mishandling these products, using them without proper training, or without the protective gear required, as well as deficient knowledge of their management and storage.

In the second place, we find greed and a very deficient sense of the value upon the lives of human beings by certain farmers that save money by not providing the training and the protective equipment necessary for their employees well-being. They seem to consider these workers disposable, especially if they are Mexican and undocumented. This second aspect is facilitated by the lack of preparation of the workers on this subject.

The third and very important aspect in this situation is lack of enforcement by authorities of the laws they are to administer. This can be attributed to several options, ranging from not having enough personnel to really patrol the farms in the best of cases, to the harsh reality that reducing costs in the multibillion dollar

agricultural industry is more important than the health or lives of a super abundant workforce of aliens, documented or otherwise. This has evolved from a reality that very few complaints are brought to the authorities, consequence of the workers' lack of knowledge of the varied laws or the dangers involved in its violations. Because of the lack of complaints, it is believed that current investigative personnel staffing is sufficient. Because the staff is actually insufficient, the process becomes a vicious, self-perpetuating circle of ignorance.

Cases we have seen

In order to be more graphic – which I feel is the only way I can express what is really happening, not only coherently but in a manner that may instill a human element basic to this situation – I will now refer to a few cases we have found in different areas of Northern California:

We received an anonymous call at the consulate – anonymous because the workers always fear being fired if someone learns they have complained – concerning the Hirai Farms in Sutter and Yolo counties, where workers were said to be applying pesticides without training or appropriate protective gear. We requested the Pesticide Enforcement Division of the Department of Food and Agriculture inspect the worksite, and they found Mexican workers spraying Disyston–S, a restricted pesticide, from tractors, without having been trained or issued protective gear. The farmer claimed he had given the workers protective gear, but that they had refused to wear it because it was very hot. In reality, only the foremen had been issued the required gear and nobody had been trained in the use of this substance.

Hirai Farms was fined $15,500. As a result, neighboring farms decided to teach their employees the importance of donning protective equipment and started training them. During the inspection, one of the agricultural commissioner's officers pointed out a worker at a neighboring farm. The same violations were also occurring there. When I asked if he was going to take any action, he responded that nobody had placed a complaint. In this case, the man doing the spraying was not a Mexican national. Therefore, I was not able to place the complaint.

In the Brentwood area, I was able to observe the application of aqua ammonia from a tractor, while a dozen workers poked the ground behind with sticks so the chemical would go deeper. Several of them suffered burns, nausea, and eye irritation.

Esteban Moreno lived with his family in the Modesto area, next to a field that was aerially sprayed frequently. No one ever notified the Moreno family that the spraying would take place so they could take measures to avoid being sprayed or poisoned. The 16 family members have each developed skin, pulmonary, and heart diseases, all of them of the same type. Nobody informed them of the risks they faced from this exposure.

This incident occurred in the face of crop-dusting industry claims that something called "field containment" exists or is possible. Through videotapes filmed during several flights to document problems with this method of application of pesticides, we can justify the contention that such containment is a physical impossibility and that legislation should be passed to prevent poisoning of neighbors of aerially-sprayed fields and, in the very least, to provide advance notice that such spraying is scheduled.

Saul Montanez, another Mexican citizen with legal residence in this country, was found by us spraying weeds with paraquat without wearing any type of protective gear and no shoes whatsoever. He told us he did not know how dangerous the substance was or what damage he could suffer from contact with it. He also mentioned that some 12 people had been employed in the same task, and not one of them had received any training or any protective gear. Mr. Montanez is now on permanent disability due to the effects of the pesticide. Prior to his accident, he had not received any education on pesticides.

On May 9, 1989, a group of 20 Mexican farmworkers were at a field in the Arbuckle area of Colusa County. A white powder had been used a few days before, which they only knew was called "weed killer," and it had not worked properly. For this reason, the workers were sent in to cut the grass.

After beginning the weed removal, the workers started having a burning sensation on their skin, followed very soon by blisters. A child who was with them had the same problem with his eyes. Soon the blisters turned into skin eruptions, with patches of skin peeling off. They suffered great pain. Today, two and a half years later, they still develop a burning sensation and sores from time to time. They are permanently scarred.

These victims were treated by Dr. Rigoberto Barba, who would not tell them what type of intoxication they had suffered. Later Dr. Barba refused to treat them at all, according to their testimonies.

I quote from page 13 of the Fall 1991 issue of the *Earth Island Institute* :

> "In July, Mexican field workers were sent into a Brentwood cornfield that had just been sprayed with the pesticide Lanate. Brentwood resident Camilia Yarborough-Nunez videotaped the incident and called the Valley Keeper because she was 'fed up with the Food and Agriculture Department.' The video shows fieldworkers – Mexican nationals – emerging from fields choking, gasping and throwing up. After the Valley Keeper was alerted, Sr. Escalante, the Mexican Consul, called the state Food and Agriculture Department.
>
> " 'Why didn't they call us first,' an indignant state official asked Escalante. 'Because they don't trust you,' he replied.
>
> "Within hours, a state employee was standing in Camilia's living room waiting for a copy of the tape. Escalante is only asking that California enforce its own law for the sake of Mexican citizens. Its a fine state of affairs when U.S. citizens have to call upon a foreign diplomat to enforce state laws."

Ignorance, greed and lack of enforcement

These few examples tend to justify my contention that the main causes for people suffering from pesticide intoxication are ignorance, greed, and insufficient enforcement of the state laws.

Of these three causes, perhaps the easiest one to attack is ignorance. Because the law already requires training in the use of restricted pesticides and at least two institutions have produced texts that could be used in such training in the two languages most commonly used in California's fields – English and Spanish, using

clear illustrations that would make their use accessible to almost everyone involved in the use of pesticides, a critical problem is money. The main requirement in attacking ignorance would be the personnel to teach farmers and workers the safe use of pesticides, together with the dangers involved in pesticide application. These trainers have to be funded.

Even more difficult will be the aspect of enforcement. Leaving aside the problems of the hiring and training personnel costs, there are other problems involved, beginning with agricultural commissioners who are closer to the farmers than to the farmworkers, who are the ones most often affected. Because of this relationship, they are more willing to let things stay the same and are not willing to make "waves."

In the bigger picture, agri-business produces a lot of wealth and is to be left alone. In any case, without real enforcement, ignorance and greed will sustain the lack of safety that so far has prevailed in the use of pesticides.

The most difficult situation to confront is that of greed, which in many cases involves racism, since most of the farmworkers are Mexicans or Asians. In some people's minds, these workers are not really worthy of the costs of training or safety gear.

The only way I see of solving the problem is by raising the cost of noncompliance with the law to a level equivalent with the level of damage that noncompliance causes, thus making it more expensive to deny workers training and gear. Certainly strict enforcement of the law would and should be required.

In the three and a half years that my main duty has been to watch for compliance with the rights of the Mexican nationals in 26 counties in California, I have found that lack of safety in the use of pesticides is the rule and not the exception. It involves a lot of suffering and in many cases a large expenditure, since medical costs are high and disability often occurs. It also involves violations of rights granted by the state laws. As I stated in the beginning of this presentation, it affects on a daily basis two recognized rights of any human being – those of life and of health.

Safe use of pesticides must be achieved now!!

Presentation of
Panel Discussion on
'Promoting the Safe Use of Pesticides'
by

Sharon Lanini
President, California Women for Agriculture

California's agworker safety net is strong

First of all, I'd like to talk briefly about the use, registration, and regulation of agricultural chemicals in California within the context of the overall perspective of regulation and worker safety.

California's Department of Pesticide Regulation worker safety program, which is a branch of the California Environmental Protection Agency (CalEPA), is widely regarded as the strongest in the nation. California is one of the few states with its own complete pesticide regulation and monitoring system. This includes a strong emphasis on worker protection and safety. The California system provides a check of and a supplement to the already rigorous and improving requirements of the U.S. Environmental Protection Agency (USEPA).

The health and safety of farmworkers and their families is of major concern to California farmers and the entire agricultural industry within California. The continued education of farmworkers and increased vigilance on the part of the entire agricultural industry are essential factors to maintaining and improving the record of safe use of pesticides, as well as ensuring proper enforcement of worker safety.

Every year, new science and more restrictive testing procedures make it harder and harder for a pesticide product to pass through the strong regulatory safety net in California. In fact, very few new products make it. There is rigorous testing of pesticide products. On average, only one in 20,000 chemicals makes it from the chemist's laboratory to the farmer's field. To ensure that a product will not present any health or environmental concerns, they are subjected to more than 120 separate tests. The development, testing, and EPA approval process takes 8 to 10 years, while costing manufacturers between $35 and 50 million for each pesticide.

It is also important to note that California provides a double safety net, in addition to the regulation and testing by USEPA. California maintains its own complete pesticide monitoring system. If a product is to be used in California, it must first pass inspection by the CalEPA's Department of Pesticide Regulation.

In terms of worker protection and safety in California, there exists a very strong and improving system for regulation and monitoring of worker health and safety. Let's take a quick look at this safety net.

Agencies regulating pesticides and monitoring the health and safety of California farmworkers, in addition to the USEPA and CalEPA, include:

-CalEPA Worker Health and Safety Branch
-California Department of Industrial Relations
-Pesticide and Environmental Toxicology Section of the Office of Environmental Health Hazard Assessment (OEHHA)
-California Occupational Safety and Health Administration (CalOSHA)
-county agricultural commissioners
-county health departments

Additionally, in a recent report issued by Dr. Louise Mehler of the CalEPA Worker Health and Safety Branch, she states, "The most striking aspect of the accumulated case reports of 1989 is that there has been a sharp drop in the number of cases attributed to field residues."

The label is the law!

The label is the law! Pesticide labels are designed to ensure the safety of all who handle or use pesticides. The label of every registered pesticide product contains detailed instructions regarding the safe handling and use procedures to be followed, including:

- Type of crop to which the chemical may be applied
- Type of pests the product will control
- Amount of chemical to use
- Type of equipment which may be used to apply the chemical
- Required safety equipment, such as rubber boots, gloves, goggles, etc.
- Proper application equipment
- Proper mixing methods
- Proper storage and disposal of the chemical and its container
- Limitations regarding re-entry into treated areas Agricultural chemicals are approved by the U.S. EPA only after extensive scientific research and years of field trials.

Misuse of products is of major concern to the entire agricultural sector. According to CalEPA, "case reports in which people suffered adverse effects (from over-exposure) typically include evidence of carelessness or misuse..." Proper use is mandatory under the law. Strict adherence to the label is required by federal and state law. In fact, recent law makes persons who violate pesticide regulations subject to civil and criminal penalties, substantial fines and imprisonment.

Additionally, worker notification of treated fields is required. All workers expected to be working in treated fields or soon-to-be treated fields are required to be notified by field posting, central bulletin board notices, or oral statements. California has the most stringent notification requirements in the nation, and additional regulations strengthening farmworker education will soon be issued by CalEPA and the USEPA.

In California, employers must comply with worker safety regulations that include:

- Safety training programs
- Medical supervision and emergency medical care
- Proper use and training of use of protective equipment
- Proper sanitation facilities
- Maintenance of records on use, medical supervision, safety training, inspections, minimal exposure pesticides
- Symptoms of pesticide illness and emergency procedures
- Instruction in label requirements

In conclusion, California has an excellent and improving record of worker protection and safety. California's growers and agricultural producers are committed to maintaining and improving the record on worker safety. The key is: how do we respond to improve the system?

The answer lies in the fact that the system is designed to be responsive in nature. The lines of this responsibility through the various agencies involved all move in the same direction – responding to the needs from the farmer's field. This is currently being evidenced by the fact that both CalEPA and the USEPA are soon to release new worker safety standards.

Finally, we should be proud of the abundance of nutritious, safe food and fiber that California supplies to the world. As a matter of fact, according to Dr. C. Everett Koop, former U.S. Surgeon General, "Our food supply is not only the safest, but it is the most abundant in the world, and pesticides are one of the important tools that have made that abundance possible."

Presentation of
Panel Discussion on
'Strategies for Source Reduction'
by

Frank G. Zalom
Director, Statewide Integrated Pest Management Project, UCD

IPM has an important role in pesticide source reduction...if given a chance

The impact of pesticide use on the environment is a complex issue, and several factors have raised scientific and public concern regarding pesticide use. Genetic resistance to chemicals has been documented from over 450 pest species.

Outbreaks of secondary pests, those released from natural control, have been well documented. For example, it is widely believed that spider mites have emerged as a serious agricultural and forestry pest since 1946, because their predators have been reduced by chemical sprays applied for primary pests.

Nontarget species are often affected because pesticides generally kill a broad spectrum of organisms, only a fraction of which are the target pests. Off-target effects on native plants, mammals, birds, fish and other wildlife is of concern. Pesticide-induced losses of honeybees, natural enemies, alternate food sources for biological control agents, those organisms that function in decomposition and mineral recycling in the soil, and phytotoxic effects on crop plants can result in reduced yields or quality.

Human exposure to pesticides is an important social issue. Agricultural workers are at the greatest risk of exposure, and may come in contact with pesticides during the application process or when entering recently treated areas. The nonagricultural public may also be exposed to small doses of pesticides if they live near treated areas (through air-drift, contaminated drinking water, etc.), eat contaminated food, or touch recently treated livestock, foliage, or stored food products.

Environmental and human health issues have typically been addressed through label restrictions imposed during the pesticide registration process, and this has provided a good degree of protection. However, it can be argued that source reduction would significantly increase the predictability of protection. One approach to source reduction would be the widespread adoption of integrated pest management (IPM) strategies and tactics.

IPM is the systems approach to reducing pest damage to tolerable levels using biological controls, cultural controls, genetically resistant hosts, and, when appropriate, chemical controls, especially those that are selective and do not contribute to environmental contamination and human health problems. A comprehensive IPM program for an agricultural system is comprised of these basic elements:

1) dedicated research and extension personnel to produce a body of timely information concerning farming practices, pest biology, and pest management tactics

2) a program to monitor both pests and natural enemy population levels, as well as the state of the crop throughout the season
3) control action thresholds – levels of pest abundance at which some control action must be taken to protect crops from unacceptable economic loss
4) IPM tactics that involve a spectrum of agents and materials used to suppress pest populations
5) crop consultants to apply the program in the field
6) willing and cooperative growers.

The application of IPM is especially relevant today as agricultural producers, consultants and scientists try to move away from reliance upon pesticides. It is ironic that IPM theory, although fairly well understood and promoted, has not been widely applied.

What are some possible IPM tactics that can be applied to manage pests in agricultural systems?

They include such biological alternatives as:

1. Biological control – including release of exotic parasites and predators, conservation and augmentation of natural enemies, genetic improvement of natural enemies, and allelopathy.
2. Microbial control agents – application of beneficial or antagonistic living microorganisms or toxins synthesized by microbial agents.
3. Host plant resistance – including cultivars and rootstocks.
4. Management practices – such as natural or living mulches, trap or cover crops that enhance natural enemies or control pest species.

Cultural alternatives such as:

1. Crop rotation – rotation of various lengths and fallow periods.
2. Physical controls – such as tillage, mowing, chopping and flaming.
3. Sanitation – removing noncrop and infested hosts.
4. Pruning and canopy management – manipulating the structure of the host plant by physical means.
5. Irrigation management – controlling water application and drainage.

And chemical alternatives such as:

1. Synthetic organic pesticides – including chlorinated hydrocarbons, organophosphates, carbamates, pyrethroids, growth regulators, etc.
2. Oils and soaps – horticultural oils and various fatty acids.
3. Botanicals – toxins derived from plants, such as pyrethrum and rotenone.
4. Semiochemicals – such as pheromones, feeding attractants, and repellents produced by an insect and which affect the behavior of other insects.
5. Inorganic or elemental compounds – such as sulfur and copper.

The University of California is trying to address issues of research and education relative to source reduction through special programs such as the Statewide Integrated Pest Management Project and the Sustainable Agriculture Research and Education Program.

The Statewide IPM Project is born

In 1979, the University of California Statewide IPM Project was approved as a special appropriation for the University's budget. In funding the program, the legislature specified that certain activities be cancelled. These activities included sponsoring short-term research on certain major crops in California, implementing of IPM locally through extension IPM Farm Advisors, writing a series of IPM manuals, and developing a computer network for delivering pesticide registration information and guidelines, and predictive models. Project staff were recruited during 1980, and funds were first available for research that field season.

Over the past 10 years, the Statewide IPM Project has supported over 220 research projects proposed by faculty of the Davis, Berkeley, and Riverside campuses, as well as Cooperative Extension. Nearly two in every five projects involved researchers from two different agricultural science disciplines and two or more different institutions. Over half of all projects involved Cooperative Extension Farm Advisors to assist in evaluating the practical usefulness of the proposed research. Over 100 faculty have served as members of IPM workgroups, which help to set research priorities for the program and review proposals and progress reports.

The Statewide IPM Project employs a group of Area IPM Advisors, located in important agricultural production regions of California. Their goal is to adapt and implement research-based IPM practices in the field, working with and through county Cooperative Extension Farm Advisors.

IPM Education and Publications produces training programs and publications on pest management and pesticide safety. During the first five years of the Statewide IPM Project the major emphasis was on the development of IPM manuals for major agricultural crops. Recently, other important activities have been initiated or incorporated into the program including: pest management guidelines, pesticide applicator training and manuals, pest control advisor training, farmworker safety training and resources, and books for gardeners, small farmers, and urban horticulturists.

Although many IPM research and extension activities at the University of California are carried out without direct support from the Statewide IPM Project, the program acts as a central focus for coordinating many of these activities and services. This has created a mechanism for identifying and supporting critical short-term research, as well as a delivery system for reaching pest management decision-makers in the field.

So why isn't everyone using IPM?

If IPM is so useful, why doesn't everyone use it? There are many obstacles to its use, including technical, financial, educational, organizational (institutional), and social issues. Technical issues include the lack of information on the basic biology of pests, beneficial organisms, and their interaction in agricultural ecosystems.

Similarly, the application of this knowledge to the management of pests in cropping systems through tactics such as monitoring guidelines, control action thresholds, biological controls, cultural controls, and host plant resistance is often lacking. Research in these areas is essential for the continued development of IPM.

Financial issues affect both producers and the scientific community. Risk is probably the most important obstacle to IPM adoption by growers. Growers value pesticides for reducing production risk, as well as contributing to profit. It is very important that IPM be shown to decrease this risk. The more growers learn about pests and their likelihood for causing damage, the more certain they will be about the state of their crop. With this new confidence level, the less likely it becomes they will choose a preventative pesticide application.

Some government programs can indirectly affect IPM adoption, as the following examples illustrate:

Commodity price supports reward growers for maximizing production. Maximized production all too frequently involves increased pesticide use that would be otherwise unprofitable in the absence of such supports.

Marketing orders, packers and processors, and retailers often specify low pest damage standards for their products, forcing growers to treat their crops with pesticides to meet these requirements. Low damage standards are justified when human health issues are at stake, but they are difficult to justify on the basis of cosmetic appeal or as tools for regulating supply.

Farm subsidy programs encourage growers to plant the same crop each year to qualify for benefits. This discourages crop rotation, an effective cultural control for many species of insects, diseases, nematodes, and weeds.

I hope that this panel can help to determine the value of source reduction as a vehicle for reducing farmworker exposure to agricultural chemicals. In addition, they will help to identify some of the issues involved in developing and implementing strategies for source reduction that can be further discussed in the breakout groups.

Presentation on
Panel Discussion of
'Strategies for Source Reduction'
by

Lawrie Mott
Scientist, Natural Resources Defence Council

California's opportunity to lead the nation in pesticide use reduction

Approximately 845 million pounds of pesticide active ingredients are applied to American farmland each year. Use of pesticides has increased dramatically over the past decade. Between 1964 and 1982, total agricultural pesticide use has increased 175%. The widespread use of agricultural chemicals has not occurred without serious environmental, social, and economic costs.

According to the United States Environmental Protection Agency (USEPA), a total of 46 different pesticides have been detected in the groundwater of 26 states from normal agricultural use. Groundwater is the source of drinking water for over 50% of the total U.S. population and 97% of rural residents. The most commonly detected pesticides in groundwater nationwide include the acutely toxic insecticide aldicarb and the potential human carcinogens atrazine and alachlor, both widely used herbicides.

Surface water is also vulnerable to pesticide contamination, posing a threat to drinking water. A 1990 study by the U.S. Geological Survey found pesticides following spring applications in 100% of the rivers and streams tested across the Mississippi, Missouri, and Ohio river basins. Atrazine, the pesticide detected in all water samples, was found at levels above EPA's drinking water standards.

Rural residents and farmworkers are not only potentially exposed to pesticides in food and drinking water, but also to pesticides in the air. Residues of 1,3-dichloropropene (Telone-II), a probable human carcinogen, have also been detected in air sampled in California's agricultural areas at levels high enough to warrant at least temporary suspension of all further use of the chemical in California.

The cumulative effect of chronic low-level exposure to pesticides is only partially understood. Two National Cancer Institute studies have found that farmers exposed to herbicides have a three to six times greater risk than nonfarmers of contracting a specific type of cancer. Other studies have shown similar results. A recent report suggests that agricultural chemical use is related to cancer mortality for three of five types of cancer studied in rural counties of the United States.

Farmworkers are frequently exposed to pesticides during their application or upon entering pesticide-treated fields. They risk not only the chronic effects of pesticides but their acute effects as well. Between 1973 and 1983, reported pesticide poisonings among California fieldworkers rose 14% each year. Fieldhands have suffered the highest rates of occupational illness in the state.

Fortunately these and other adverse impacts of pesticides can be mitigated by reducing the use of pesticides through alternative agriculture. Decreasing applications of agricultural chemicals is a logical and practical strategy for protecting public health and the environment.

In May 1991, the Natural Resources Defense Council (NRDC) released Harvest of Hope, the results of a two-year study of the potential for alternative agriculture to reduce pesticide use in crops selected as representative of the array of U.S. agriculture. We concluded that techniques currently available could potentially reduce pesticide applications between 25–80%. In California, pesticide reductions of between 25–50% are possible. (See attached Table 1.)

Several barriers stand in the way of widespread adoption of promising alternative farming practices. In some areas, a scarcity of skilled labor makes it difficult to follow aspects of IPM that require scouting and other labor-intensive activities. Weather-induced risks, such as heavy spring rains in the Corn Belt, can deter mechanical cultivation, Regional soil conditions can also make it difficult to adopt alternative strategies. For example, the heavy clay soils in certain rice-growing regions of California deter crop rotations.

Federal and state policies also hinder the adoption of alternative farming systems. First, the federal government is the hub of the huge agricultural research and extension complex that spends more that $1.5 billion each year. Yet alternative agricultural research is underfunded and dissemination of information about these techniques is inadequate.

Second, many farmers receive a large portion of their income from farm subsidies disbursed by the federal government. However, the rules by which these payments are distributed prevent reductions in pesticide use by penalizing crop rotations and promoting surplus production and increased yields.

Third, federal and state marketing orders and grade standards can result in unnecessary pesticide applications by specifying cosmetic criteria for produce that are difficult to attain cost-effectively without the use of chemicals.

Fourth, current pesticide regulations hinder the rapid registration of biologically-based materials that could substitute for chemical pesticides.

Fifth, the U.S. Bureau of Reclamation supplies grower in California and other western states with irrigation water at rates substantially below the true cost. Growers, therefore, are discouraged to invest in water conservation techniques that could facilitate reductions in pesticide use.

Finally, the costs farmers now pay for pesticides fail to account for the impact of these chemicals on human health and the environment (so-called externalities). This makes pesticides incorrectly cheaper than alternative farming systems.

Policy reforms in six key areas are essential for eliminating many of the barriers to widespread adoption of alternative farming systems: agricultural research, federal farm programs, marketing policies, pesticide registration requirements, water pricing, and hidden costs of agricultural chemicals. To date, the development and implementation of agricultural techniques that reduce chemical use have been stymied by the lack of funds directed to alternative agricultural research. Funds for alternative farming research, particularly on-farm, systems-oriented research, should be substantially increased.

The federal farm programs reward farmers for producing a handful of commodity crops that tend to use large amounts of chemicals. The commodity programs should be amended so farmers can adopt more environmentally-sound farming systems without incurring financial penalties.

Federal and state marketing policies often make if difficult for farmers to adopt alternative farming practices that use fewer pesticides. Federal and state marketing orders should not be allowed to use cosmetic quality standards to differentiate produce. In addition, exemptions from marketing orders should be granted to all certified organic produce.

The development of biologically-based materials such as botanicals, microbials, and pheromones has been obstructed by federal and state pesticide registration requirements. Congress should direct the National Academy of Sciences to review existing regulations for biologically-based materials and make recommendations for improving government procedures to hasten the registration of biologically-based pest control techniques.

The use of efficient irrigation systems has the potential to significantly reduce the use of agricultural chemicals and their transport to water supplies. However, because of the low price of irrigation supplies available to many growers, more efficient technologies and management practices have not been widely adopted. The U.S. Bureau of Reclamation should revise its water prices to encourage greater efficiency. Similarly, irrigation districts should adopt tiered water rate schedules that discourage inefficient irrigation practices and encourage the adoption of alternative farming systems.

Conventional agricultural practices rely extensively on the use of pesticides and fertilizers. However, current market prices for pesticides and fertilizers do not reflect the true environmental and social costs of their use. Federal and state governments should levy fees on the use of pesticides and fertilizers to reflect the environmental and health costs, and to provide revenues for alternative agricultural research and development programs, as is the current case in Iowa.

Reductions in pesticide use are already becoming a reality in other countries. In 1985, Sweden introduced a program to reduce pesticide use by 50% and was expected to have reached this goal by the end of 1990. In June of 1990, the Swedish Parliament established another 50% reduction goal in agricultural pesticide use, to be reached after the mid-1990s. The most successful measure taken to reach this goal was to lower recommended application rates by one half.

Following the Swedish example, the Netherlands also aims to reduce pesticide use by at least 50% by the year 2000. In addition, it has established goals to reduce pesticide use 35% by 1995 and 50% by 2000. A new study by Cornell University's Dr. David Pimentel estimates if 50% of pesticides now used in American agriculture were replaced by nonchemical control techniques, crop yields would not decline and food prices would rise less than one percent.

In California, there is an opportunity to set a national precedent in pesticide source reduction. The NRDC and others are urging Governor Wilson to adopt a goal of reducing California's agricultural use of pesticides by 35% by the year 2000. Establishing a statewide pesticide use reduction goal makes sense for the public

health and the environment, and for farmers. As the premier agricultural state in the nation, California has the opportunity to provide the leadership necessary to prove prevention of environmental problems and protection of public health are not incompatible with the economic prosperity and long-term sustainability of agriculture.

California is in a unique position to evaluate the accomplishment of a pesticide use reduction goal. By 1992, California will be the first state in the nation to have available complete information documenting the full extent of pesticide use. These records are an excellent means of measuring the attainment of a pesticide use reduction goal. In breaking with the failed policies of the past, the California Environmental Protection Agency (CalEPA) can play a critical role in assuring California agriculture is able to meet this 35% pesticide use reduction goal. In particular CalEPA can:

1) convene a statewide taskforce consisting of CalEPA staff, University of California agricultural researchers, legislators, members of the environmental community, and farmers to identify methods for attaining a statewide pesticide use reduction goal;
2) issue a public report detailing existing institutional and regulatory barriers that impede broad adoption of alternative agricultural techniques;
3) facilitate and coordinate greater development, registration and dissemination of alternative agricultural techniques that reduce the use of chemicals; and
4) issue an annual report to the public tracking statewide pesticide use and progress towards the reduction goal.

NRDC is urging Governor Wilson to adopt a 35% pesticide use reduction goal by the year 2000 as one of the first actions taken by the CalEPA. This would not only send a clear message that CalEPA's new jurisdiction over pesticides will be a significant departure from past practices, but it would carry out the agency's stated mandate of pollution prevention.

Table 1

SUMMARY OF POTENTIAL PESTICIDE REDUCTIONS

Crop	Pest	Alternative Agriculture Technique	Chemical	Potential Pesticide Reduction
Alfalfa	Insects	Border harvesting/strip cutting	I	30%
	Weeds	Intercropping	H	40%
Citrus	Insects	Integrated Pest Management (IPM) techniques: monitoring, reducing overall broad-spectrum insecticide applications, applying nondisruptive materials, biological control	I	50%[a]
	Weeds	Middles management	H	40%
Cotton	Insects	Interplanting, IPM sampling technique	I	25%[b]
	Weeds	Research needed	H	*
Grapes	Insects	Habitat management for beneficials, leaf removal, microbial insecticides, optimizing grapevine fertility, IPM monitoring techniques and action thresholds	I	35%
	Weeds	Mechanical weed control	H	50%
	Diseases	Leaf removal	F	30%[c]
Lettuce	Insects	IPM, biological control, botanicals, relaxing cosmetic grade standards	I	25%
	Weeds	Reduced application rates, timing cultivations during critical period of competition, increased hand hoeing, crop rotations, transplants	H	50%
	Diseases	Relaxing cosmetic grade standards, crop rotations	F	20%
Rice	Aquatic Invertebrates	No-till/drill-seed	I	25%
	Weeds	No-till/drill-seed, cover crops, crop rotations, deeper water	H	50%

Tomatoes	Insects	IPM sampling technique, Bacillus thuringiensis	I	**25%**
	Weeds	Subsurface drip irrigation, crop rotations, calculated timing of applications	H	**50%**
	Diseases	Research needed	F	*
Corn	Insects	Crop rotations, corn rootworm bait	I	**80%**
	Weeds	Banding herbicides, ridge-till, narrow row production, strip intercropping	H	**50%**
Soybeans	Insects	Alter planting dates	I	*
	Weeds	Banding herbicides, ridge-till, narrow row production, strip intercropping	H	**50%**

a This reduction is applicable only to San Joaquin Valley citrus production
b This reduction is applicable only to San Joaquin Valley cotton production
c This reduction is applicable only to wine grape production
* Not possible to estimate at this time

Presentation of
Panel Discussion on
'Strategies for Source Reduction'
by

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Source reduction starts between the ears

Source reduction of toxic pesticides starts in the area between the ears. Here we find the basic values and attitudes regarding nature, agriculture, and the farmer's role in food and fiber production.

Today we see a shift from the prevailing value of control and dominion over nature to becoming a responsible partner with nature. If we want to be good stewards of the natural world we share, we will attempt to understand and cooperate with natural processes, rather than trying to manipulate and coerce nature for human benefit.

If we adopted the "partnership" approach, we would seek information on how a well functioning system keeps itself healthy and less susceptible to the damaging effects of the natural predators we call "pests." Another way of saying this is we would study "wellness" and attempt to imitate nature through preventative pest management strategies.

Although there is much we must learn about natural defenses, we do have evidence about what such a system might be like. First, it would start with a "healthy environment" for our plants and one less healthy for pests. We would use soil and water management strategies to minimize stress and facilitate root and plant development. We would enhance the beneficial effects of plant interaction through biodiversity, rotations, and cover crops. We would build on genetic strengths by choosing resistant varieties. We would look for balance in our cultivated environment, encouraging predators that hold each other in check. We would regard the chemical "cure" as a last, rather than the first, resort.

CHEMICAL CURES	WELLNESS APPROACH
Herbicides	Management/cultural practices
Insecticides	Rotations
Nematicides	Biodiversity
Fungicides	Resistant Varieties
	Natural Balance and Change

Although we do not know nearly enough to fully implement such an approach, we do have evidence it works. In general, the introduction of biological diversity, both in space and in time, into both annual and perennial systems is beneficial. In annual systems, crop rotation prevents many pest problems. In perennials, this may be achieved by inserting cover crops into the system. These cover crops, however, should be evaluated in a systems context.

OTHER EXAMPLES WILL BE PRESENTED IN SLIDES TO DEMONSTRATE THE FOLLOWING ALTERNATIVE APPROACHES TO PESTICIDES:

Herbicides	– buried drip and flame weeding for vegetables
	– cover crops in trees and vines
Insecticides	– insectiary plants in lettuce
	– cover crops in trees and vines
Nematicides	– cover crops, organic matter management
Fungicides	– leaf removal of grapes
	– environmental monitoring (temperature and free water)

Presentation for
Panel Discussion on
'Strategies for Source Reduction'
by

John Britton
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IPM and worker safety: Trends observed

For the past 15 years, we have been implementing an Integrated Pest Management (IPM) program on our 800-acre family farm. This approach has been a normal part of our deciduous crop operation, which consists of peaches, almonds, and walnuts. Until about four years ago, our primary motivation for this kind of an approach was largely economic, inasmuch as we were able to realize a savings of approximately 25% in pest and disease control materials compared to conventional approaches. In 1988 and 1989, we became aware of two rather disturbing and unrelated trends that served as the catalyst for some additional refinements in not only our IPM program, but in our worker safety program as well. In addressing these two trends, we were able to significantly effect each of them positively. Therefore, I would like to confine my remarks relative to those two trends.

First trend: IPM improves worker morale, safety

During two growing seasons, one of the trends we became aware of was a noticeable reduction in control of Oriental Fruit Moth (OFM), one of the major worm pests in peaches. Guthion had satisfactorily controlled this pest for a number of years, and we experienced little or no disruption of naturally occurring predacious insects at the low rates we were using. As a result, we typically only applied two cover treatments using a low rate of Guthion, and for a number of years it was unnecessary to make any additional treatments for mites.

Guthion-resistant strains of OFM had been documented in certain areas of the Sacramento Valley. After limited testing on our own property, we were convinced that while we may not have had full-blown resistance, we were certainly experiencing some degree of tolerance. As a result, we began investigating alternate methods of control.

In 1990, for the first time in our experience, we utilized the use of what is commonly called the "confusion technique" as a means of control for OFM. Simply put, the confusion technique is the introduction of large amounts of synthetically produced pheromone into the target area, having as its primary result the disruption of mating patterns. In the case of OFM, the synthetically produced

pheromones are similar enough to the naturally occurring female pheromone that the male moths are attracted to the scent, but are unable to locate the females for mating. We introduced this technique to our IPM program for peaches by making two applications of a synthetically produced OFM pheromone and were able to eliminate entirely the need for chemical treatments against OFM.

Unfortunately, this technique is not effective against Peach Twig Borer (PTB), another major worm pest in peaches. In the past, the PTB had been considered a secondary pest, in large part controlled by the low rates of Guthion directed against OFM. As a result, we ultimately had to continue the Guthion treatments as a control for the PTB instead of the OFM. Although this was somewhat discouraging, in 1991 we again utilized the "confusion technique," this time with only one application. Again, we experienced excellent control of OFM without chemical control. Once again, we had to make chemical treatments to control PTB, but in the process learned that when we directed control measures against PTB early in the season (either at petal fall or no later than the May brood) we had excellent control. Because the pheromone worked so well against OFM, no additional chemical treatments against either pest were needed.

In nearly every block where we made a single application with a pesticide that is fairly low in toxicity, either at petal fall or mid-May, we experienced very satisfactory control without the use of additional chemical treatments during the growing season. In blocks where early treatments were not made for PTB, in hopes of either not treating or delaying treatments until July, serious worm pressure developed to the point of having to make multiple treatments against PTB. This, in turn, created the need for treatments against damaging species of mites.

The 1992 season will undoubtedly solidify our thinking. Yet, at least for now it appears likely that early treatments against PTB using low-toxicity pesticides in combination with a single application of the OFM pheromone may be the next step for our operation. This will allow us to continue implementation of a program that integrates both the judicious use of agricultural chemicals and naturally occurring biological agents.

Synthetic pheromones are rather expensive, certainly more so than low rates of Guthion. Consequently, the opportunities to reduce direct costs are minimal. On the other hand, the synthetic pheromone technique in combination with early applications against PTB offer the distinct possibility of making chemical treatments during the coolest part of the growing season. This creates a safer and more comfortable environment for our applicators. Additionally, if treatments can be made early enough, preferably at petal fall, cultural operations and thinning in particular can be performed without costly interruptions.

Last, but certainly not least, this technique has been warmly received by those employees directly involved in the application of agricultural chemicals. Although it is very difficult to measure the effect in dollars and cents, the morale of those workers has dramatically improved. They have a greater understanding of what we are trying to accomplish and an appreciation for our efforts at reducing their chemical exposure to a bare minimum. Their response, in our opinion, makes the confusion technique a viable part of our IPM program, while additionally addressing some of the major worker health and safety concerns.

Second trend: Safety plan pays dividends for employer and employees

A second disturbing trend we began to see was an increase in the number of somewhat minor accidents, resulting in significantly higher workers' compensation premiums. Despite general safety being routinely discussed, we continued to have a number of accidents.

In 1991, we implemented a worker safety program with four basic components: training, accountability, regularity, and incentive. While time does not permit a detailed account, generally the program consisted of training or retraining every employee in every job for which they were responsible. Formal and informal meetings were held as often as weekly, and always in both English and Spanish. Every employee was eligible to earn certain "rewards" and was issued a 'safety seal' each week on his or her paycheck, provided that week was accident-free. If there was an accident of any kind, no one received a safety sticker. Every employee was issued a hat adorned with a safety slogan, along with a complete copy of the safety manual in his or her language. Needless to say, safety was not only emphasized, but became a part of everyone's thinking.

The results were astounding! Accidents were reduced by over 90% and workers' compensation costs were reduced by 25% in a workforce that typically numbers between 30-50 employees. Equally important in my mind, the employees have taken responsibility for initiating many of the safety features of the program. As a result, the program is not seen as "just something management has to do to satisfy the requirements of the law." Employees that meet certain requirements are eligible to earn jackets, sweaters, tee-shirts, and even days off. More importantly, they are having some fun at work, while continuing to develop the positive attitude of "safety first."

Preliminary Statement
1991 National Expert Meeting on Children and Pesticides
Sponsored by National Migrant Resource Program in
Savannah, GA, November 9-10, 1991
DRAFT ONLY
As reported on by

David Goldsmith
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Special attention must be paid to children

The primary objective should be to reduce the risk of pesticide exposure to children. While the concern for all children is great, special attention must be paid to those children for whom the danger of a broad range of exposure routes exist – the children of migrant and seasonal farmworkers.

There are approximately 65,000 chemical pesticides in commerce, with about 10,000 chemicals as active ingredients. Few have been tested for cancer, reproductive effects, neurotoxicity, developmental neurotoxicity, other developmental problems, effects on growth, and immunology. Additionally, little to nothing is known about interactions or synergism, and usually there is no information about the metabolic products and their toxicity.

The degree of exposure to pesticides among migrant farmworker children is largely unknown, but there are several possible modes of exposure, including:

- transplacental exposures prior to birth
- "take home" exposure on parent's clothing
- child labor in agriculture
- "baby sitting" in the field
- ambient air levels
- levels in dust and soil on migrant worker homes
- indoor air levels from home usage (structural pest, fleas)
- residues in food
- residues in drinking water

There are a few cases in which such exposures have been clearly documented. They need to be expanded to include...

- child labor in agriculture – acute illness
- ambient air – arsenic, telone, and parathion
- residues in food – aldicarb and alar
- residues in drinking water – DBCP poisoning

These problems apply not only to farmworker children, but also to growers, their families, and to consumers. But farmworker families have the greatest potential for exposure.

Epidemiologic perspective

The degree of morbidity and mortality resulting from these exposures is largely unknown. For acute illness, there are systems in some jurisdictions for reporting pesticide illness. But many health providers are unfamiliar with how to recognize (pesticide illness) and even more fail to report.

For chronic illness, there is very little known about the burden of cancer, neurodevelopmental and other developmental effects.

Cancer – There have been reports of cancer clusters in agricultural areas in California and there is epidemiologic literature that suggest a link for leukemia and childhood brain cancer. Cancer in farmers may have relevance for children.

Neurotoxicity – There have been no studies of neurotoxic effects of pesticides on children. Many toxic substances – lead, methyl mercury and PCBs – have more profound neurological effects on children than adults.

Developmental effects – There have been no studies of growth and development effects. A few toxic chemicals – lead, cigarette smoke (transplacental & passive childhood exposure) – have been shown to inhibit growth in children.

Other considerations include:

- Hepatic
- Respiratory
- Dermatologic illness
- Allergic
- Immune

Examination of chronic effects is made difficult by the uncertainties in assessment to exposure. Exposures to pesticides occur in complex mixtures of multiple pesticides. Most pesticides currently in commerce do not bioaccumulate in tissues. So, unlike lead which accumulates in teeth and bones, there is no way to objectively measure cumulative exposures.

Toxicology knowledge

The "data gaps" in pesticide toxicology result not only from "grandfathering" of pesticides that were in commerce in 1973 and the slow pace of assessment of new chemicals, but also because the effects on children are not examined even when new chemicals are evaluated. The pesticide registration process does not examine developmental carcinogenicity, neurodevelopmental effects, transplacental transfer or effects on growth and development. An exposure assessment for children (pediatric impact report) is not conducted.

Enforcement

Even when laws exist and are well publicized, they are not enforced (e.g. field sanitation and disposal of containers).

Preventive policy

The current regulatory policy is that action is not taken to control pesticides unless risks can be definitively demonstrated. Inadequate income forces mothers to work during pregnancy, children to do piece work to boost family income, and parents do bring children to the fields for child care. Because the default position is that no action is taken in the absence of information, there is little motivation for manufactures to generate new data. The economic forces encourage exposure and result in housing that may be inadequately protective.

Proposed solutions for research

- Need for cross sectional studies to evaluate outcomes
- Short neurobehavioral tests to be available for use by pediatricians
- Research on neurobehavioral aspects of pesticide exposure that can be used by clinicians for diagnostic workshop
- Look at existing research models (i.e. DDT) to expand to pesticide exposure
- Conduct a long-term study of farm children and compare to other available studies (can be done with small groups) Sec.402–JTPA/Migrant health
- Initiate a national pesticide exposure database (illness registry) to be able to report single cases and track those exposed. (1-800...) expand pesticide network number.
- Any patient with a physical finding (suspicious physical event) could be added, thereby of use for data sources and for those wanting to conduct research. Perhaps to be managed by CDO.
- Develop a national pesticide use reporting system (by acre, use, etc.) and find a simplified way for the reporting to be done (colored dot system) to understand usage for regulation on a targeted basis. Build this on local extension agents.
- Biological monitoring for children to assess levels of exposure.
- Need research on in-home pesticide exposures.
- Need to develop short-term test methods and test assessment.
- Enlarge/expand the end point from acute toxicity and carcinogenesis to multiple end points. Develop a blue print on how to gather the data needed to do effective research.
- Move forward with relevant data (human and animal).
- Need to do a census of farmworkers and children (who are they? where are they? Including to what extent are children left behind).
- Make recommendation to the National Center on Health Statistics.
- Use Migrant Head Start data for preschool children.
- Research which educational messages work best, format, etc.

Education – Providers, community members, policymakers, etc., have inadequate education. Farmworkers and families need more education and have a right to know about pesticides.

The perception about risk is often skewed, ranging from agribusiness and manufacturers who perceive "no risk," to people who are overly alarmed and believe all pesticides should be stopped.

NOTE: This document does not contain findings for the areas of policy and education.

Presentation of
Panel Discussion on
'Pesticide-Related Health Care Issues'
by

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Migrant health centers: 30 years of hope

Almost 30 years ago, the first national legislation was signed into law by then-President John F. Kennedy establishing health services for migrant and seasonal farmworkers. In many respects we have come a long way since the establishment of the Migrant Health Act.

National Focus

One key point in the 1960s was that the vehicle of health care delivery for the migrant health program was through the local health departments. This method had some successes, but for the most part was a hindrance to effectuate change at the local level. Many times, the county health departments became silent in enforcing environmental health conditions affecting farmworkers. A very important factor in the '70s effectuated change in federal legislation in favor of funding community-based organizations, which at that time were more adaptable and willing to provide advocacy for farmworkers. The migrant program is considered to be precursor to the concept we know now – Community Oriented Primary Care (COPC).

While the '80s saw a change in increased funding for the migrant health clinics, the increase was not sufficient to compensate for the cost of inflation. The average annual increase in migrant funding during the '80s was only 3.2%.

The migrant health program continues to be underfunded, serving at the present time only 12% of the U.S. migrant population. There is a persistent need. According to the U.S. Department of Health and Human Services (DHHS) own study, the migrant health program takes care of only 500,000 migrants, leaving 3.5 million with no access to quality health care.

It has been 30 years since the migrant legislation was established, yet we are still facing considerable problems.

The status of farmworkers in California

Comprehensive demographic data about the numbers of farmworkers in California are elusive, because of the migratory and undocumented status of many farmworkers in California. Interviews with selected samples of farmworkers yield some information about their status and living patterns.

A statewide survey published in 1986 by Philip Martin and Richard Mines (1,286 respondents) revealed the following:

- The average income was about $4,300 per year from farm work and $320 from non-farm work.
- More than 60% had a home base in California, from which they drove many miles to work.
- Approximately 37% were migrants who followed one of two patterns: back and forth between Mexico, or follow-the-crop migration within the US. (Profile of California Farmworkers, 1986)

A more recent study conducted among workers in the central San Joaquin Valley (361 respondents), by Andrew Alvarado and coworkers, in June-October 1989 (California State University, Fresno, Center for Agricultural Business) revealed similar findings:

- Seven of 10 workers were male, but fully half of workers in grapes, nuts and vegetables are female
- Mean average age was 35
- Only 6% were born in the US; 87% were born in Mexico
- Those interviewed worked for an average of 2.9 agricultural employers during the course of one year
- Mean average years of school completed was 5.9
- About one-third were able to find non-agricultural jobs between farm jobs
- Average length of employment in agriculture was 22 weeks
- On average, farm employees worked in at least two different crops during the 1989 summer season
- More than three-fourths expect to remain in agricultural work
- Approximately half drew unemployment insurance during periods without employment
- Forty percent made use of their own savings to get through unemployed periods
- Less than 1% obtained support from AFDC
- Just under 2% used food stamps

Although over half of those interviewed have settled in farmworker communities in California, they are by no means living off of public assistance. In fact, those who have obtained legal status through the IRCA Program avoid any semblance of public assistance to avoid threatening their permanent legal residency. Undocumented workers are not eligible for public assistance.

In another study of farmworker households in Tulare County, conducted in 1981 (473 respondents), the following information was gathered about occupational safety and health concerns:

- Only one-fifth used any form of health insurance, even in serious cases

- Farmworkers with the lowest incomes are the least likely to gain access to government social insurance programs (eg., welfare, food stamps, unemployment insurance and social security)
- The most commonly cited minor health problems are complaints such as headaches or nervousness, dental problems, skin irritations, respiratory problems, and musculo-skeletal problems
- Over half of the health problems occurring on the job are injuries
- Although injuries are the main cause of job-related health problems, farmworkers tend to fear chemicals more than accidents
- In general, farmworkers rarely miss work or seek medical treatment for chemical-related problems
- Over 45% of workers said they developed rashes; 44% said they developed headaches, and 26% said they had eye irritations from agricultural chemicals
- Chemicals used on grapes seem to cause more trouble than any other combination of crop and chemical

The hazards of farm work

People employed in "...agricultural occupations are at greater risk of suffering work-related deaths and injuries than persons employed in other industries." In 1988, the National Safety Council estimated that 1,500 deaths and 140,000 disabling injuries resulted from work accidents in farming occupations. While the death rate for all industries averages nine per 100,000, "...the accidental death rate for agriculture was 48 per 100.000 workers, higher than any other major industry." (Farm Script, Safety & Health News, Fall 1989)

Health and safety hazards on the farm include dangers from tractors and other mechanical equipment, overexertion from constant lifting and stooping, heat stress, exposure to pesticides, fertilizers and other chemicals, and the use of a wide variety of powered and hand tools.

In California, 12,886 disabling nonfatal work injuries and illnesses were reported for farmworkers through worker's compensation in 1987. In 1988, there were 2,204 occupational illness/injury reports associated with suspected pesticide exposure filed by physicians. It is commonly accepted that most work-related injuries or pesticide illnesses are not reported by farmworkers, farmers, or physicians for a variety of reasons. These reasons range from socio-economic factors, to fear of reprisal, and lack of information and understanding of regulations on the part of parties involved.

California State University, Fresno researchers found that among agricultural employees in the central and southern San Joaquin Valley, "...20% reported having been injured while working at a farm job within the past five years, and 84% of these required medical attention." Within this same survey sample of 361 farmworkers, 41% identified "pesticides" and "work hazards" as the most serious problem facing farmworkers.

Needs of agricultural workers

Despite the magnitude of the health and safety problems facing workers in the agriculture sector, there have been few efforts to address this crisis. A recent report compiled by the University of Iowa's Institute of Agricultural Medicine and Occupational Health states: "A double standard separates agriculture and general industry: agricultural deaths, diseases, and injuries occur at much higher rates than in industry, yet agricultural health and safety problems are largely ignored by federal and state agencies. Farmers have been systematically denied the potential benefits of a variety of programs aimed at supporting and protecting the American worker." (Agriculture at Risk, A Report to the Nation, 1989)

The "Farm Safety Fact Sheet" published by the United States Department of Agriculture Extension Service notes that unlike many other types of employers, "...farmers lack safety specialists on site who could train workers, be sure shields are in place, and insist that everyone read and heed labels and information manuals." (July 1988) This situation forces most farmers to conduct their own "safety programs," even though they generally lack the expertise, time, and communication skills necessary to conduct an effective safety program.

Access to health care

At any point during the year, it is estimated there are over 1,362,534 farmworkers in California. The largest agricultural areas with a large concentration of farmworkers include the San Joaquin, Salinas, Imperial, Coachella, and northern Sacramento Valleys.

There are a group of farmworker clinics in California that have been providing accessibility to primary health care to this farmworker population. Some clinics are partially funded from federal funds and others are funded by the State of California. Many may have a combination of both funding sources. The clinics provide an invaluable service to the farmworker population. Each year, 335 urban and rural clinics provide over 4 million medical visits to California's medically underserved.

Although they are organized to provide comprehensive primary care services, they also provide other unique services that respond to a local community need. Clinics may provide medical, dental, laboratory, x-rays, nutrition, health education, pharmacy, mental health, social services, outreach, multi-lingual and other technical services. The clinics are comprehensive in nature because they often case manage the health care by providing referral to specialty care providers and hospitalization services.

People in rural areas are among the most disenfranchised populations. Seasonal employment and lack of medical insurance coverage of many residents, as well as long distances to specialist and hospital services, continue to challenge the many providers of care practicing in rural clinics.

Pesticide exposure

California has been at the national forefront in providing health and safety protection to pesticide applicators, mixers, loaders, and farmworkers. The regulations in California are tougher than those promulgated by the federal Environmental Protection Agency.

Many feel we are doing an excellent job and suggest California is overstepping its bounds by doing more than the federal government requires. The problem has not been the regulations, but the reality that in spite of these regulations there is under-reporting of pesticide-related work injuries and disabilities. There are several factors involved in under-reporting listed as follows:

- When a worker is exposed and pesticides might be the cause of his/her illness, they are afraid to let their crew boss know because of a fear of reprisal by their employers
- Farmworkers have a limited awareness of pesticide related symptoms and exposure.
- Providers of care often do not recognize appropriate pesticide-related diagnosis
- The toxicology and epidemiology literature on humans is incomplete and scarce.
- Provider training often concentrates in recognizing anything other than acute organophosphate poisoning.
- Lack of primary health care providers in rural areas to meet the needs of the population.
- Lack of surveillance and enforcement programs.
- Conflict of interest on some agencies that do both promotion of pesticides and pesticide safety
- Inaccurate and insufficient labeling and standards causing false assurances of safety
- Lack of understanding of environmental contamination of air, water, schools, and the home
- General public perception that only agricultural workers are at risk from the effects of pesticide use.
- Lack of toxicology and epidemiology literature on child exposures.
- Lack of an effective registration program that ensures human safety before a pesticide is approved for use.

In conclusion, there is much to be done in these areas of pesticide safety. At the same time, we must do something to reduce the dependency of chemical use in this country. Over 7 million chemicals are currently registered with the American Chemical Society registry, and 6,000 new items are introduced each week. There are some companies and universities doing active research on alternatives to the use of pesticides. Some farmers have stopped using pesticides altogether. Others use a combination of natural means and chemicals to control their pests.

Presentation for
Panel Discussion on
'Pesticide-Related Health Care Issues'
by

Salvador Sandoval, M.D.
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Health care concerns with pesticides

Introduction

Surveys performed among farmworkers show they are concerned about the health hazards of pesticides. In Tulare County, over 91% of those polled reported personal or family members affected. In Salinas, there was a subjective complaint rate 250% higher than the reported rate. Surveys in several other states report similar concerns.

These concerns are not reflected in pesticide illness reports and statistics. There are several reasons for this, which I shall explore toward the end of this report.

I have worked with farmworkers, cannery workers, and other rural poor for well over 15 years in the Merced area, counting my years in family practice, residency and general practice. Over these years, I have seen chemicals banned that were once in general use. I have seen concern grow regarding water table contamination with DBCP and other chemicals. The child cancer clusters and the surrounding controversy surfaced, and are yet with us.

From the time I saw my first pesticide case, I was impressed with how little we actually know of the chronic health effects of these chemicals. I was also amazec to find that many of the chemicals to which farmers and farmworkers have been exposed for years had not been studied adequately.

For example, only two of the 400 active ingredients in pesticides commonly used for years have been studied adequately. Also, only seven of 53 substances listec by the National Academy of Sciences as potentially cancer-causing are listed as restricted, an oversight that hopefully will improve with the universal reporting requirement in the state.

I have learned most of what I know about pesticide illnesses and other occupational health problems from self study and continuing education courses. From the perspective of time, much of the information not widely known previously has become readily accessible and accepted over the years. This is true particularly as concern over toxics and the environment has grown. However, training in occupational health in general, and farm health in particular, is still weak and neglected for the average physician in practice and recent graduates of primary care residencies alike.

Spectrum of cases seen

I have seen acute pesticide poisonings, including systemic poisoning from organophosphates, among other chemicals. Also, I have seen many skin problems eye problems, some asthma, and two cases of chemical pneumonitis. However, I mention the following to highlight my particular concern for the delayed or long-term effects that are less readily apparent.

1. Parkinson's disease and cardiomyopathy in a tractor driver and applicator exposed to several chemicals, of onset 14 years ago. Initial reports of organophosphates causing these health conditions were only available via Med-lir searches for studies done in other countries, and not available to the consultants that saw this man at the time. Neurology and cardiology texts today do list these chemicals as possible causes.

2. At least four cases of documented peripheral neuropathies, two with axonal degeneration, in pesticide applicators or others. Again, no "definitive" proc of pesticide poisoning, but all other causes were ruled out.

3. I have seen several cases of delayed constitutional and neuropsychiatric symptoms following acute poisonings, including one with psychosis and abnormal encephalogram. Although these symptoms are often attributed to malingering, literature supports the fact that recovery is often delayed in poisoned individuals.

4. Of major public health concern is the issue of pesticide drift, which I have seen affect residential areas adjacent to sprayed fields. A mass evacuation was cause in one instance, with several illnesses resulting. Several patients were misdiagnosed at a local hospital, but subsequently confirmed as poisoning victims a the clinic where I work. In another instance, an elderly couple with chronic heart and respiratory ailments were affected by drift from an adjacent almond field spraying. Other poisonings from pesticide drift have included farmworkers who were not pesticide applicators, and for that reason not tested for baseline levels or not knowledgeable as to the chemical dangers. An instance of note, although I was not involved, had to do with the direct spraying of a farmworker camp and occupie daycare facility.

5. Lastly, to highlight the need for heightened awareness and coordinatec efforts, I wish to mention certain concerns:

   a. Increased reporting of asthma during cotton defoliation.
   b. Sporadic reports of increases in miscarriage during airborne application of chemicals in San Joaquin Valley towns.
   c. The difficulty in ascribing chronic respiratory ailments, such as pulmonary fibrosis, to paraquat and other chemicals, given that there are no definitive diagnostic tests. In fact, we are able to diagnose only acute organophosphate and carbamate poisonings with the tests at our disposal. Estimates are that these latter chemicals account for only 34% of the pesticide poisonings; ever here timing is important as reliability is effected by delays in testing (particularly for the carbamate class), by the method and lab used, and by the variations in baseline normal values for individuals.

Recommendations

1. Awareness among healthcare providers has to be heightened in order to better document and treat the acute and chronic effects of pesticide poisonings. Farmworkers often are unwilling or unable to mention a potential exposure because:

- they fear retaliation
- do not want to miss work
- underestimate the risk involved
- are undocumented
- do not know they are covered by worker's compensation
- think the doctor can tell by examining them
- cannot communicate due to language or inadequate interpretation

Methods of increasing healthcare provider awareness include:

a. Making crop sheets available to treating physicians that indicate potential chemical exposures according to the crops, seasons, and chemicals readily used. These resources should be sent automatically to local emergency rooms, to clinics serving farmworkers, and to public health departments. They should be available to local physicians on request.

b. Utilizing San Joaquin Valley migrant health centers and residency training programs for education on farm health hazards. Of note are the Migrant Clinicians Network and National Migrant Referral Project newsletters, videos, new provider orientation manuals, etc., available to accommodate this purpose.

2. Follow-up from the agricultural commissioners and the state needs to be improved. There is often no feedback on whether reported cases were declared pesticide poisonings or not. I find disturbing the fact that half of all reported cases are denied by the California Department of Food and Agriculture, particularly in view of the investigation delays that characterize many cases.

3. Education on pesticides and other farm health hazards has to be addressed and improved. This is especially true for non-applicators, since only 40% of the poisonings are among those routinely tested.

4. The industry bears the responsibility of ensuring that information on pesticide hazards is disseminated to the general citizenry of agricultural communities, particularly since 13,000 people – the majority of these children – seel treatment for pesticide exposure each year .

5. Finally, much more research needs to be done, particularly on reentry levels, which are often unreliable. The Zolone case is an unfortunate example of this need. Monitoring for excessive incidences of asthma, miscarriage, and other health problems, especially in the setting of defoliants, also needs to be improved.