



U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Public Health Service / Center for Disease Control

National Institute for Occupational Safety and Health

Proceedings:

PESTICIDE RESIDUE HAZARDS TO FARM WORKERS

PESTICIDE RESIDUE HAZARDS TO FARM WORKERS

PROCEEDINGS OF A WORKSHOP HELD
February 9-10, 1976, by the
WESTERN AREA LABORATORY FOR
OCCUPATIONAL SAFETY AND HEALTH

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Public Health Service
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Western Area Laboratory for Occupational Safety and Health
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PREFACE

The potential hazards presented by pesticide residues in the agricultural workplace have been a subject of considerable concern and controversy over the past decade. This concern has fostered extensive research programs within the government, business, and academic communities alike. It has produced Federally promulgated standards regarding minimum allowable time intervals for reentry into a field following pesticide application. These "reentry standards" have themselves been the object of considerable research activity and controversy.

Furthermore, Federal legislation has made the subject of pesticide residue hazard to farm workers of legislative concern to NIOSH, EPA, NIEHS, and USDA. All of these agencies have been sponsoring both in-house and extramural research addressing this subject.

The continuing concern with the questions of research priorities, duplication of effort, and the true magnitude of the problem led NIOSH to initiate plans to invite to a workshop a small number of individuals who were prominent in the field of reentry research. As a result of an enthusiastic response the list of participants quickly grew to a total of forty-three individuals.

The workshop sponsors are most grateful for the enthusiasm and contributions of the participants. A minimal editing of the proceedings was initially accomplished in an attempt to expedite their publication and preserve the informal and direct language which prevailed during the workshop. A more extensive editing was performed by NIOSH prior to final publication in order to insure the finished manuscript conformed with existing NIOSH requirements for uniformity and quality. Manuscripts for some of the presentations were not available for one reason or another for incorporation into these proceedings. These are noted in the body of this report.

Administrative announcements, "Asides", and incomplete or repetitious comments were deleted. For any errors which occurred during the compilation of these proceedings, we apologize. We would like to extend a special thanks to Ms. Carol Swanson, Utah Biomedical Test Laboratory, for coordinating and attending to the details required to make this a successful workshop, and to Ms. Sharon Takade, Utah Biomedical Test Laboratory, for her invaluable contributions to the editing and organization of the transcribed presentations and discussions, and in the assembly of this final manuscript.

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ABSTRACT

Nineteen papers with discussion are presented from Pesticide Residue Hazards to Farm Workers Workshop held at Salt Lake City in February 1976 with primary focus on occupational safety and health significance of the pesticide reentry and residue intoxication issue and the research areas needing to be addressed with presentation of supporting evidence and rationale. A priority list of research areas considered most critical is given.

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PESTICIDE RESIDUE HAZARDS TO FARM WORKERS

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FEBRUARY 9-10, 1976, BY THE
WESTERN AREA LABORATORY FOR
OCCUPATIONAL SAFETY AND HEALTH

INTRODUCTION

This workshop was convened to produce a solid foundation upon which NIOSH, EPA, NIEHS, and USDA could come to an agreement on two important questions:

- 1) What, if any, new and/or continuing research areas in reentry should be pursued in the future and with what priorities?
- 2) What agency assignments are appropriate for sponsoring the specific research needed?

The workshop purpose was to provide this foundation by reviewing the status of current knowledge and research and to establish research needs and priorities in the area of reentry as it relates to pesticide residue intoxication.

During the course of the workshop all participants were provided the opportunity and encouraged to present their opinions in two specific areas:

- 1) Definition of the problem - What is the occupational safety and health significance of the pesticide reentry and residue intoxication issue? What documented evidence is there which supports this view?
- 2) The research areas which should be addressed - What are their priorities? What is the supporting rationale?

It was considered imperative that an open and extensive interchange take place between workshop participants in these two areas. It was requested that each participant view his contribution to this process and

the workshop as an objective scientist apart from personal research capabilities and biases.

In order to catalyze an effective workshop, the program was initiated with an informal presentation/discussion period by Dr. John E. Davies, Dr. Thomas H. Milby, and Homer R. Wolfe. This was directed toward providing a common overview or perspective of the reentry question, including a review of the conclusions and recommendations of the Milby and Mrak Reports.

This was followed by a session comprised of invited informal presentations from a number of investigators from throughout the country active in conducting research in the area of pesticide residues as they relate to the reentry question. These presentations were adequately interleaved with discussion periods and it was intended that they address, in a direct fashion, the previously itemized subjects of classification/definition of the problem and identification of research areas and priorities.

To influence and assist in the process of identification and prioritization of research needs, each participant was requested to develop and bring to the workshop a prioritized list of those research areas they regarded as most critical to the question of reentry and residue intoxication. These were collected at the beginning of the workshop and utilized without reference to the contributor to compile a master list for distribution to all participants at the end of the first day. This list is reproduced in Appendix A.

The workshop participants were charged with reviewing this list of reentry and residue intoxication research areas and selecting those three which, based upon the sum of their individual experiences, were the most important to pursue in the future. The results of this tabulation were that items number 12 and 60 (Appendix A) had an equal number of votes for being the highest priority research area. Item number 22 was judged to be of second highest priority, and number 76 was third.

The prioritized research area list coupled with the presentations and discussions that developed in the course of the workshop provided a very substantial foundation for further discussions and decisions among the four Federal agencies concerned.

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1st Session - Overview and Perspective

Session Chairman: Jeffrey S. Lee

Keynote Speakers: Thomas H. Milby, M.D.
Discussion

John E. Davies, M.D.
Discussion

Homer R. Wolfe
Discussion

PESTICIDE RESIDUE HAZARDS TO FARM WORKERS

OVERVIEW AND PERSPECTIVE

Thomas H. Milby, M.D., M.P.H.
Berkeley, California

As keynote speakers, we have been given the charge of providing your workshop with an overview and perspective. This is a relatively easy assignment because serious interest in the subject of "pesticide residue hazard to farm workers" has had a short history marked with only a few really meaningful accomplishments.

Historically, residue poisoning of farm workers was first thought worthy of scientific publication by Dr. Griffith Quinby of the Public Health Service. He encouraged Mr. Alan Lemmon of the California Department of Agriculture to secure the necessary information and, together, they published a report in the Journal of the American Medical Association in 1958 entitled "Parathion Residues as a Cause of Poisoning in Crop Workers." In this publication, they summarized 11 episodes of poisoning from contact with parathion residues, involving a total of more than 70 workers who were employed in harvesting, thinning, cultivating, and irrigating such crops as apples, grapes, citrus, and hops. Although six of the outbreaks occurred within two days of pesticide application, in the remainder of the episodes the residues have been from 8 to 33 days old. Percutaneous absorption was thought to be the primary route of entry of the toxicant. If this publication occasioned any interest or activity, it was not evidenced in California the next year, 1959, since despite more than 275 parathion poisonings reported among workers harvesting citrus crops throughout the state, no official investigation of the outbreak was made.

Again, in 1963, there was an episode of parathion poisoning due to exposure to residues dislodged from parathion-treated foliage. Preharvest spraying had been particularly heavy that year because of an unusually heavy infestation of insect pests. The results of this investigation were published by my colleagues and me in The Journal of the American Medical Association in 1964. We reported that although parathion could be recovered easily from all aspects of the orchard environment, it was not present in amounts sufficient to account for the observed illnesses. We suggested that this inconsistency might be a result of the presence, in the spray residue, of a compound evolved from parathion alteration which was considerably more toxic than parathion, but identifiable by the routine analytical procedures available at that time only as parathion. We considered paraoxon as a likely suspect, and we postulated it as a prime cause of the outbreak. The California Department of Agriculture was quick to accept our recommendations to limit the application of parathion to the California peach crop. The

next year, under close observation, California's peach crop was harvested without incident and the problem was put aside.

The next date of historical interest is April, 1969, at which time the then Secretary of Health, Education, and Welfare, Mr. Robert Finch, appointed Dr. Emil Mrak to chair the Secretary's Commission on Pesticides and Their Relationships to Environmental Health. It was my privilege to be a member of that Commission. The issue of pesticide residue poisoning among farm workers was alluded to in several of the sub-committee reports of the Commissions, but was accorded no real importance. One concept in the chapter entitled "Effects of Pesticides on Man" did find its way into Recommendation Nine of the Commission:

"Establish a Department of Health, Education, and Welfare clearing house for pesticide information and develop pesticide protection teams."

The concept of pesticide protection teams originated with our colleague, Dr. John Davies. This concept, in part, held that teams should be developed from existing local personnel and coordinated with federal and state personnel and facilities from Agriculture, Wildlife, and Public Health. Part of their activities would be to improve local surveillance of pesticide-related problems and to investigate usage patterns and episodes of human toxicity. This is about as close as the Mrak Commission came to the pesticide residue - farm worker health problem.

In 1970, four separate episodes of organophosphorus (OP) residue poisoning were reported between the months of May and October in California. All episodes occurred in citrus crops. In all, 55 farm workers were made sufficiently ill to seek medical attention. State and county health officials, in cooperation with local physicians and state and county agricultural officials, were able to study these episodes in considerable detail. During the course of these investigations, it became abundantly clear that although pesticide application rates were well within legally approved limits, all workers examined were suffering from marked cholinesterase depression.

At that time, it was decided by California health and agriculture officials that the annual threat of episodic outbreaks of residue poisoning among farm workers constituted an unacceptable situation. However, because OP pesticide residue poisoning among farm workers had not been previously considered a serious occupational health problem, little thought had been given to methods of prevention. Several alternatives to the solution of the problem were considered. The first and most obvious alternative was to prohibit or severely curtail the use of OP pesticides. This alternative was rejected. A second alternative was to require the use of personal protective devices such as respirators and impervious clothing. This alternative was considered unrealistic in view of the high ambient temperatures encountered in California's central valley during the summer months. A third alternative considered was to require periodic cholinesterase testing of all potentially exposed farm workers. This alternative, in turn, was

rejected as being impractical in view of the very large numbers of farm workers involved in California agriculture. A fourth alternative embodying the traditional industrial hygiene principle of "make the work place safe" was chosen as the most practicable of all alternatives considered. This alternative was thought to be feasible because of the evanescent nature of members of the organophosphorus family of compounds after their application to the agricultural environment.

Accordingly, through cooperation with public agencies and private groups, a schedule was devised which stipulated required waiting times between application of certain OP pesticide compounds to certain crops and entry by workers into the treated fields, orchards, or vineyards. These waiting times were called "reentry intervals" and in 1971 were applied through administrative regulation to all organophosphorus compounds legally registered for use in citrus, grapes, peaches, and nectarines in California.

Although the agricultural community in California expressed concern that reentry intervals might prove to be a serious economic burden on their operations, to date such does not seem to have been the case.

Early in 1972, the Federal Working Group on Pest Management appointed a task group on occupational exposure to pesticides. I was asked to chair this task group, and I accepted. The charge of the task group was as follows:

"It has been recognized that chemical pesticides remaining as residues on treated plant surfaces may constitute a hazard to the health of workers who must, in the course of their work, come into substantial contact with these surfaces.

"The purpose of this task group is 1) to assemble and interpret all available information regarding the extent and severity of this occupational health problem in the United States; 2) to prepare a report which will identify significant areas in which relevant information is not available; 3) to make recommendations for the development of standard research protocols to determine safe reentry intervals for the protection of agricultural and forest workers; and 4), where possible, suggest interim reentry standards based upon existing knowledge. These recommendations should take into consideration the medical-ethical aspects of research involving human subjects."

We interpreted this charge as limiting our concern to the effects of OP compounds existing as residues on foliage on the health of farm workers. Further, we in effect interpreted the word "protocols" to mean "guidelines" rather than precise standards, since we did not believe that we were in possession of sufficient information to establish hard and fast rules for the conduct of reentry interval research. I believe the following quotation from the summary of this report is worth reviewing for you as you begin your two-day workshop.

"The fundamental concept central to the formulation of a safe, workable reentry interval is the concept of 'no response' in the test population during the period of controlled exposure. It is absolutely vital for the investigator to differentiate clearly between 'no response' and 'no exposure.' The former concept is fundamental; the latter meaningless, insofar as reentry is concerned. Given this approach, the problem becomes one of an exposure-response relationship. At this writing, techniques for estimation of exposure to organophosphorus residues are not well developed. However, measurement of response, namely analysis of the blood for erythrocyte and plasma cholinesterase activity, is satisfactory from an ethical, medical, epidemiological, and cost basis. Emphasis is placed on the two-fold purpose of blood cholinesterase analysis, first as a diagnostic tool to assure the protection of individual participants against excessive exposure to organophosphorus residues, and, secondly, as an epidemiological tool to assess mean group response to the exposure conditions under study. It is this second use which serves as a determinante of the safety of the reentry period under investigation; that is, if a significant group mean cholinesterase decline is observed, the reentry period is not sufficiently restrictive. Careful attention to preexposure cholinesterase testing for purposes of individual baseline determinations as well as daily quality control measures to protect against unacceptable laboratory variations are strongly recommended.

"Medico-ethical considerations specific to the use of human subjects in reentry investigations are enumerated and discussed. Paramount among these are the principles of informed consent, freedom from coercion, thorough prior studies in species other than man, a clear assessment of risk versus benefit, peer review of research design, confidentiality of individual information, and prompt dissemination of scientific reports. The Task Group firmly asserts its belief that reentry investigations involving human subjects are necessary and, if carried out properly, fully comply with all canons of medical ethics.

"Utilizing the concepts summarized in the foregoing paragraph, the actual design of a reentry investigation is discussed. Salient points include selection of a satisfactory experimental plot, selection of suitable experimental groups, arrangements for reliable cholinesterase monitoring, and attention to a number of other minor, but potentially confounding, variables."

I believe the concepts contained in the preceding quotation are worthy of your attention and consideration. The general recommendations included in the report are available to you. I believe that they are less important than the concepts I have read to you, primarily because you are now in a position of making recommendations of your own, and although you should be

mindful of the Task Group's recommendations, you should not be unduly influenced by them.

During the 22-month period of committee deliberations, a number of events occurred which are of relevance to this workshop. These events involved a number of the federal agencies represented here today, and I will defer any reference to these events to later, when, in the course of their presentations, these representatives may wish to summarize these events for you as well as bring you up-to-date on the activities of their respective agencies in connection with reentry interval regulations.

This concludes my remarks, and I would be pleased to entertain any questions which you might wish to ask.