

guidelines
for
physicians

who supervise workers exposed to
cholinesterase-inhibiting pesticides

fourth edition

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Office of Environmental
Health Hazard Assessment

California Environmental
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Updated 2013



GUIDELINES FOR PHYSICIANS
*WHO SUPERVISE WORKERS EXPOSED TO
CHOLINESTERASE-INHIBITING PESTICIDES*

Fourth Edition
2002
[updated in 2013]

Pesticide and Environmental Toxicology Branch
Office of Environmental Health Hazard Assessment
California Environmental Protection Agency

Contributors to the fourth edition:

William Ngai, Public Health Medical Officer, Pesticide Epidemiology Section

Richard G. Ames, Chief, Pesticide Epidemiology Section

Joy Wisniewski, Staff Toxicologist, Pesticide Epidemiology Section

Anna M. Fan, Chief, Pesticide and Environmental Toxicology Branch

The Office of Environmental Health Hazard Assessment (OEHHA) of the California Environmental Protection Agency is responsible for identifying the adverse effects of chemicals in the environment, and assessing the health risks associated with exposures to environmental contaminants.

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Office of Environmental Health Hazard Assessment

Pesticide and Environmental Toxicology Branch

1515 Clay St., 16th Floor

Oakland, CA 94612

Telephone: (510) 622-3170

FAX: (510) 622-3218

<http://www.oehha.ca.gov/pesticides.html>

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PREFACE

Since 1974, California has required medical supervision of agricultural pesticide applicators with monitoring of blood cholinesterase activity levels. Currently, the California Code of Regulations requires employers to provide medical supervision for employees who regularly handle pesticides that contain an organophosphate or a carbamate labeled with the signal words, “Danger” (Toxicity Category I) or “Warning” (Toxicity Category II), for the commercial or research production of an agricultural plant commodity. This publication, *Guidelines for Physicians Who Supervise Workers Exposed to Cholinesterase-Inhibiting Pesticides*, is published to instruct and advise physicians who provide the medical supervision for these workers. In addition, the Regulations require that physicians who provide this medical supervision possess a copy of this publication and be aware of its contents.

Medical supervision can be effective at several levels. It provides the obvious benefit of preventing excessive exposure to cholinesterase-inhibiting pesticides before illness occurs. In addition, it reinforces to the employees and employers how highly toxic the Toxicity Categories I and II pesticides are and promotes vigilance. The common goal of the safe handling of Toxicity Categories I and II pesticides can be achieved when the employee knows that the employer cares for his or her safety, and the employer, in turn, can be assured that the employee(s) will handle these pesticides responsibly. If excessive exposure is detected, the employer is directed to re-examine the workplace and pesticide handling procedures. If illness occurs or if cholinesterase levels fall below the removal levels, monitoring facilitates case management and supervision requires the employee to be removed from further exposure until it is safe for that employee to return to working with cholinesterase-inhibiting pesticides.

This version of the *Guidelines for Physicians Who Supervise Workers Exposed to Cholinesterase-Inhibiting Pesticides* is an update of the third edition and contains a new section, “*Frequently Asked Questions*,” which emphasizes and clarifies the main points of the medical supervision program. There are also changes in the Appendices, including newly updated excerpts from the *California Code of Regulations* (specifically *Sections 6000, 6710, 6720, 6724, 6728 {Medical Supervision}, 6734, 6736, 6738, 6742, 6760,*

6762, 6764, 6768, 6770, and 6772), as well as an updated version of *Treatment of Poisoning* taken from the latest edition of the U.S. Environmental Protection Agency’s book, *Recognition and Management of Pesticide Poisonings*. Also updated are excerpts from the *California Health and Safety Code* pertaining to physician requirements for reporting pesticide illness. Although the above noted regulations have been updated, the essence of the medical supervision program has not changed significantly except for the standardization of the laboratory measurement of cholinesterase activity levels. The *Introduction* and *Guidelines* sections of this publication, which describe the medical supervision program, contain some changes since the publication of the third edition of these *Guidelines* and all the addresses and phone numbers have been updated.

Questions and requests for assistance can be directed to the Pesticide and Environmental Toxicology Branch of the Office of Environmental Health Hazard Assessment of the California Environmental Protection Agency.

INTRODUCTION

California regulations require employers to arrange with a licensed physician for medical supervision of agricultural workers who apply Toxicity Categories I and II organophosphate and carbamate pesticides. Medical supervision is a surveillance program that monitors applicators of such pesticides. It consists of periodic measurements of cholinesterase activity levels in applicators that are compared to measurements of baseline cholinesterase activity levels, which were established prior to exposure to cholinesterase-inhibiting organophosphate and carbamate pesticides. This document is intended to guide physicians who undertake such supervision. It contains information on when the medical supervisor should order laboratory testing, what type of testing is required, how to interpret cholinesterase activity test results, and what actions are to be taken when indicated by test results. Treatment procedures taken from the U.S. Environmental Protection Agency (U.S. EPA) publication, *Recognition and Management of Pesticide Poisonings*, are presented in Appendix E for cases of organophosphate and carbamate pesticide poisonings.

Plasma and red blood cell (RBC) cholinesterase tests are the only practical means available for measuring the effects of exposure to pesticides that contain organophosphates and carbamates. Excessive exposure to these compounds can inhibit cholinesterase activity levels sufficiently to induce serious illness. Results of cholinesterase activity tests should always be interpreted by a physician. These guidelines offer uniform procedures for testing enzyme levels and reporting the results. Establishing an individual's baseline value for both plasma and RBC cholinesterase activity is essential for medical supervision. Since there is a fourfold difference between the upper and lower limits of a laboratory "normal range" for some of the common testing methods, the "normal range" cannot be relied upon for occupational health supervision. The frequency with which periodic follow-up cholinesterase tests are conducted is primarily a medical decision although the California regulations require certain minimum intervals that are stated in this document. The employer is required to follow the recommendations of the medical supervisor concerning matters of occupational health. Factors to consider are workplace conditions, pesticide toxicity, duration of exposure, and worker hygiene. Appropriate testing enables the physician to detect the existence of overexposure among a group of employees or in an individual worker before the occurrence of clinical illness. Under the regulations, the employer is responsible for removing employees from exposure upon recommendation of the medical supervisor.

To insure reliability of test results for a given individual, serial cholinesterase monitoring should be performed in the same California Department of Public Health (CDPH)-approved laboratory using the same analytical method, whenever possible.

The employer is required to keep for three years a record of the written agreement of contracted service with the medical supervisor, all recommendations received from the medical supervisor, and all results of cholinesterase tests required to be made upon the employees.

The medical supervisor should arrange for the prompt transmittal of copies of the cholinesterase monitoring results to the employer.

Although the diagnosis and treatment of poisoning is discussed, it should be noted that the medical supervisor does not necessarily undertake to provide emergency or other medical treatment.

California law requires physicians to report any illness they *believe or suspect* may be related to pesticide exposure to their local county health officer by telephone within 24 hours.

Medical supervision is important because it can detect excessive exposure before workers become clinically ill. Also, there are antidotes for poisoning, which if administered early and in adequate amounts, can save the lives of victims who have absorbed even several times the fatal dose of cholinesterase-inhibiting pesticides.

GUIDELINES FOR PHYSICIANS WHO SUPERVISE WORKERS EXPOSED TO CHOLINESTERASE-INHIBITING PESTICIDES

Regulations administered by the California Department of Pesticide Regulation (DPR) require that employers provide medical supervision for agricultural employees who regularly apply cholinesterase-inhibiting pesticides in Toxicity Categories I and II. Specifically, these regulations apply to workers engaged in the commercial or research production of an agricultural plant commodity who apply organophosphate or carbamate pesticides with the signal words “DANGER” or “WARNING” on the label for more than six days in any 30 consecutive day period. These workers include mixers, loaders, ground and aerial applicators, and flaggers. Only pre-exposure baseline testing of cholinesterase activity levels is required by the regulations for employees whose contact with these pesticides is limited to mixing and loading with “closed systems.” All other specified employees require periodic retesting of cholinesterase activity levels after a pre-exposure baseline level has been established. This requirement is specified in Section 6728 of the California Code of Regulations (which is in Appendix A for your reference). Also, medical supervision of pesticide formulators is required as described in the California General Industry Safety Order, Section 3450. The agricultural regulations set forth *minimum* requirements and do not restrict the employer and physician from providing more intensive medical supervision. The following paragraphs briefly describe the nature and underlying principles of medical supervision. These are, as the title says, offered as guidelines and are not intended to constrain the exercise of sound medical judgment.

1. Mutual Understanding Between Employers and Physicians

Employers are responsible for obtaining and paying for the required medical supervision. It is important that both physicians and employers have a clear understanding of their relationship and of their respective responsibilities. Employers may wish to engage physicians’ services for a complete industrial medical program or they may wish to provide only the basic occupational health services required by state regulations.

Employers’ expenses for a medical supervision program are part of the “cost of production” for enterprises using hazardous materials. Agreement about services and costs are best arrived at through personal discussion. Physicians may find it advisable to set their fees according to the amount of time and effort they estimate this supervision will take rather than to charge solely on the basis of each patient visit or examination. Much of the work will be preventive, such as ordering and interpreting cholinesterase tests, and may not involve actual patient visits or examinations.

2. Occupational Health Services

In their occupational health role, supervising physicians’ responsibilities go beyond the familiar therapeutic doctor-patient relationship to include preventive and consultative functions for the individual workers and for employers’ work forces as a group. These functions include the following:

Medical supervisor responsibilities

- While supervising physicians may advise the employer in planning and arranging for emergency medical treatment of pesticide poisonings and other occupational injuries, they do not necessarily undertake to provide emergency or other medical treatment themselves. They reserve the right to refer occupationally injured employees for hospitalization, consultation, emergency treatment, or other medical care as needed. However, the plan for emergency care should be understood by all concerned. Arrangements should include the provision, at the site of emergency medical treatment, of adequate supplies of medication (atropine and pralidoxime [Protopam or 2-PAM]) and information concerning the treatment of organophosphate poisoning. See Appendix E for treatment information. Further consultation on the treatment of organophosphate poisoning can be obtained from the following sources:
 - Office of Environmental Health Hazard Assessment at (510) 622-3170
 - Environmental Health Investigations Branch, California Department of Public Health at (510) 620-3620
 - Worker Health and Safety Branch, California Department of Pesticide Regulation at (916) 445-4222
 - Occupational Health Branch, California Department of Public Health at (510) 622-5757
 - U.S. Environmental Protection Agency at (415) 947-8721. Also on the Web at www.epa.gov/region09/lib-hot.html#r9lines
 - California Poison Control Center at (800) 411-8080.
- Physicians should endeavor to be conversant with the work practices and exposures of the workers that they medically supervise. For this purpose it is good practice for them to visit the workplaces and obtain from employers a list of the compounds regularly used. The county agricultural commissioner's office is also a good source of information on local pesticide practices. Valuable information on the toxicology of specific pesticides can be obtained from label and package inserts and from pesticide dealers and manufacturers.
- Supervising physicians should provide the employers with written instructions concerning standard procedure, such as handling overexposures and emergencies, and scheduling cholinesterase tests. They should confirm in writing any verbal instructions they give to employees or employers.
- When physicians decide to end their responsibility as medical supervisors, they should notify employers in writing and allow enough time for employers to arrange for a replacement.

Worker office visits and testing

- Both the employers and physicians should understand that each employee to be supervised is to be sent to the physician's office before that employee begins work that would involve cholinesterase-inhibiting pesticide exposure. The employers and physicians should also understand that, thereafter, the employee is to be sent as often as required by the physician and that medical services and laboratory tests which the physician considers essential for

medical supervision are to be authorized by the employer and required of the employee. It should further be understood that physicians will recommend removal of individual workers from exposure when indicated, and under the regulations, employers are required to follow the physicians' recommendations. These activities are described in more detail in the numbered sections that follow.

- Each supervised employee should be authorized by their employer to contact or visit the designated physician whenever the employee:
 - i. believes they have had overexposure to an organophosphate or carbamate pesticide,
 - or
 - ii. experiences symptoms suggestive of poisoning by such pesticides.

Employer responsibilities

- The employer should notify the medical supervisor in writing when a supervised employee permanently stops working with cholinesterase-inhibiting pesticides.
- DPR regulations require that the employer have a written agreement or a letter signed by a physician stating that the physician has agreed to provide medical supervision and that the physician possesses a copy of, and is aware of the contents of the document, *Guidelines for Physicians Who Supervise Workers Exposed to Cholinesterase-Inhibiting Pesticides* (this document). The regulations require that a copy of the letter or agreement is given by the employer to the local agricultural commissioner. A sample letter setting forth these instructions and a statement of services to be provided are offered in Appendix B. (The use of standard forms can facilitate medical supervision. Examples of possible formats for such forms are given in Appendix C.)
- DPR regulations require that the employer follow the recommendations of the medical supervisor concerning matters of occupational health.

Confidentiality and records

In occupational health practice, physicians' goals and ethics are no different from those in other forms of medical practice except for the added responsibility to the employer. Their primary concern is the protection and maintenance of the workers' health. One practical difference is the modified confidentiality of reports of cholinesterase tests performed for monitoring purposes. Employers should receive copies of these reports. The employer is required by the DPR to maintain these records for three years and to make them available for inspection by appropriate State and county agencies. These agencies include, but are not limited to, the county health and agriculture departments, the DPR, the Office of Environmental Health Hazard Assessment (OEHHA), and the California Department of Industrial Relations (DIR). The medical supervisor should arrange for the prompt transmittal of cholinesterase test results to employers so they will not be in violation of the regulations. One way to do this is to have the laboratory routinely send a copy of the report to the employer.

3. Pre-exposure Examinations

At the initial visit of a worker, the physician should take a pre-exposure history and conduct a physical examination. The physician should obtain identifying, occupational, and medical

information pertinent to protecting the employees working with these compounds. Because individuals with significant respiratory, hepatic, or cardiovascular impairment face special risks in jobs requiring exposure to cholinesterase inhibitors, the physician should also inquire about a history of conditions which may be adversely affected by cholinergic reactions, such as active peptic ulcer or bronchial asthma. Other conditions in which complications may be anticipated include anemia, degenerative diseases of the central nervous system, chronic colitis, history or evidence of psychosis, and diseases such as myasthenia gravis and glaucoma, which are treated with cholinesterase inhibitors. Workers with congenital cholinesterase deficiency will have abnormally low plasma cholinesterase activity, but this will not affect their ability to work with organophosphate or carbamate pesticides.

4. Cholinesterase Monitoring

Biological monitoring of workers is indicated in occupations where repeated toxic exposure may have a cumulative effect. Working with organophosphate and carbamate pesticides is such an occupation and cholinesterase testing is the single most important tool in medical supervision of pesticide workers. Cholinesterase testing, like all biological monitoring, serves two separate functions:

1. to detect potentially serious individual exposures *before* the occurrence of clinical illness, and
2. to provide indirect monitoring of the workplace exposure of the employee group as a whole, as relatively small changes in the group's mean value of cholinesterase levels may indicate that there is some repeated, common, and correctable exposure.

5. The Cholinesterase Test

It is important to remember that the toxic effect of concern is inactivation of cholinesterase in the nervous system. Plasma and RBC cholinesterase activity levels are used as available measurable surrogates for monitoring this effect.

Laboratory testing of cholinesterase levels has definite limitations and must be used with the following qualifications:

Use of approved laboratories required

- A laboratory performing cholinesterase tests as part of medical supervision must be approved by the CDPH and shall have a quality control program and an analytical method acceptable to that department. Copies of the updated list of approved laboratories may be obtained by writing to the California Department of Public Health, Environmental Health Laboratory Branch, 850 Marina Bay Parkway, G365, Richmond, CA 94804, by calling (510) 620-2801, or from the website:
<http://www.cdph.ca.gov/certlic/labs/Pages/ApprovedCholinesteraseLaboratories.aspx> Because of marked variation among different analytical methods and among laboratories using the same analytical method, it is misleading to extrapolate from one method to another or from the results of one laboratory to another. Consequently, baseline determinations and serial follow-up testing should be performed in the same laboratory using the same method, insofar as possible.

- The state approved cholinesterase testing standard method is the Ellman technique. If a different method is used, it shall be shown to be comparable to the Ellman technique (the specific procedures and conditions for this are stated in the regulations in Appendix A) and a conversion equation shall be prepared. Results shall be reported in International Units per mL on the converted (Ellman) scale. To be acceptable, the results between the alternative and the reference methods shall have at least a 0.9 correlation coefficient squared (r^2). “Kit” methods, which test whole blood and do not provide separate measures for plasma and RBC cholinesterase determinations, are not satisfactory. Information about specific methods and how to obtain approval of a laboratory for cholinesterase testing can be obtained by writing to the Environmental Health Laboratory Branch at the above address.

Plasma and RBC cholinesterase

- Both plasma (or serum) and RBC cholinesterase should be determined on each sample tested because the two tests have different meanings and the results need to be considered in combination for proper interpretation. Certain organophosphates exhibit preferential inhibition of either plasma or RBC cholinesterase activity.
- Plasma cholinesterase, or “pseudo-cholinesterase,” is more labile than RBC cholinesterase and is thus less reliable in reflecting actual enzyme depression at neuro-effector sites. It is generally more rapidly inactivated by exposure to organophosphates, but it may also be depressed by such other factors as alcohol, infection, and hepatic disease. Since plasma cholinesterase is produced in the liver, it can be regenerated relatively quickly. After mild exposure there is sometimes a rebound phenomenon resulting in elevated levels.
- RBC cholinesterase, or “true cholinesterase,” is biochemically the same enzyme as the acetylcholinesterase located at the neuro-effector cell synapses. It is considered a more accurate measure of the actual acetylcholinesterase activity level at the neuro-effector sites and is often depressed more slowly than plasma cholinesterase by exposure to organophosphates. Regeneration of RBC cholinesterase is slow and occurs only as new red blood cells are regenerated at a rate of approximately 1 percent per day.

Establishing baseline values

- A pre-exposure baseline level should be determined for each worker against which later values can be compared. The DPR regulations require the employer to provide for a physician to obtain baselines for all employees who “regularly handle” pesticides in Toxicity Categories I and II that contain organophosphates or carbamates, regardless of how frequently subsequent cholinesterase monitoring is done. “Regularly handle” is a term defined in Section 6000 of the regulations (see Appendix A); it means the employee is handling pesticides during any part of the day for more than six calendar days in any 30 day qualifying period beginning on the first day of handling. This baseline value should be the average of two or more tests taken at least 72 hours but not more than 14 days apart at the same laboratory. (One test is permissible under the regulations if two cannot be obtained.) If two tests are done and the difference between them exceeds 15 percent, a third baseline test should be performed. The average of the two closest values should be considered the true baseline value. **All baseline tests should be taken when the worker has had no exposure to cholinesterase inhibitors for at least 30 days.** When circumstances preclude the achievement of a 30-day exposure-free period for obtaining a

baseline, a “working baseline” should be obtained after the longest practicable exposure-free period available, with notation as to when the last exposure occurred. If this “working baseline” is below “normal or in the low-normal” laboratory range, the worker should be advised to discontinue exposure for at least 30 days, at which time a new exposure-free baseline can be established.

- The use of a laboratory “normal range” has no place in cholinesterase monitoring for occupational health purposes. There is a fourfold difference between the upper and lower limits of the “normal range” with some of the common laboratory methods.
- **All monitoring results must be interpreted as a percent of the individual’s baseline value.**
- Each worker’s cholinesterase values should be kept in an individual folder or file, preferably recorded on a separate chart or graph to facilitate interpretation of serial measurements.
- Interpretation of the cholinesterase test is a medical function. The laboratory reports should always be sent to the physician for interpretation and recommendations, although the regulations require that test results and recommendations be sent routinely to the employer’s office as well. The employee is entitled to know the results of his or her own tests and their interpretation. In addition, agricultural regulations require that cholinesterase test results and recommendations be made available by the employer upon request to inspecting agricultural and health officials of the state or county governments.
- The regulations specify that the baseline determinations shall be verified every two years (as a minimum). Any recent monitoring test showing that no depression has occurred should be sufficient to verify the original baseline.
- For new employees, the medical supervisor may accept previously established baseline values if they were obtained in accordance with the regulations by the same laboratory methodology and are acceptable to the laboratory which will analyze the new employee’s blood samples.

6. Permissible Levels of Cholinesterase Depressions

Limits are set for biological indicators of occupational exposures at levels that will indicate the existence of unsatisfactory working conditions or the occurrence of excessive exposure. The limit must allow an adequate margin of safety; i.e., it must be set at a level where it is not likely to be associated with toxic manifestations. The margin of safety is especially important in the case of cholinesterase inhibitors because of the insidious onset and nonspecific nature of early symptoms in cases of chronic exposure.

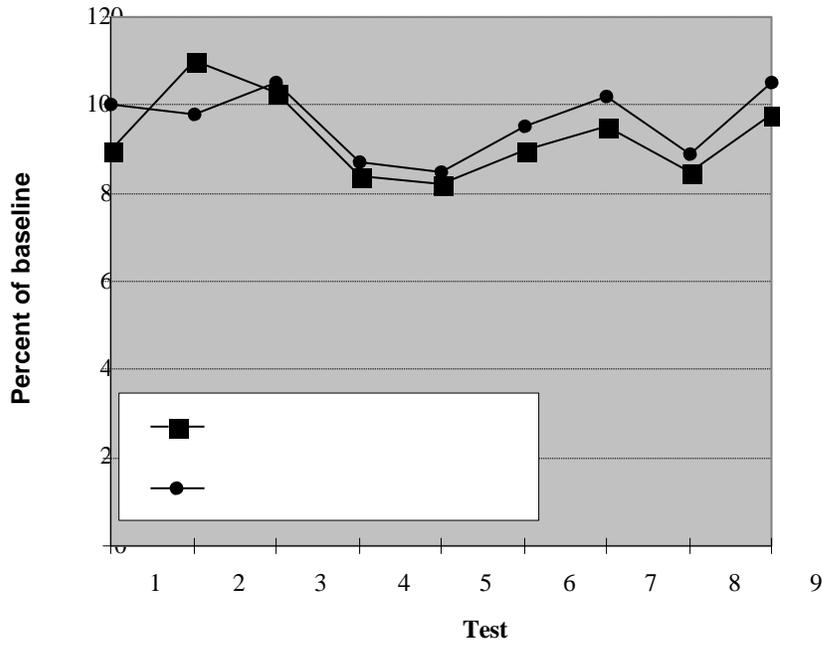
DPR regulations specify that a drop to 70 percent or lower in RBC cholinesterase or to 60 percent or lower in plasma cholinesterase relative to the individual’s baseline is an indication for immediate removal of the individual from all exposure to organophosphate and carbamate pesticides. The supervising physician should so inform the employer, who is obligated to follow the medical recommendation.

In actual practice, the physician should be alert to cholinesterase depressions before they reach the action level. Depression to below 80 percent of baseline is generally an indication for prompt retesting and notification to the employer to search for possible faulty work practices. The

agricultural regulations require the employer to investigate work practices, including a review of the safety equipment used and its condition, employee sanitation, pesticide handling procedures, and equipment usage, whenever an employee's cholinesterase, either plasma or RBC, falls below 80 percent of baseline. The employer is then required to maintain a written record of the findings, any changes in equipment or procedures, and any recommendations made to the employee.

On the following page, Figure 1 shows two charts illustrating hypothetical monitoring data for two workers: one without significant exposure and the other with overexposure. Plasma and RBC cholinesterase activity levels are shown as a percent of the workers' baselines. Note the key threshold values: below 80 percent of baseline indicates a need for prompt retesting and notification for the employer to search for possible faulty work practices; 70 percent or lower of RBC cholinesterase baseline level or 60 percent or lower of plasma cholinesterase baseline level calls for immediate removal of the individual from all exposure to organophosphate and carbamate pesticides. In the second chart, removal of the overexposed worker from exposure after test #5 resulted in a return to baseline values.

Worker With No Exposure



Overexposed Worker

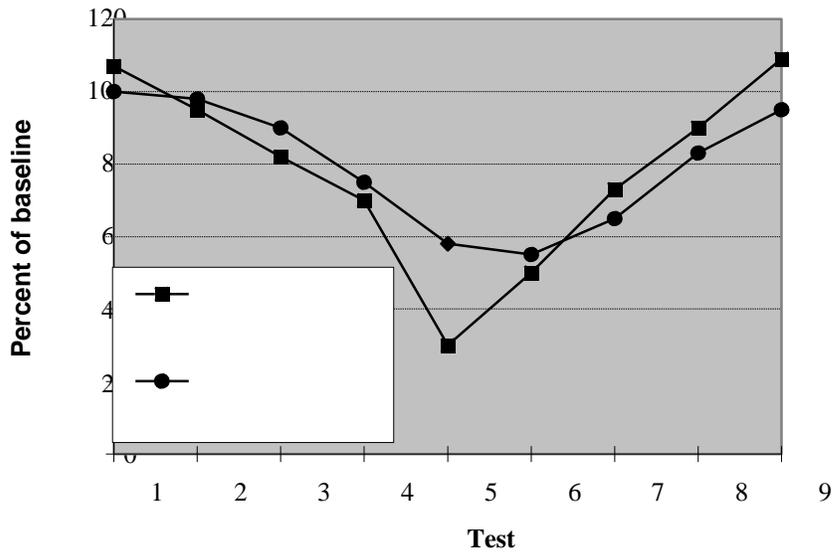


Figure 1. Illustrative cholinesterase monitoring charts. Data are shown for hypothetical tests taken at prescribed intervals. In the lower chart, the rise in both the plasma and RBC cholinesterase values following test 5 reflects removal of the worker from continued exposure.

7. Removal from Exposure and Return to Work

A worker removed from a job involving exposure to cholinesterase inhibitors because of depressed cholinesterase levels may be employed at other types of work. If no such work is available, the worker should be considered occupationally disabled under Workers' Compensation provisions until ready to be returned to the job, even though the worker is not clinically ill.

Removal from exposure means avoidance of areas where organophosphate or carbamate materials are handled or mixed and avoidance of any contact with opened containers or with equipment that is used for mixing, dusting, spraying, or otherwise applying organophosphates or carbamates. This restriction includes cleaning or repair of mixing or application equipment. In addition to handling activities, the removed worker should be kept from exposure to residues of organophosphates and carbamates.

When a worker has been removed from exposure because his/her cholinesterase activity has fallen below the acceptable limits, the worker should not be returned to his/her regular job until his/her enzyme activity levels have returned to 80 percent or greater of the baseline value for both plasma and RBC cholinesterase.

The employer is required to maintain, for three years, written records of the dates of removal and the dates when the employee returned to work.

8. Frequency of Periodic Follow-up Cholinesterase Testing

In general, cholinesterase testing should be done during the active season when workers are employed full-time and are regularly exposed to Toxicity Categories I and II organophosphates and carbamates. Initially, the follow-up testing should be done at intervals of 30 days, or less if requested by the medical supervisor. Later, this may be increased to 60-day intervals unless circumstances such as those given below indicate a need for more or less frequent testing. The purpose of cholinesterase testing is to detect excessive exposure at an early stage so intervention can be taken to protect employees.

The *minimum* frequency for cholinesterase testing is given in Section 6728(c)(2) (See Appendix A). After a pre-exposure baseline is established, the first test should occur within three working days after the conclusion of a 30-day qualifying interval in which the employee has regularly handled Toxicity Categories I and II organophosphates and carbamates. This frequency of testing should continue for two more 30-day qualifying intervals. After these first three 30-day qualifying intervals, the follow-up tests are conducted at 60-day intervals while the employee continues to regularly handle pesticides unless the medical supervisor specifies a different frequency in writing. (For convenient reference, the minimum requirements are presented in tabular form in Appendix D. Also, some explanations on testing intervals have been included in the physician's sample letter to the employer in Appendix B.)

The medical supervisor should consider the following factors in determining the frequency of cholinesterase testing:

- The extent and severity of potential exposure are major considerations. These will vary with the toxicity of the pesticides being used and the frequency with which they are handled. Different categories of work may involve different risks of exposure.

- The nature of the equipment being used may be an important factor. The institution of “closed systems” for mixing and loading pesticides, for example, has greatly reduced the exposure of the work force. Those employees who work only with closed systems are required as a *minimum* to have a baseline cholinesterase determination.
- The degree to which good work practices are followed will have an important effect on worker safety. Such practices include the use of the following: clean protective work clothes which are provided by employers and changed each day, showering before changing back to street clothes, proper use of gloves, boots, hats, and face shields, avoidance of eating, drinking, and smoking in pesticide-contaminated situations, and prompt and effective decontamination in the event of spills.
- The past history of an agricultural operation or of an individual is important. A company with well-maintained equipment, good discipline and work practices, and a long record of safety should require less intensive monitoring than one with a known record of worker poisoning. Even within one company, certain individuals may occasionally require more frequent testing on the basis of their previous work-related accident and injury history or their lack of experience.
- The physician’s experience and familiarity with a specific work force may be an additional consideration.
- Cholinesterase tests should be repeated any time a worker becomes sick while working with organophosphates or develops symptoms within 12 hours of their last exposure. If a worker dies within 24 hours of their last exposure to organophosphates, the physician should attempt to arrange for a post-mortem cholinesterase test.

9. Prophylaxis, Medical Treatment, First Aid, and Self-Medication

Neither atropine nor pralidoxime (Protopam or 2-PAM) should be taken by workers as a prophylactic measure. These drugs will not prevent poisoning. Nor should workers carry atropine or pralidoxime for first aid.

Oral atropine has no place in treatment of organophosphate or carbamate poisoning. The absorbed dose is likely to be too small and the victim cannot take oral medication when vomiting or stuporous. Atropine tablets can mask or delay early symptoms of poisoning, which can be detrimental in at least two ways. The worker may go back to work and receive additional exposure, or, if taken to a physician who does not know that atropine has been taken, the diagnosis of poisoning may be missed or delayed. Atropine tablets can create a false sense of security, delay medical treatment, and cause important first aid measures to be neglected.

Furthermore, atropine and pralidoxime are obtainable legally only through a physician’s prescription for the individual for whom they are intended. Physicians should not provide employers with these medications to dispense to their employees as they see fit.

When supervising physicians can be certain that the workers will be brought to medical treatment immediately if there is any question of poisoning, the physicians may wish, under exceptional circumstances, to prescribe atropine as first aid for patients who are on their way to medical treatment. If atropine has been administered, it should always be called to the attention of the treating physician.

It should be noted that when poisoned workers are brought to the hospital for treatment, the emergency room staff have sometimes made the mistake of drawing blood for cholinesterase testing after intravenous administration of pralidoxime has begun. The pralidoxime that has already entered circulation will reactivate the inhibited enzyme and falsely indicate that the symptoms were not due to cholinesterase inhibition. *Blood for cholinesterase assays should always be drawn before administration of pralidoxime.* (Ten cc of blood should be drawn for plasma and RBC cholinesterase tests before pralidoxime is given. Use heparin or EDTA as an anticoagulant. If the tests cannot be done right away, the specimen should be kept on ice or at a temperature of 4°C until the time of assay. Do not wait for results before initiating treatment.) See Appendix E for more information about medical treatment.

Carbamates differ in several ways from organophosphates and treatment of carbamate poisonings also differs in that pralidoxime is probably not indicated. The cholinesterase depression caused by carbamates is brief, usually reversing within 24 hours, and frequently within one or two hours. Because the reversal also occurs in vitro, testing is rarely accurate and must be done promptly to detect cholinesterase activity depression.

10. Physicians' Responsibility to Report Pesticide-Related Illness and Injury

As required in the California Health and Safety Code, Section 105200, physicians must report to their local health officer by telephone within 24 hours any case which they know, or have reasonable cause to believe, is related to pesticide poisoning. The Pesticide Illness Report form can be obtained at: <http://www.oehha.ca.gov/pesticides/programs/Helpdocs1.html>. All types of pesticide-related cases must be reported: skin and eye injuries, systemic poisonings, suicides and homicides, and home and occupational cases. For occupational cases involving pesticides, Health and Safety Code Section 105200 and Labor Code Section 6409(a) (see Appendix G) also require the treating physician to send a copy of the Worker's Compensation form, "Doctor's First Report of Occupational Injury or Illness," to the local health officer within seven days and to the Division of Labor Statistics and Research of the DIR. In addition, the usual filing process with the employer or the employer's insurance company of the "Doctor's First Report" should be followed. "Doctor's First Report" forms can be obtained from the Department of Industrial Relations, Office of the Director – Research Unit, P.O. Box 420603, San Francisco, CA 94142-0603 or from the Web site: <http://www.dir.ca.gov/OPRL/dlsrform5021.pdf>. Pesticide illness reporting provides valuable information to the State for its programs that are aimed at diminishing accidents and achieving greater safety with pesticides. Failure to report to the local health officer as required by the Health and Safety Code renders physicians liable for a civil penalty of \$250, enforced by the Division of Occupational Safety and Health of DIR. Failure to report occupational cases as required in the Labor Code Section 6409(a) may render physicians liable for additional fines.

A case seen as pesticide poisoning or as a condition suspected as pesticide-related may not be categorized as a "first aid case" and must be reported.

11. Importance of Medical Supervision

Medical supervision has more to offer in the prevention and treatment of organophosphate and carbamate poisoning than is true for many other occupational hazards. First, there is the cholinesterase test which can detect excessive exposure before workers become sick. Second, there are antidotes for poisoning which, if administered early and in adequate amounts, can save the lives of victims who have absorbed even several times the fatal dose. Third, there is medical management of poisoned workers to prevent re-exposure until cholinesterase values have been

restored to 80 percent or greater of baseline.

12.Assistance

OEHHA will be glad to offer advice and consultation to physicians undertaking responsibility for medical supervision of pesticide workers. Address inquiries to:

Office of Environmental Health Hazard Assessment Pesticide
and Environmental Toxicology Branch
1515 Clay St., 16th Floor
Oakland, California 94612
Telephone (510) 622-3170
FAX (510) 622-3218
Website: <http://www.oehha.ca.gov>

FREQUENTLY ASKED QUESTIONS

1. What is the medical supervision program?

Medical supervision is a surveillance program that monitors employees who “regularly handle” cholinesterase-inhibiting pesticides with the signal words “**Danger**” or “**Warning**” for the commercial or research production of an agricultural plant commodity. This is done by periodically measuring cholinesterase activity levels and comparing these results to a previously established baseline activity level measured prior to exposure to these pesticides. If one of these periodic measurements of cholinesterase activity shows inhibition below certain levels in a monitored worker, steps are then taken to prevent that worker from getting further exposure to those pesticides. These steps may include a review of the work practices, safety equipment, and employee pesticide handling practices, and for more severe inhibition, removal of the worker from exposure.

2.- Which employees are monitored?

The employees monitored are the pesticide applicators who “regularly handle” organophosphate or N-methyl carbamate pesticides with the signal words “**Danger**” or “**Warning**.” Applicators include mixers, loaders, applicators (both ground and aerial application), and flaggers. “Regularly handle” is a term defined in the California Code of Regulations and means that the employee is handling pesticides during any part of the day for more than six calendar days in any 30 consecutive day qualifying period beginning on the first day of handling. Employees whose contact with these pesticides is limited to mixing and loading with “closed systems” are required to have only baseline testing of their cholinesterase levels and are not required to have periodic retesting.

3. Why are these employees monitored?

The purpose of medical supervision is to prevent accumulative inhibition of cholinesterase activity resulting from multiple exposures to highly toxic organophosphate pesticides. By monitoring the employees’ cholinesterase levels, illness can be prevented if a significant lowering or inhibition of their cholinesterase activity levels can be detected early and they are removed from further exposure to cholinesterase-inhibiting pesticides before symptoms occur. Monitoring employees already removed from work for depressed cholinesterase levels will help determine when it will be safe for them to return to that work. Other benefits of monitoring are forced vigilance, increased worker and employer awareness of how toxic these chemicals are, and development of a common goal of safe handling of highly toxic organophosphate and carbamate pesticides.

4. Do field workers need medical supervision?

Field workers do not need medical supervision if that is the only type of work they do because there are other means to prevent excessive exposure such as restricted entry intervals and pre-harvest intervals. If field workers also mix, load, or apply the above-mentioned pesticides or are flaggers for more than six days in a 30-day period, then they will need medical supervision.

5. What are the pesticides with the signal words “**Danger**” and “**Warning**”?

Pesticides labeled with the signal word “**Danger**” are in Toxicity Category I and are highly

acutely toxic. Pesticides labeled with the signal word “**Warning**” are in Toxicity Category II and are moderately acutely toxic. The employees requiring medical supervision are those who “regularly handle” organophosphate and carbamate pesticides in these two more highly toxic categories of pesticides. Pesticides in Toxicity Categories III and IV are less toxic and are each labeled with the signal word “**Caution.**”

6. Who is responsible for the medical supervision?

The employer is responsible for setting up the medical supervision program for his qualifying employees. This program requires the employer to maintain pesticide use records that identify the employee, the name of the pesticide, and the date of use. The employer is also required to have a written agreement with a physician contracted to provide medical supervision and to maintain records of recommendations received from the medical supervisor and of all results of required cholinesterase tests for three years. A sample contract form is included in Appendix C of this publication.

7. Who does the actual medical supervision?

A physician contracted by the employer for this purpose does the actual medical supervision. The employer shall have a written agreement signed by this physician that includes the names and addresses of both the physician and the employer and states that the physician has agreed to provide medical supervision. This agreement shall also state that the physician possesses a copy of this document, *Guidelines for Physicians Who Supervise Workers Exposed to Cholinesterase-Inhibiting Pesticides* and is aware of its contents. A copy of this agreement shall be delivered to the county agricultural commissioner no later than the time an employee begins to regularly handle Toxicity Categories I and II cholinesterase-inhibiting pesticides.

8. What tests are done?

Blood is drawn to measure the enzymes plasma cholinesterase (also known as pseudo, serum, or butyryl cholinesterase) and red blood cell cholinesterase (also known as RBC, acetyl, or true cholinesterase).

9. Why are both the plasma cholinesterase and the RBC cholinesterase measured?

Although RBC cholinesterase is the same enzyme that is found at the neuro-effector site and thought to reflect inactivation there more accurately, it is more difficult to measure and is depressed more slowly than plasma cholinesterase. Some pesticides can preferentially lower the activity of either enzyme. For example, chlorpyrifos and mevinphos preferentially lower plasma cholinesterase activity while phosmet and dimethoate preferentially lower RBC cholinesterase activity. Since each of these enzymes has different characteristics, measuring both will give a more accurate assessment of the cholinesterase activity level and, hence, any possible exposure.

10. How often are cholinesterase tests done?

The first tests are done to establish a baseline level in the employee prior to exposure to Toxicity

Categories I and II cholinesterase-inhibiting pesticides. Once the baseline is established, periodic follow-up testing is begun if the employee handles these pesticides during any part of a day for more than six calendar days in a 30 consecutive day qualifying period beginning on the first day of handling. Periodic testing should be done for three 30-day qualifying intervals; if the medical supervisor has no written recommendations to the contrary at that time, the testing interval shall then become 60 days. The testing after the 30-day qualifying intervals has to be done within three working days after the conclusion of the required testing intervals. If the employee handles these pesticides for six or fewer days in a 30-day period, then that employee does not need to take a test for that time period, even if he was required to be tested for a prior 30-day qualifying period. Results of the periodic follow-up tests must be interpreted as a percent of the employee's pre-exposure baseline level.

11. Can a physician require more frequent testing than what is required by the regulations?

Yes. Neither the *Guidelines* nor the regulations are intended to constrain the exercise of sound medical judgment. The regulations set forth the *minimum* requirements and do not restrict physicians from providing more intensive supervision. It is clearly stated in the regulations that "The employer shall follow the recommendations of the medical supervisor concerning matters of occupational health."

12. Can any laboratory do the cholinesterase tests?

No. The plasma and red blood cell cholinesterase tests ordered by the medical supervisor for occupational health surveillance must be done by a clinical laboratory approved by CDPH. Copies of the updated list of approved laboratories can be obtained from the California Department of Public Health, Environmental Health Laboratory Branch, 850 Marina Bay Parkway, G365, Richmond, CA 94804, by calling (510) 620-2801, or from the website: <http://www.cdph.ca.gov/certlic/labs/Pages/ApprovedCholinesteraseLaboratories.aspx>

13. How important is it to store the blood samples on ice?

Very important! To obtain the most accurate cholinesterase assay results, the blood samples must be stored on ice as soon as possible after drawing and until the tests are run. It is stated in the regulations that "Blood samples shall be kept in ice or at a temperature of 4°C until time of assay. If the sample is centrifuged to remove the erythrocytes from the plasma, the plasma shall be frozen at a temperature of minus 20°C until the assay is performed. If possible, the assay shall be performed within 24 hours after collection."

14. Are there other factors of the testing procedure that can affect the test results?

Yes. One of these is the blood draw itself. The area from which the blood is drawn should be as clean as possible since even a small amount of pesticide contaminant can affect the results. A standard vacutainer with EDTA or heparin as the anticoagulant should be used for sample collection. The assay method used can also affect the results. The standard Ellman technique for the assay is recommended in the regulations. If an alternative method is used, the results have to be convertible to units of the Ellman standard with 90 percent accuracy ($r^2 = 0.90$).

Since there is variability in results from different labs, it is recommended that the same laboratory and technique for assay be used for the baseline level determination and for the periodic follow-up cholinesterase determinations. As previously mentioned, the pesticide itself can preferentially

affect one enzyme or the other. Consequently, which enzyme is measured can affect the results. Other factors that can potentially affect the results are laboratory error, incorrect calculation of the baseline, and poor record keeping and organization.

15. What is a baseline value?

The baseline is the plasma cholinesterase and RBC cholinesterase determinations that are measured prior to an employee's exposure to Toxicity Categories I and II cholinesterase-inhibiting pesticides. By regulation, this is required of all employees who will "regularly handle" these pesticides regardless of how frequently subsequent monitoring is done.

16. How is the baseline value established?

All baseline tests should be taken when the worker has had no exposure to cholinesterase inhibitors for at least 30 days. If circumstances preclude the achievement of a 30-day exposure-free period, then a "working baseline" should be obtained after the longest practicable exposure-free period possible with a notation as to when the last exposure occurred. However, a 30-day exposure-free period from cholinesterase-inhibiting pesticides prior to obtaining the baseline tests is the best and preferred way to establish the most accurate baseline value. The baseline value should be the average of two or more tests taken at least 72 hours but not more than 14 days apart and assayed at the same lab. (One test is permissible under the regulations if two are not obtainable.) If the difference between the two tests exceeds 15 percent, then a third test should be done and the average of the two closest values should be the true baseline value.

17. Why are 2-3 tests recommended to establish a baseline?

The reason two or three tests each of the plasma cholinesterase and the RBC cholinesterase are recommended to establish the baseline values for both is to reduce test-retest variability which in turn will reduce the number of false positive and false negative results from the periodic follow-up tests. Test-retest variability can normally be as much as 15 percent to 23 percent.

18. Why is the baseline value important?

The baseline value is important because it is the level against which all subsequent post-exposure cholinesterase determinations are compared. Since the baseline value is determined before the employee is exposed and the periodic follow-up tests occur after exposure, it is assumed that any subsequent inhibition of the cholinesterase activity is due to exposure to these pesticides. All of the subsequent determinations must be interpreted as a percent of the baseline value. If this percent falls below certain thresholds, then certain actions are taken, including investigation of employee work and safety practices and equipment and removal of the employee from further exposure to these pesticides. Effective monitoring requires an accurate baseline.

19. How is the baseline verified every two years?

Although the regulations state, "Baseline values shall be verified every two years," verification is not defined and a process for it is not specified. It is our recommendation that a simple method for verification is to repeat the baseline tests and reconstruct the baseline values every two years.

20. Can a cholinesterase determination be compared to the laboratory normal levels instead of to a baseline value?

No. Laboratory “normal levels” can have a very wide range. If this wide range of cholinesterase activity levels were used instead of a baseline for comparison with the follow-up cholinesterase activity levels, it would be difficult, if not impossible, to determine if an individual’s cholinesterase activity levels were actually depressed. In addition, a significant number of people will have normal baseline values that fall outside of the laboratory normal range.

Therefore, the most accurate comparison would be to their own baseline value that was determined prior to any exposure to cholinesterase-inhibiting pesticides.

21. What are the levels of cholinesterase inhibition that trigger actions to be taken and what are these actions? Also, if an employee is removed from working with cholinesterase-inhibiting pesticides, when can this employee return to work with those pesticides?

After a baseline value is established, working season testing (periodic follow-up testing) is begun if the worker handles Toxicity Categories I and II cholinesterase-inhibiting pesticides for more than six calendar days in a 30 consecutive day qualifying period beginning on the first day of handling. If either of the follow-up plasma or RBC cholinesterase activity levels fall below 80 percent of its baseline, 70 percent of RBC cholinesterase baseline, or 60 percent of plasma cholinesterase baseline, the following actions are triggered:

< 80 percent of the RBC or plasma cholinesterase baseline values: The employer shall investigate the work practices of the employee, including employee sanitation, pesticide handling procedures, and equipment usage, and conduct a review of safety equipment and its condition. The employer shall maintain a written record of the findings, changes in equipment or procedures, and any recommendations made to the employee. Depression to this level is an indication for prompt retesting.

≤ 70 percent of RBC cholinesterase baseline value: The employer shall remove from exposure to cholinesterase-inhibiting pesticides an employee whose RBC cholinesterase activity level falls below this level. The employee will not be allowed to return to work with these pesticides until his/her RBC cholinesterase and plasma cholinesterase activity levels each returns to 80 percent or more of baseline. The employer shall maintain written records of the date of removal and the date when the employee is returned to exposure.

≤60 percent of plasma cholinesterase baseline value: The employer shall remove from exposure to cholinesterase-inhibiting pesticides an employee whose plasma cholinesterase level falls below this level. The employee will not be allowed to return to work with these pesticides until his/her plasma cholinesterase and RBC cholinesterase activity levels each returns to 80 percent or more of baseline. The employer shall maintain written records of the date of removal and the date when the employee is returned to exposure.

22. If an employee’s cholinesterase activity levels are below the action levels, does it mean that worker cannot work at all?

No. The employee cannot work with cholinesterase-inhibiting pesticides until his/her inhibited cholinesterase activity levels (the RBC or plasma cholinesterase or both) recovers to 80 percent or more of the baseline values. Unless this employee has other work restrictions, he/she can work modified duty and do any other available work for which he/she is qualified.

23. If the cholinesterase activity levels are *elevated*, does the employee have to be removed from further exposure to cholinesterase-inhibiting pesticides?

No. An elevation in cholinesterase activity levels is not an adverse effect of exposure to cholinesterase-inhibiting pesticides. A depression in cholinesterase activity levels is an adverse biological response of exposure to cholinesterase-inhibiting pesticides and is what the medical supervision program is designed to detect.

24. Are there any medical or physical conditions other than exposure to organophosphates or carbamates that can affect cholinesterase levels?

Yes. Three per cent of the population have a genetically determined lower level of plasma cholinesterase and have an increased susceptibility to the muscle paralyzer, succinylcholine, but are not more susceptible to organophosphates. These people usually have normal levels of RBC cholinesterase. Plasma cholinesterase can also be lowered by liver disease, malnutrition, alcoholism, nephrotic syndrome, early pregnancy, cocaine, carbon disulfide, organic mercury, birth control pills, and metaclopramide.

RBC cholinesterase levels can be affected by hemolytic anemia, pernicious anemia, recovery from hemorrhage, and conditions associated with reticulocytosis.

25. Why does a physician have to interpret the results? Can't the lab or the employer tell from looking at the results themselves if any action has to be taken?

On the surface, it appears as if it would not be difficult for the laboratory or an employer to interpret the test results. In reality, it is not so simple and requires a physician to make the proper interpretation. A physician has the clinical training, background, and experience to understand how other conditions can affect test results and how to put those factors in their proper context to arrive at the proper interpretation of the results. In addition, determining if a worker can work or not and how often to retest are clinical decisions. Furthermore, a physician supervisor is required by the regulations.

26. What is the aim of this publication, *Guidelines for Physicians Who Supervise Workers Exposed to Cholinesterase-Inhibiting Pesticides*?

The main purpose of this document is to describe the steps to be taken to provide a program for medical supervision of workers who regularly handle Toxicity Categories I and II cholinesterase-inhibiting pesticides. The regulations cited in these *Guidelines* set forth the minimum state requirements and are not intended to constrain physicians from exercising sound medical judgment or from providing more intensive medical supervision. These *Guidelines* also briefly mention certain aspects of prophylaxis, treatment of organophosphate and carbamate poisoning, and the requirement of physicians to report all cases of pesticide poisoning to the local count health officer. In addition, the California Code of Regulations requires that the physician providing medical supervision "possesses a copy of, and is aware of the contents of" this document.

27. Who maintains the records for the medical supervision program and for how long do these records have to be maintained?

The California Code of Regulations requires the employer to keep a record of the agreement with
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the physician to provide medical supervision, pesticide use records, all recommendations received from the medical supervisor, and all results of cholinesterase tests required to be made on his/her employees. It is required that these records be maintained for three years and that they be available for inspection by the employee, the Director, commissioner, county health officer, or state health officials. It would be desirable to have the records filed together as worker groups in case other similarly exposed workers need to be contacted.

28. If a worker has been made ill by pesticides at work, is the medical supervisor the physician this worker sees for diagnosis and treatment?

Not necessarily. The physician with whom the employer has the agreement is only contracted to provide medical supervision as set forth in the regulations and described in these *Guidelines*. Under this agreement, the medical supervisor is not required to provide emergency or other medical treatment. The medical supervisor and the employer and the employee can have other arrangements and agreements to provide diagnosis and treatment for occupational or other illnesses or injuries, in which case, the designated physician would see this worker.

29. Are pesticide related illnesses reportable?

Yes. A physician who knows or believes that a patient is suffering from a pesticide poisoning or any disease or condition caused by a pesticide shall promptly report that fact to the local health officer by telephone within 24 hours (as required by the Health and Safety Code Section 105200). Poisoning from all pesticides, including the cholinesterase inhibitors, is reportable. Definitely diagnosed cases as well as suspected but not definitely diagnosed cases are reportable.

30. If a worker is removed from work because his/her cholinesterase activity levels are 70 percent or less of the RBC cholinesterase or 60 percent or less of the plasma cholinesterase baseline levels, does this have to be reported? If it does, how, when, and to whom should it be reported?

If the removed worker is asymptomatic and well, then this does not have to be reported. If the worker is ill with signs and symptoms consistent with or suspected to be a pesticide related illness (any pesticide including cholinesterase inhibiting ones), then this should be reported. As stated in the Health and Safety Code Section 105200, the report has to be made to the local health officer within 24 hours after seeing the patient. If consulted, the Poison Control Center can make this report for the treating physician. For occupational cases of pesticide illness, there are additional reporting requirements. As stated in the Labor Code 6409, the report has to be made to the local health officer within 24 hours by telephone (as stated above) or by facsimile. Also, copies of the "Doctor's First Report of Occupational Injury or Illness" has to be sent to the local health officer within 7 days, the employer or insurer within 5 days of the initial visit, and to the Division of Labor Statistics and Research of the Department of Labor Statistics.

Copies of the "Pesticide Illness Report" and copies of the "Doctor's First Report of Occupational Injury or Illness" form can be obtained at:

<http://www.oehha.ca.gov/pesticides/programs/Pestrpt.html>.

31. Besides what has been stated in these *Guidelines*, is there anything else the medical supervisor, the employer, and the employee can do to implement and make the medical supervision program more effective?

It is strongly recommended that the medical supervisor provide medical exams for each employee to be sure they are fit for the duties, to be familiar with the pesticides used by the employers, and to know the signs and symptoms caused by exposure to these pesticides. Also, filing medical supervision records by work groups would facilitate contacting other similarly exposed workers, if needed.

It would be desirable for the employer to inform the physician of the pesticides used, to explain medical supervision to the employee, and to inform the physician of the reason an employee was being seen. The employer is also required by the California Code of Regulations to provide employee training, to send in employees for baseline determinations and working season testing, to honor physician judgments and requests, and to file the name of the medical supervisor with the county agricultural commissioner.

It would be desirable for the employee to present oneself for baseline and working season testing, inform the employer of other exposures and of illness symptoms, and to follow the instructions of the physician and the employer.

32. Is there a summary of the guidelines laid out in this document that can be referenced to help remind the medical supervisor of the main points of this program?

Some of the main points stated in this document can be found in a table in Appendix D. However, the only way to understand this program and how it operates is by reading this booklet and learning the guidelines set forth and the details of them, which is strongly recommended. The information in the Appendices is included in this document as reference material.

33. Is there any penalty for not implementing this program or not following this program correctly?

There is no set penalty for the physician for not implementing the program correctly. However, the county agricultural commissioner is responsible for enforcement of the employer's compliance with the regulations and the employer can be fined for non-compliance. Rather than focusing on issues of non-compliance, it is more important to focus on the fact that an effective medical supervision program protects the employee, employer, and the entire work setting.

REFERENCES ON MEDICAL SUPERVISION

Books:

Handbook of Pesticide Toxicology. Vol. 1-3. Hayes WJ, Jr., Laws ER, Jr. (eds.). San Diego: Academic Press, Inc., 1991.

Occupational and Environmental Medicine. 2nd ed. LaDou J (ed.). Stamford, Connecticut: Appleton & Lange, 1997.

Recognition and Management of Pesticide Poisonings. 5th ed. Reigart JR, Roberts JR. EPA-735-R-98-003. U.S. Environmental Protection Agency, Office of Prevention, Pesticides, and Toxic Substances, Washington, D.C. March 1999.

Individual chapters on classes of pesticides giving common commercial products grouped according to toxicity; sections on toxicology; symptoms and signs of poisoning; procedures for confirmation of diagnosis; treatment and antidotes. Special index to pesticide poisonings by symptoms and signs, coordinating symptoms with pesticides that could cause them. (Note that the most essential section of this book regarding treatment of organophosphate pesticide poisonings is included in this document in Appendix E.) Copies are available in English or Spanish. For more information: Tel: 703-305-7666 or Fax: 703-308-2962. The manual is available in electronic format at:
<http://www.epa.gov/oppfead1/safety/healthcare/handbook/handbook.htm>

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Lessenger JE (1996). The California pesticide program: comments from the front lines. *J. Agromed.* 3(4), 57-68.

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Wagner SL (1997). Diagnosis and treatment of organophosphate and carbamate intoxication. Occup. Med. 12(2), 239-249.

Wilson BW, Sanborn JR, O'Malley MA, Henderson JD, Billitti JR (1997). Monitoring the pesticide-exposed worker. Occup. Med. 12(2), 347-363.

APPENDIX A:

EXCERPTS FROM THE CALIFORNIA CODE OF REGULATIONS

TITLE 3. Food and Agriculture

Division 6. Pesticides and Pest Control Operations

Chapter 1. Pesticide Regulatory Program Subchapter 1.

Definition of Terms

Article 1. Definitions for Division 6

§6000. Definitions.

"**Agricultural commodity**," for the purpose of this chapter, means an unprocessed product of farms, ranches, nurseries and forests (except livestock, poultry and fish). Agricultural commodities include fruits and vegetables; grains, such as wheat, barley, oats, rye, triticale, rice, corn and sorghum; legumes, such as field beans and peas; animal feed and forage crops; rangeland and pasture; seed crops; fiber crops such as cotton; oil crops, such as safflower, sunflower, corn and cottonseed; trees grown for lumber and wood products; nursery stock grown commercially; Christmas trees; ornamentals and cut flowers; and turf grown commercially for sod.

"**Applied to the soil**" or "**applied to the ground**" means the labeling of a pesticide product includes terminology such as:

- (a) Soil fumigant;
- (b) Soil applied;
- (c) Soil treatment product;
- (d) Can be used as a soil drench;
- (e) Application to soil;
- (f) Inject into the soil;
- (g) Incorporate in top (x) inches of soil; pre-plant incorporation;
- (h) Use on soil for control of soil-borne diseases;
- (i) Surface application; band treatment, surface blend;
- (j) Side dressing both/one side of row and cultivate into soil;
- (k) Should be mixed uniformly into top (x) inches of soil;
- (l) Pre-emergent to the weed;
- (m) Broadcast to the soil;
- (n) Apply in seed furrow.

"**Assure**" or "**Ensure**" means to take all reasonable measures so that the behavior, activity, or event in question occurs. When the behavior, activity, or event in question involves or concerns an employee, reasonable measures by an employer include determining that the employee has the knowledge to comply; providing the means to comply; supervising the work activity; and having and enforcing a written workplace disciplinary action policy covering the employer's requirements, as well as other measures required by pesticide law or this division.

"**Authorized representative**" means an employee of the person responsible for making decisions regarding the general operation of the property or a licensed agricultural pest control adviser who has written authorization from such person to act on his or her behalf.

"**Branch location**" means any location, other than the principal place of business, operated by a pesticide dealer or agricultural pest control operator to carry out licensed activities in California.

"**Carbamates**" means esters on N-methyl carbamic acid which inhibit cholinesterase.

"**Certified commercial applicator**" means:

- (a) A person holding a valid qualified license issued by the director;
- (b) A pilot holding a valid journeyman pest control aircraft pilot's certificate issued by the director;
- (c) A person holding a certified technician certificate issued by the Vector Biology and Control Section of the Department of Health Services;
- (d) A person holding a valid structural pest control operator or field representative license issued by the Structural Pest Control Board of the Department of Consumer Affairs; and
- (e) A person holding a valid qualified applicator certificate by the director.

"Certified private applicator" means a private applicator holding a valid restricted material permit.

"Chemical resistant" or **"waterproof"** means a material that allows no measurable movement of the pesticide through it during use. When a specific material is specified on pesticide product labeling, personal protective equipment constructed of that material shall be used.

"Chemigation" means the application of pesticides through irrigation systems.

"Closed system" means a procedure for removing a pesticide from its original container, rinsing the emptied container and transferring the pesticide product, mixtures and dilutions and rinse solution through connecting hoses, pipes and couplings that are sufficiently tight to prevent exposure of any person to the pesticide or rinse solution. Rinsing is not required when the pesticide is used without dilution. The system's design and construction shall meet the director's closed system criteria.

"Commercial applicator" means a person who uses or supervises the use of a pesticide for any purpose or on any property other than as provided by the definition of **private applicator**.

"Conflict with labeling" means any deviation from instructions, requirements or prohibitions of pesticide product labeling concerning storage, handling or use except:

- (a) A decrease in dosage rate per unit treated;
- (b) A decrease in the concentration of the mixture applied;
- (c) Application at a frequency less than specified;
- (d) Use to control a target pest not listed, provided the application is to a commodity/site that is listed and the use of the product against an unnamed pest is not expressly prohibited;
- (e) Employing a method of application not expressly prohibited, provided other directions are followed;
- (f) Mixing with another pesticide or with a fertilizer, unless such mixing is expressly prohibited;
- (g) An increase in the concentration of the mixture applied, provided it corresponds with the current published UC Pest Management Guidelines of the University of California, which are available from their Statewide Integrated Pest Management Project, One Shields Avenue, Davis, California 95616, or on-line at <http://www.ipm.ucdavis.edu/> or
- (h) The use of personal protective equipment consistent with the exceptions and substitutions in section 6738.

"Continuous monitoring" means the measurement of the air concentration of a specific pesticide on an uninterrupted, real-time basis by instrumental methods.

"Coverall" means a one- or two-piece garment of closely woven fabric or equivalent that covers the entire body, except the head, hands, and feet, and must be provided by the employer as personal protective equipment. Coverall differs from, and should not be confused with, work clothing that can be required to be provided by the employee.

"Display" means to make information available to the employee so that he or she may readily see and read the document, during normal business hours, without having to make a specific request of any person. An employee shall not be hindered or impeded from examining documents required to be displayed. This definition does not preclude using a binder or filing cabinet, that otherwise meets these criteria, to contain documents for display.

"Early entry" means entry into a treated field or other area after the pesticide application is complete, but before the restricted entry interval or other restrictions on entry for that pesticide have expired.

"Employee" means any person who, for any kind of compensation, performs work, services, or activities covered by this division.

"Employer" means any person who exercises primary direction and control over the work, services, or activities of an employee. A foreman, crew leader, supervisor, or similarly situated person represents the employer when hiring an employee or when exercising, or having responsibility for exercising, the primary direction and control, but is not considered the employer himself or herself.

"Enclosed cab" means a chemical resistant barrier that completely surrounds the occupant(s) of the cab and meets those portions of the requirements in American Society of Agricultural Engineers Standard S- 525 (Rev. 11/97) that pertain to dermal protection.

"Enclosed cab acceptable for respiratory protection" means an enclosed cab that incorporates a dust/mist filtering and /or a vapor or gas removing air purification system, as appropriate for the exposure situation. Enclosed cabs certified by the manufacturer as meeting American Society of Agricultural Engineers Standard S-525 (Rev. 11/97) are acceptable under this definition. The Director may, upon request, approve other enclosed cabs as acceptable under this definition.

"Examination" means written examination.

"Feasible" means capable of being accomplished in a successful manner, within a reasonable period of time, taking into account economic, environmental, social, and technological factors.

"Feasible alternatives" means other chemical or non-chemical procedures which can reasonably accomplish the same pest control function with comparable effectiveness and reliability, taking into account economic, environmental, social, and technological factors and timeliness of control.

"Feasible mitigation measure" means a condition attached to the approval of an activity which, if implemented, would substantially reduce any adverse impact, taking into account economic, environmental, social, and technological factors and timeliness of control.

"Field" means any area (including a greenhouse) upon which one or more agricultural plant commodities (including forest and nursery products) are grown for commercial or research production. Field does not include range or pasture harvested by grazing animals.

"Fieldworker" means any person who, for any kind of compensation, performs cultural activities in a field. Fieldworker does not include persons performing tasks as a crop advisor, including field checking or scouting, making observations of the well being of the plants, or taking samples, nor does it include local, state, or federal officials performing inspection, sampling, or other similar official duties.

"Greenhouse" means a structure or space, of sufficient size to permit entry, that is enclosed with a nonporous covering and used in the commercial or research production of an agricultural plant commodity. The term includes polyhouses, mushroom houses, rhubarb houses and similar structures.

"Ground-based application equipment" means equipment such as:

- (a) Hand sprayers;
- (b) Backpack sprayers;
- (c) Air-blast sprayers;
- (d) Field soil injection equipment;
- (e) Dusters;
- (f) Drills;
- (g) Granular applicators; or
- (h) Ground-rig sprayers.

"Groundwater protection advisory" means a written statement containing advice for the use of a pesticide product containing a chemical listed in Section 6800(a) in its respective Pesticide Management Zone(s) and includes the information listed in Section 6557.

"Hand labor" means any cultural activity, performed by hand or with hand tools, that causes substantial contact with

surfaces (such as plants or soil) that may have pesticide residues. These activities include hand harvesting, detasseling, thinning, hand weeding, topping, planting, sucker removal, pruning, disbudding, roguing, and packing produce into containers in the field. Hand labor does not include operating, moving, or repairing irrigation equipment or performing the duties of a crop advisor, field checker, or scout, making observations of the well being of the plants, or taking samples.

"Handle" means mixing, loading, transferring, applying (including chemigation), or assisting with the application (including flagging) of pesticides, maintaining, servicing, repairing, cleaning, or handling equipment used in these activities that may contain residues, working with opened (including emptied but not rinsed) containers of pesticides, adjusting, repairing, or removing treatment site coverings, incorporating (mechanical or watered-in) pesticides into the soil, entering a treated area during any application or before the inhalation exposure level listed on pesticide product labeling has been reached or greenhouse ventilation criteria have been met, or performing the duties of a crop advisor, including field checking or scouting, making observations of the well being of the plants, or taking samples during an application or any restricted entry interval listed on pesticide product labeling. Handle does not include local, state, or federal officials performing inspection, sampling, or other similar official duties.

"Home use" means use in a household or its immediate environment.

"Industrial use" means use for or in a manufacturing, mining or chemical process; or use in the operation of factories, processing plants, and similar sites.

"Institutional use" means use within the confines of, or on property necessary for the operation of, buildings such as hospitals, schools, libraries, auditoriums and office complexes.

"Medical supervision" means occupational health guidance and necessary associated health evaluation by a physician licensed to practice medicine.

"Notice of Intent" means oral or written notification to the commissioner, as specified by the commissioner, prior to the use of a pesticide pursuant to a permit.

"Nursery" means any operation engaged in the outdoor commercial or research production of cut flowers or ornamental cut greens or any plants that will be used in their entirety in another location.

"Operator of the property" means the person primarily responsible for the control or management of the property.

"Organophosphates" means organophosphorus esters which inhibit cholinesterase.

"Personal protective equipment" (PPE) means apparel and devices worn to minimize human body contact with pesticides or pesticide residues that must be provided by an employer and are separate from, or in addition to, work clothing. PPE may include, chemical resistant suits, chemical resistant gloves, chemical resistant footwear, respiratory protection devices, chemical resistant aprons, chemical resistant headgear, protective eyewear, or a coverall (one- or two-piece garment).

"Pest management guides" are manuals prepared by the department or University of California that include pest management information on specific crops and which have been adopted as a standard by the director.

"Pesticide" means:

- (a) Any substance or mixture of substances that is a pesticide as defined in the Food and Agricultural Code and includes mixtures and dilutions of pesticides;
- (b) As the term is used in Section 12995 of the Food and Agricultural Code, includes any substance or product that the user intends to be used for the pesticidal purposes specified in Sections 12753 and 12758 of the Food and Agricultural Code.

"Pesticide exposure study" means:

- (a) A data gathering project that meets one or more of the following criteria:
 - (1) Human participants are to be directly exposed to the pesticide for the purpose of determining its

- pharmacokinetics or pharmacodynamics;
- (2) Human participants are monitored and the use of the pesticide is not consistent with current accepted labeling or current regulations;
 - (3) Humans are exposed as the result of a contrived application in order to monitor exposure without routine pest control being a significant objective;
 - (4) Human participants are monitored for the purpose of satisfying initial or continuing registration requirements of the U.S. Environmental Protection Agency or the department; or
 - (5) Human participants are monitored to develop or contribute knowledge of pesticide exposure to be generalized to other populations.
- (b) "Pesticide exposure study" does not include the following:
- (1) Data collected for the purpose of satisfying an existing health standard for exposure monitoring or if it is understood that routine monitoring is a condition of employment;
 - (2) Unscheduled monitoring of persons in response to a medical emergency to identify possible sources of exposure;
 - (3) Monitoring conducted by a government agency or by an employer, to determine the workplace exposure of his or her employees.

"Pesticide Safety Information Series" means a series of leaflets that summarize health and safety aspects of various pesticides and groups of pesticides.

"Pesticides in toxicity category one" means pesticide products which are required to prominently display the signal word "DANGER" on the label.

"Pesticides in toxicity category two" means pesticide products which are required to prominently display the signal word "WARNING" on the label.

"Private applicator" means:

- (a) A person who uses or supervises the use of a pesticide for the purpose of producing an agricultural commodity on property owned or rented by him or her or his or her employer; or
- (b) A householder who uses or supervises the use of a pesticide, outside the confines of a residential dwelling for the purpose of controlling ornamental, plant or turf pests on residential property owned or rented by that householder; or
- (c) A householder who uses or supervises the use of a pesticide not included in Section 6400(a) (federally restricted) within the confines of a residential dwelling owned or rented by that householder.

"Qualified applicator certificate holder" means a person who has qualified by examination in one or more pest control categories to supervise pesticide applications. However, such qualification shall not entitle the holder to supervise the operations of a pest control business licensed pursuant to Section 11701 of the Food and Agricultural Code, except as provided in Section 11704.

"Qualified applicator licensee" means a person who has qualified by examination in one or more pest control categories to supervise the pesticide applications made by a pest control business licensed pursuant to Sections 11701 to 11709, inclusive, of the Food and Agricultural Code, and who is responsible for safe and legal operations under such license.

"Restricted entry interval" (REI) means the period of time after a field is treated with a pesticide during which restrictions on entry are in effect to protect persons from potential exposure to hazardous levels of residues. An REI may be found on pesticide product labeling or in regulation.

"Regularly handle" means that the employee is handling pesticides during any part of the day for more than six calendar days in any 30 consecutive day qualifying period beginning on the first day of handling. Any day spent or loading pesticides while exclusively using a closed system or mixing only pesticides sealed in water-soluble packets is not included for any employee who has a baseline blood cholinesterase level established pursuant to Section 6728(c)(1).

"Restricted materials hazard chart" means a chart developed by the department that specifies the degree of potential hazard for each restricted material to public and occupational health, adverse impact on pest

management systems, users of restricted materials, farm workers, bees, nontarget plants, fish, and wildlife, and other parts of the environment.

"Site specific" means a pesticide permit that identifies the specific area to be treated, the size of that area, and the commodity(ies) or site(s) on that area to be treated.

"Solicits services or sales", as used in Section 11410 of the Food and Agricultural Code, means sells, or offers for sale, any pesticide, method, or device outside of a fixed place of business.

"Structural use" means a use requiring a license under Chapter 14 (commencing with Section 8500), Division 3 of the Business and Professions Code.

"Substantial drift" means the quantity of pesticide outside of the area treated is greater than that which would have resulted had the applicator used due care. This definition is applicable to Section 12972 of the Food and Agricultural Code and Section 6614 of Title 3, California Code of Regulations.

"Time specific" means a pesticide permit that specifies the date the intended application is to commence or permit with a notice of intent requirement. The pesticide use may commence within four days following such date if delays are caused by uncontrollable conditions such as adverse weather or unavailability of equipment. The commissioner shall require a notice of intent from either the grower, the grower's authorized representative, or the pest control business when necessary to make the permit time and site specific.

"Treated field" means a field that has been treated with a pesticide or had a restricted entry interval in effect within the last 30 days. A treated field includes associated roads, paths, ditches, borders, and headlands, if the pesticide was also directed to those areas. A treated field does not include areas inadvertently contaminated by drift or over spray.

"Use" means any pesticide related activity including:

- (a) Pre-application activities, including:
 - (1) Arranging for the application;
 - (2) Mixing or loading; and
 - (3) Making necessary preparations for the application, including responsibilities related to notification, handler training, decontamination facilities, use and care of personal protective equipment, medical monitoring and assistance, and heat stress management;
- (b) Application of the pesticide;
- (c) Post-application activities, including:
 - (1) Control of the treated area to reduce exposure, including responsibilities for restricted entry intervals, warnings, decontamination facilities, medical assistance, and fieldworker training;
 - (2) Management of the treated area, crop, or crop by-products, including responsibilities for preharvest intervals and plant back restrictions;
 - (3) Transportation, storage, and disposal of excess pesticides, spray mix, equipment wash water, and pesticide containers; and
 - (4) Cleaning of application equipment and other pesticide containing materials.
- (d) Use does not include:
 - (1) Activities where involvement is only incidental to other tasks such as emergency responders providing incident management, commercial transportation of pesticide related waste for disposal or recycling, or a waste disposal or recycling facility accepting or handling these wastes; or
 - (2) Manufacturing, formulating, or packaging (including bulk repackaging) by a registered pesticide producing establishment.

"Veterinarian" means a person licensed to practice veterinary medicine in California.

"Weed oil" means a pesticide, the label of which states that the product may be used, by itself, to control weeds, and which contains 70 percent or more of the following active ingredients: petroleum hydrocarbons, mineral oil, petroleum oil, petroleum distillates, and/or aromatic petroleum distillates.

“**Work clothing**” means garments such as long-sleeved shirts, short-sleeved shirts, long pants, short pants, shoes, and socks. Work clothing is not considered personal protective equipment although pesticide product labeling or regulations may require specific work clothing during some activities. Work clothing differs from and should not be confused with a coverall. While coveralls shall be provided by the employer, work clothing can be required to be provided by the employee. Short sleeved shirts and short pants are considered acceptable work clothing only under conditions expressly permitted by pesticide product labeling.

NOTE

Authority cited: Sections 11502, 12111, 12781, 12976, 12981, and 14005, Food and Agricultural Code.
Reference: Sections 11408, 11498, 11410, 11501, 11701, 11702(b), 11704, 11708(a), 12042(f), 12103, 12971, 12972, 12973, 12980, 12981, 13145, 13146 and 14006, Food and Agricultural Code.

Chapter 1. Pesticide Regulatory Program
Subchapter 4. Inspection and Investigation Procedures Article 1.
Inspection, Copying and Sampling

§6140. Inspection Authority.

- (a) The director or commissioner may, during business hours, or if necessary to ensure immediate compliance, at any other reasonable time enter and inspect, and/or sample any of the following or related items in order to determine compliance with the provisions of this chapter and Divisions 6 and 7 of the Food and Agricultural Code, which pertain to pesticides and pest control operations.
- (1) Fields, areas, structures, and greenhouses where pesticides are handled, stored or applied;
 - (2) Growing crops and harvested commodities;
 - (3) Equipment (including protective clothing and equipment) used to store, transport or handle pesticides;
 - (4) Change areas and other facilities used by employees; and
 - (5) Pesticides and tank mixtures thereof.
- (b) Each person responsible, pursuant to the provisions of this Chapter and Division 6 and 7 of the Food and Agricultural Code which pertain to pesticides and pest control operations, for preparing and maintaining records, shall make those records available to the director or commissioner during business hours upon demand of the director or commissioner. The required records include:
- (1) Records concerning work hours, training and medical monitoring of employees;
 - (2) Pest control recommendations and pesticide use and operations records; and
 - (3) Pesticide transaction, sales and delivery records.

NOTE

Authority cited: Sections 407 and 12981, Food and Agricultural Code. Reference: Sections 408, 12980 and 12981, Food and Agricultural Code.

§6141. Employee Interviews.

The director or commissioner may confidentially interview any employee during work hours when reasonably necessary for an investigation of employee illness(es) suspected of having been caused by a pesticide or to investigate a suspected pesticide related safety violation.

NOTE

Authority cited: Sections 407 and 12981, Food and Agricultural Code. Reference: Sections 408, 12980 and 12981, Food and Agricultural Code.

Chapter 3. Pest Control Operations
Subchapter 3. Pesticide Worker Safety Article 1.
General Scope and Purpose

§6700. Scope.

This group specifies work practices for:

- (a) Employees who mix, load, apply, store, transport, or otherwise handle pesticides for any use, except for manufacturing, formulating or repackaging of pesticides; and
- (b) For employees who are exposed to residues of pesticides after application to fields.

The requirements of this group do not allow a lower standard of protection when pesticide labeling statements require a higher standard of protection.

The requirements of this group do not apply to storage and transportation of pesticides in the manufacturer's sealed or closed container. In general, the work practices and safety requirements stated in this group are designed to reduce risk of exposure and to ensure availability of medical services for employees who handle pesticides, and to provide safe working conditions for field and other workers.

NOTE

Authority cited: Sections 407 and 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6702. Employer-Employee Responsibilities.

- (a) The employer shall comply with each regulation in this subchapter which is applicable to the employer's action or conduct.
- (b) The employer:
 - (1) Is responsible for knowing about applicable safe use requirements specified in regulations and on the pesticide product labeling;
 - (2) Shall inform the employee, in a language the employee understands, of the specific pesticide being used, pesticide safety hazards, the personal protective equipment and other equipment to be used, work procedures to be followed, and pesticide safety regulations applicable to all activities they may perform;
 - (3) Shall supervise employees to assure that safe work practices, including all applicable regulations and pesticide product labeling requirements are complied with;
 - (4) Has the duty to provide a safe work place for employees and require employees to follow safe work practices; and
 - (5) Shall take all reasonable measures to assure that employees handle and use pesticides in accordance with the requirements of law, regulations, and pesticide product labeling requirements.
- (c) Employees shall utilize the personal protective equipment and other safety equipment required by pesticide product labeling or specified in this subchapter that has been provided by the employer at the work site in a condition that will provide the safety or protection intended by the equipment.

NOTE

Authority cited: Section 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6704. Application of Labor Code.

In order to insure that rights granted to California employees by Chapter 1 of Division 5 of the California Labor Code are adequately provided to agricultural employees, including employee rights (1) to file confidential complaints alleging unsafe work conditions, (2) to have complaints promptly investigated, (3) to talk to inspectors or compliance officers, and to point out hazards during the inspection process, (4) to be notified of any relevant job hazard, and (5) to not be subject to any retaliation or discrimination because such employee has filed any complaint regarding an unsafe work condition, the director, commissioners, and the Department of Industrial Relations shall cooperate in fully implementing any master agreements entered into between these parties which are designed to insure enforcement of employees' rights as well as any inspection protocols adopted pursuant to such master agreements.

NOTE

Authority cited: Sections 407 and 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6706. Hazardous Areas.

When there is a reasonable suspicion by the director or commissioner that a specific workplace has been or may be unsafe for workers due to exposure to active or inert ingredients in pesticide products, or breakdown products of these ingredients, the director or commissioner may require the employer to prohibit entry of employees into that workplace. The director or commissioner may require the employer to provide medical supervision for the period of time necessary for the director to determine the safety of the workplace to protect employees who have been working in or will enter that workplace. This medical supervision may include biological monitoring of persons for possible over-exposure to pesticide product ingredients or breakdown products of these ingredients. The director or commissioner may also specify exposure time limits and protective clothing and equipment to be worn by employees under these circumstances.

NOTE

Authority cited: Sections 407 and 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6710. Studies on Pesticide Safety.

- (a) No person shall conduct any pesticide exposure study in California, which involves human participants, except as provided in subsection (g), unless the Director has given written approval of the protocol. The study shall be conducted in accordance with the approved protocol. The protocol shall be submitted to the department, in writing, and shall be no more than ten double-spaced pages, exclusive of appendices. The protocol shall include the following, addressed in the order given below:
- (1) A descriptive title and statement of the aim/purpose of the study, including:
 - (A) Identification of the test and control substance by name, chemical abstract (CAS) number or code number;
 - (B) A statement as to whether the test substance is a currently registered pesticide;
 - (C) A statement as to whether the pesticide will be used in accordance with labeling directions and applied at the maximum rates listed on the labeling, if a currently registered pesticide is to be used. Provide an explanation if the pesticide is to be applied other than in accordance with labeling directions and/or at less than the maximum labeling rate; and
 - (D) The proposed starting and completion dates, including the date of submission of the final report;
 - (2) Background for the study, including previous relevant research and justification for the participation of humans in the study;

- (3) The significance of the study;
- (4) Methods to be used in conducting the study, including a description of:
 - (A) The study design, including type and frequency of tests, measurements to be made and methods for the control of bias;
 - (B) The methods of data analysis;
 - (C) How the human participants will be selected, including:
 - (1) Who the proposed human participants are, including whether or not they usually handle or are exposed to pesticides;
 - (2) A justification for studying this group of individuals;
 - (3) The total number of humans participating in the study and rationale for using that number of participants;
 - (4) Criteria, including medical conditions, used for exclusion or inclusion of human participants;
 - (D) How the human participants will be recruited, including:
 - (1) Detail the source(s) of prospective human participants;
 - (2) Describe how and by whom human participants will be contacted initially;
 - (E) How, when, and by whom written consent will be obtained from the participants. The consent form must be written in a language understandable to the participant and accompanied by a Research Participant Bill of Rights. An example of a consent document and a copy of the Bill of Rights can be found in Health and Safety Report 1619 (HS-1619), available from the department.
 - (F) Study procedures, including:
 - (1) The frequency and duration of each study procedure; and
 - (2) The location(s) where the study procedures will be carried out;
 - (G) Possible risks and discomforts to human participants, a discussion of the significance of the risks and descriptions of how the risks were assessed, and an explanation of how the participants will be informed of the potential risks;
 - (H) How participants will be provided any necessary medical care or medical supervision and a statement of who is to bear the cost of such care;
 - (I) How human participants will be informed that their participation in the study is voluntary and that they may leave the study at any time with no penalty;
 - (J) Any costs that the human participant or a third party (e.g. insurance) may be expected to assume;
 - (K) How human participants are to be paid for their participation in the study beyond their normal salary, including a description of the type and amount of payment to be offered; and
 - (L) Whether the research records will be anonymous. If not, include a discussion of how the records will be kept and where and how signed consent forms will be maintained;
- (5) A brief list of the qualifications of investigators;
- (6) A reference for all attachments;
- (7) A bibliography; and
- (8) The signature of the study director and/or principal investigator.
- (b) Protocols submitted to the Director for review shall be submitted to the Office of Environmental Health Hazard Assessment (OEHHA) for its concurrent review.
- (c) The department shall submit the protocol to an appropriate committee of a public or private California research university, which has an agreement with the department to review protocols with regard to use of human participants in research. After review of the protocol, the committee shall make a recommendation to the Director regarding approval of the protocol. The Director shall make the final decision and inform the registrant of the decision.
- (d) Protocol sponsors shall be required to pay \$300 per protocol to cover the costs incurred by the committee referred to in subsection (c) in reviewing the protocol.
- (e) Approval of a study protocol is valid for one year. Before the end of that year, the person conducting the study must submit a final report or request, in writing, that the approval be reviewed for renewal. Upon request for renewal, the study may continue pending review by the Director.
- (f) Once approved, no changes may be made to the study protocol without the approval of the Director. Requests to amend the protocol must be submitted in writing (except as provided below), and the written

approval of the Director must be received prior to implementing the proposed change. If the change to the study protocol will have an impact on the human participants, the changes must also be approved by the committee referred to in subsection (c). The Director may accept changes conveyed, orally and give oral approval for changes to the protocol that he or she determines to be minor, and to have no impact on the human participants in the study. When an oral request is made and oral approval is given, written notice of the change must be submitted to the department within 24 hours.

- (g) The following exemptions apply to this section:
- (1) Studies which have been approved by a human subjects review committee of any university or medical institution in California are exempt from the approval process described in subsection (c).
 - (2) Studies conducted by any university or medical institution in California which are conducted only for the purpose of research and are not intended for submission to the department or the U.S. EPA to support the registration of a pesticide are exempt from the requirements of this section.
- (h) The director, agricultural commissioner of the county where the study is taking place, or the chair (or a representative) of the committee referred to in subsection (c), may order any human exposure in the study to cease immediately, and the director may cancel approval of the study whenever it is deemed necessary to protect employee safety, public safety, or the environment.

NOTE

Authority cited: Sections 12976 and 12981, Food and Agricultural Code. Reference: Sections 12980, 12981, 12987 and 12988, Food and Agricultural Code.

**Chapter 3. Pest Control Operations Subchapter
3. Pesticide Worker Safety Article 2. General
Safety Requirements**

§6720. Safety of Employed Persons.

- (a) The requirements of this article shall be complied with by the employer for the safety of employees handling pesticides.
- (b) When only vertebrate pest control baits, solid fumigants (including aluminum phosphide, magnesium phosphide, and smoke cartridges), insect monitoring traps or non-insecticidal lures are handled, the employer is exempt from the requirements of Sections 6730 (Working Alone), 6732 (Change Area), and 6736 (Coveralls).
- (c) When antimicrobial agents, used only as sanitizers, disinfectants, or medical sterilants, or pool and spa chemicals are handled, the employer is exempt from complying with the provisions of this subchapter, provided the employer instead complies with any applicable requirements in the following corresponding provisions of Title 8, California Code of Regulations. Where the word "None" appears in the Title 8 column, the employer does not have to comply with the corresponding regulations specified in the Title 3 column.

Title 3, CCR	Title 8, CCR
6700	3200 and 3202
6702	3200 and 3203
6704	None
6706	None
6710	None
6720	As indicated in this Subsection
6723	3203, 3204, and 5194
6724	3203 and 5194
6726	3400
6728	None

Title 3, CCR	Title 8, CCR
6730	None
6732	3367
6734	3363 and 3366
6736	3383
6738	3380 through 3385, and 5144
6740	3317
6742	5141
6744	3203 and 5194
6746	None
Article 3	None
Article 4	None
Article 5	None
Article 6	None

- (d) The provisions of Sections 6734 and 6768 (Decontamination), 6726 and 6766 (Emergency Medical Care), 6736 (Coveralls), 6738(b)-(i) (Personal Protective Equipment), and 6770 (Field Reentry) do not apply to licensed agricultural pest control advisers and registered professional foresters, or employees under their direct supervision, while performing, after the application is completed, crop adviser tasks, including field-checking or scouting, making observations of the well-being of the plants, or taking samples provided:
- (1) They have been trained equivalent to the requirements of Section 6724 (licensed agricultural pest control advisers are considered trained for the purposes of this exception); and
 - (2) The licensed agricultural pest control adviser or registered professional forester responsible for the direct supervision has:
 - (A) Made specific determinations regarding appropriate personal protective equipment, needed decontamination facilities, and how to safely conduct crop adviser tasks;
 - (B) Informed each employee under his or her direct supervision of the pesticide product and active ingredient(s) applied, method and time of application, the restricted entry interval, and determinations made pursuant to (A) above; and
 - (C) Instructed each employee under his or her direct supervision regarding which tasks to perform and how to contact him or her if the need arises.
- (e) The provisions of this Subchapter do not apply to employees handling consumer products packaged for distribution to, and use by, the general public, provided that employee use of the product is not significantly greater than the typical consumer use of the product.

NOTE

Authority cited: Section 12981, Food and Agricultural Code. Reference: Sections 11501, 12973, 12980 and 12981, Food and Agricultural Code.

§6612. Age.

No person shall permit a minor under 18 years of age to mix or load a pesticide which, in any use situation, use of any of the following is required by labeling or regulation:

- (a) air supplied respiratory protection,
- (b) closed systems, or
- (c) full-body, chemical-resistant protective clothing.

NOTE

Authority cited: Sections 407 and 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

HISTORY

Renumbering and amendment of Section 6722 to Section 6612 filed 9-26-88; operative 10-26-88 (Register 88, No. 41)

§6724. Handler Training.

The employer shall assure that employees who handle pesticides have been trained pursuant to the requirements of this Section and that all other provisions of this Section have been complied with for employees who handle pesticides.

- (a) The employer shall have a written training program. The training program shall describe the materials (e.g., study guides, pamphlets, pesticide product labeling, Pesticide Safety Information Series leaflets, Material Safety Data Sheets, slides, video tapes) and information that will be provided and used to train his or her employees and identify the person or firm that will provide the training. The training program shall address each of the subjects specified in subsection (b) that is applicable to the specific pesticide handling situation. The employer shall maintain a copy of the training program while in use and for two years after use, at a central location at the workplace.
- (b) The training shall cover, for each pesticide or chemically similar group of pesticides, to be used:
 - (1) Format and meaning of information, such as precautionary statements about human health hazards, contained in pesticide product labeling;
 - (2) Hazards of pesticides, including acute and chronic effects, delayed effects, and sensitization, as identified in pesticide product labeling, Material Safety Data Sheets, or Pesticide Safety Information Series leaflets;
 - (3) Routes by which pesticides can enter the body;
 - (4) Signs and symptoms of overexposure;
 - (5) Emergency first aid for pesticide overexposure;
 - (6) How to obtain emergency medical care;
 - (7) Routine and emergency decontamination procedures, including spill clean up and the need to thoroughly shower with soap and warm water after the exposure period;
 - (8) Need for, limitations, appropriate use, and sanitation, of, any required personal protective equipment;
 - (9) Prevention, recognition, and first aid for heat-related illness;
 - (10) Safety requirements and procedures, including engineering controls (such as closed systems and enclosed cabs) for handling, transporting, storing, and disposing of pesticides;
 - (11) Environmental concerns such as drift, runoff, and wildlife hazards;
 - (12) Warnings about taking pesticides or pesticide containers home;
 - (13) Requirements of this chapter and chapter 4 relating to pesticide safety, Material Safety Data Sheets, and Pesticide Safety Information Series leaflets;
 - (14) The purposes and requirements for medical supervision if organophosphate or carbamate pesticides with the word "DANGER" or "WARNING" on the labeling are mixed, loaded, or applied for the commercial or research production of an agricultural plant commodity;
 - (15) The location of the written Hazard Communication Information For Employees Handling Pesticides (Pesticide Safety Information Series leaflet A-8), other Pesticide Safety Information Series leaflets, and Material Safety Data Sheets;
 - (16) The employee's rights, including the right;
 - (A) To personally receive information about pesticides to which he or she may be exposed;
 - (B) For his or her physician or employee representative to receive information about pesticides to which he or she may be exposed; and
 - (C) To be protected against retaliatory action due to the exercise of any of his or her rights.
- (c) The training shall be in a manner the employee can understand, be conducted pursuant to the written training program, and include response to questions.
- (d) Training shall be completed before the employee is allowed to handle pesticides, continually updated to cover any new pesticides that will be handled, and repeated at least annually thereafter. Initial training may be waived if the employee submits a record showing that training meeting the requirements of this Section and covering the pesticides and use situations applicable to the new employment situation was received within the last year. A certified applicator is considered trained for the purposes of this Section.

- (e) The date and extent of initial and annually required training given to the employee and the job to be assigned shall be recorded. This record shall be verified by the employee's signature and retained by the employer for two years at a central location at the workplace accessible to employees.
- (f) The person conducting the training for employees who will be handling pesticides for the commercial or research production of an agricultural plant commodity shall be qualified as one of the following:
 - (1) A California certified commercial applicator;
 - (2) A California certified private applicator;
 - (3) A person holding a valid County Biologist License in Pesticide Regulation or Investigation and Environmental Monitoring issued by the Department of Food and Agriculture;
 - (4) A farm advisor employed by the University of California Extension Office;
 - (5) A person who has completed an "instructor trainer" program presented by one of the following:
 - (A) the University of California, Integrated Pest Management Program after January 1, 1993; or
 - (B) other instructor training program approved by the Director;
 - (6) A California licensed Agricultural Pest Control Adviser;
 - (7) A California Registered Professional Forester; or
 - (8) Other trainer qualification approved by the Director.

NOTE

Authority cited: Section 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6726. Emergency Medical Care.

- (a) Emergency medical care for employees handling pesticides shall be planned for in advance. The employer shall locate a facility where emergency medical care is available for employees who will be handling pesticides.
- (b) Employees shall be informed of the name and location of a facility where emergency medical care is available. The employer shall post in a prominent place at the work site, or work vehicle if there is no designated work site, the name, address and telephone number of a facility able to provide emergency medical care whenever employees will be handling pesticides and, if the identified facility is not reasonably accessible from that work location, procedures to be followed to obtain emergency medical care.
- (c) When there is reasonable grounds to suspect that an employee has a pesticide illness, or when an exposure to a pesticide has occurred that might reasonably be expected to lead to an employee's illness, the employer shall ensure that the employee is taken to a physician immediately.

NOTE

Authority cited: Sections 407 and 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6728. Medical Supervision.

- (a) Whenever an employee mixes, loads, or applies a pesticide with the signal word "DANGER" or "WARNING" that contains an organophosphate or carbamate, for the commercial or research production of an agricultural plant commodity, the employer shall maintain use records that identify the employee, the name of the pesticide, and the date of use. The original or copies of documents otherwise required to be maintained by this chapter may be used to meet the requirements of this Section provided they contain the information required by this Section.
- (b) Each employer who has an employee who regularly handles pesticides specified in (a) shall have a written agreement signed by a physician, that includes the names and addresses of both the physician providing the medical supervision and the employer responsible for the employees, stating that the physician has agreed to provide medical supervision and that the physician possesses a copy of, and is aware of the contents of the document "Medical Supervision of Pesticide Workers-Guidelines for Physicians" (available from the Department of Health Services). A copy of this agreement shall be given to the commissioner by the employer no later than when an employee begins to regularly handle pesticides specified in (a).
- (c) The employer's responsibilities for medical supervision for employees regularly handling pesticides specified in (a) shall include the following:

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- (1) All covered employees shall have baseline red cell and plasma cholinesterase determinations. Baseline values shall be verified every two years. For new employees, the medical supervisor may accept previously established baseline values if they are obtained in accordance with these regulations by the same laboratory methodology and are acceptable to the laboratory which will analyze the new employee's blood samples.
- (2)(A) The employer shall ensure that each employee, not previously under medical supervision associated with that employer, has red cell and plasma cholinesterase determinations within three working days after the conclusion of each 30-day period in which pesticides specified in (a) are regularly handled.
(B) After three tests at 30-day intervals, further periodic monitoring shall be at intervals specified in writing by the medical supervisor except for verification of baseline as specified in (1).
(C) Where the medical supervisor has made no written recommendation for continued periodic monitoring, the testing interval shall be 60 days.
- (3) The employer shall keep a record of the agreement to provide medical supervision, use records, all recommendations received from the medical supervisor, and all results of cholinesterase tests required to be made on his/her employees by this Section or by the medical supervisor. Records required by this Section shall be maintained for three years and shall be available for inspection by the employee, the Director, commissioner, county health official or state health official.
- (4) The employer shall follow the recommendations of the medical supervisor concerning matters of occupational health.
- (5) The employer shall post the name, address, and telephone number of the medical supervisor in a prominent place at the locale where the employee usually starts the workday; or if there is no locale where the employee usually starts the workday, at each worksite; or in each work vehicle.
- (d) The employer shall investigate the work practices of any employee whose red cell or plasma cholinesterase levels fall below 80 percent of the baseline. The investigation of work practices shall include a review of the safety equipment used and its condition; and the employee's work practices which included employee sanitation, pesticide handling procedures, and equipment usage. The employer shall maintain a written record of the findings, any changes in equipment or procedures, and any recommendations made to the employee.
- (e) The employer shall remove an employee from exposure to organophosphate or carbamate pesticides if the employee's plasma cholinesterase level falls to 60 percent or less of baseline, or if red cell cholinesterase falls to 70 percent or less of baseline. The employee shall be removed from further exposure until cholinesterase values return to 80 percent or more of their respective baseline values. The employer shall maintain written records of the dates of removal and the dates when employees are returned to exposure.
- (f) To meet the requirements of these regulations, acetylcholinesterase (also known as red blood cell cholinesterase) and butyrylcholinesterase (also known as plasma or serum cholinesterase or pseudocholinesterase) tests ordered by a medical supervisor for occupational health surveillance shall be performed by a clinical laboratory currently approved by the State Department of Health Services to perform these tests. By January 1, 2000, tests shall be performed according to the procedures outlined below. If tests cannot be performed according to the following procedures, the conversion procedure outlined in 6728 (f)(8) shall be performed.
 - (1) Using personnel and procedures acceptable to the Department of Health Services (Business and Professions Code sections 1242, 1243, 1246, 1269, 2070; Health and Safety Code sections 120580, 1607), blood collection and storage shall be done according to the following conditions:
 - (A) Blood samples shall be kept in ice or at a temperature of 4 ° C until time of assay. If the sample is centrifuged to remove the erythrocytes from the plasma, the plasma shall be stored frozen at a temperature of minus 20 ° C until the assay is performed. If possible, the assay shall be performed within 24 hours after blood collection. Time of sample collection, analysis, and storage conditions shall be specified on the report.
 - (B) Ethylenediaminetetraacetic acid (EDTA) or heparin shall be used as an anticoagulant in a standard vacutainer tube.
 - (2) The reagents and equipment shall conform to the following conditions:
 - (A) A spectrophotometer at a wavelength between 405 and 425 nanometers shall be used.
 - (B) The assay shall be performed at a temperature of 25 ° C.

- (C) The following conditions regarding the buffer/chromogen shall apply:
 - 1. A sodium phosphate buffer shall be used at a concentration of 0.1 M adjusted to a pH of 8.0 with a pH meter calibrated at both 7.0 and 10.0.
 - 2. Dithiobisnitrobenzoic acid (DTNB) at a stock concentration of 9.7 mM in 0.1 M sodium phosphate buffer pH 7.0 shall be used.
- (D) The substrate acetylthiocholine iodide shall be used at a stock concentration of 10.1 mM in 0.1 M sodium phosphate buffer pH 8.0.
- (E) The butyrylcholinesterase inhibitor quinidine hydrochloride monohydrate shall be used at a stock concentration of 6 mM in distilled deionized water.
- (3) The acetylcholinesterase enzyme assay shall be performed within 15 minutes of preparation and the procedure for performing the assay shall be as follows:
 - (A) Measure 0.2 mL whole blood and add into a 1.8 mL solution of deionized distilled water; mix thoroughly and keep the solution on ice.
 - (B) To 2.5 mL of the sodium phosphate buffer, add 0.02 mL of the blood solution, 0.1 mL of DTNB (0.32 mM final concentration) and 0.1 mL of quinidine (0.2 mM final concentration); mix thoroughly and allow to sit for 5 minutes.
 - (C) Add 0.3 mL acetylthiocholine iodide (1.0 mM final concentration) into the buffer/sample solution and mix thoroughly.
 - (D) Measure absorbance over the linear portion of the enzyme activity curve in the spectrophotometer.
- (4) The procedure for performing butyrylcholinesterase enzyme assay determination shall be as follows:
 - (A) Physical separation of plasma or serum shall be performed.
 - (B) If samples are frozen, they shall be thawed at room temperature to assure homogeneity of the sample.
 - (C) To 2.6 mL of the sodium phosphate buffer, add 0.02 mL of the plasma or serum and 0.1 mL of DTNB (0.32 mM final concentration), mix thoroughly and allow to sit for 5 minutes.
 - (D) Add 0.3 mL acetylthiocholine iodide (1.0 mM final concentration) into the buffer/sample solution and mix thoroughly.
 - (E) Measure absorbance over the linear portion of the enzyme activity curve in the spectrophotometer.
- (5) A Buffer Blank containing 2.6 mL of sodium phosphate buffer, 0.3 mL of acetylthiocholine (1.0 mM final concentration), and 0.1 mL of DTNB (0.32 mM final concentration) and 0.02 mL of distilled deionized water shall be run with every batch of assays.
- (6) Reporting units shall be in International Units per milliliter of sample (IU/mL).
- (7) Baseline and follow up assays specified in 6728 (c)(2)(A) shall be conducted by the same laboratory method.
- (8) If an assay different from that described above is used, the method shall be shown comparable with the foregoing conditions and a conversion equation prepared. Results shall be reported in International Units per mL on both the original and the converted scale. The conditions to establish comparability shall be as described below.
 - (A) Using personnel and procedures acceptable to the Department of Health Services (Business and Professions Code sections 1242,1243,1246,1269,2070; Health and Safety Code sections 120580, 1607), blood samples shall be collected from at least ten subjects.
 - (B) Blood from each subject shall be tested by serial dilution as specified in "Comparison of Acetylcholinesterase Assays Run under Conditions Specified by the Standard Ellman Method and Conditions Specified by a Commercial Cholinesterase Reagent Kit." HS-1752, July 30, 1998, Department of Pesticide Regulation, Worker Health and Safety Branch.
 - (C) Test dilutions shall be made at 100 percent and 50 percent of enzyme activity.
 - (D) Triplicate samples shall be run by both the reference and the alternative methods.
 - (E) Pearson product-moment correlation coefficient squared (r^2) shall be at least 0.9 between results of the alternative and reference methods.
- (9) Within five years from the effective date of amendment, the Director, in consultation with the Secretary for Environmental Protection, shall review this regulation to determine whether it should be retained, revised, or

repealed.

NOTE

Authority cited: section 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6730. Working Alone.

- (a) An employee mixing, loading, or applying a pesticide in toxicity category one for production of an agricultural commodity may not work alone during daylight hours unless personal, radio, or telephone contact is made to a responsible adult at intervals not exceeding two hours.
- (b) An employee mixing, loading, or applying a pesticide in toxicity category one for production of an agricultural commodity may not work alone during nighttime hours unless personal, radio, or telephone contact is made to a responsible adult at intervals not exceeding one hour.
- (c) A pilot, mixer-loader, and/or flagger team shall be considered as working together. In the case of two ground applicators working in the same field, no additional person is necessary if they can see each other or each other's application vehicles.

NOTE

Authority cited: Sections 407 and 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6732. Change Area.

For any employee who regularly handles pesticides with the signal word "DANGER" or "WARNING", and for all employees who handle any pesticides for the commercial or research production of an agricultural plant commodity, the employer shall assure that there is, at the place where employees end their exposure period and remove their personal protective equipment, an area where employees may change clothes and wash themselves. Clean towels, soap, and sufficient water shall be available to allow for thorough washing. The employer shall provide a clean, pesticide-free place where employees may store any personal clothing not in use while at work handling pesticides.

NOTE

Authority cited: Section 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6734. Handler Decontamination Facilities.

- (a) The employer shall assure that sufficient water, soap and single use towels for routine washing of hands and face and for emergency eye flushing and washing of the entire body are available for employees as specified in this Section.
 - (1) This water shall be of a quality and temperature that will not cause illness or injury when it contacts the skin or eyes or if it is swallowed, and shall be stored separate from that used for mixing with pesticides unless the tank holding water for mixing with pesticides is equipped with appropriate valves to prevent back flow of pesticides into the water.
 - (2) One clean change of coveralls shall be available at each decontamination site.
- (b) The decontamination site for employees handling pesticides for the commercial or research production of an agricultural plant commodity shall be at the mixing/loading site and not more than 1/4 mile (or at the nearest point of vehicular access) from other handlers, except that the decontamination site for pilots may be at the loading site regardless of distance from where the pilot is working. The decontamination site shall not be in an area being treated or under a restricted entry interval unless:
 - (1) The handlers for whom the site is provided are working in that area being treated or under a restricted entry interval;
 - (2) The soap, towels, and extra change of coveralls are in an enclosed container; and
 - (3) The water is running tap water or enclosed in a container.
- (c) One pint of water for emergency eye flushing shall be immediately available (carried by the handler or on the vehicle or aircraft the handler is using) to each employee handling pesticides for the commercial or research production of an agricultural plant commodity if the pesticide product labeling requires protective eyewear.

- (d) The decontamination site for employees handling pesticides for uses other than the commercial or research production of an agricultural plant commodity shall be within 100 feet of the mixing/loading site when they are handling pesticides with the signal word "DANGER" or "WARNING" on the label.

NOTE

Authority cited: Section 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6736. Coveralls.

- (a) The employer shall provide coveralls for each employee who handles any pesticide with the signal word "DANGER" or "WARNING" on the label except as provided in 6738(i).
- (b) The employer shall assure that:
 - (1) Employees start each work day wearing coveralls whenever they handle pesticides with the signal word "DANGER" or "WARNING";
 - (2) Employees wear coveralls whenever they handle pesticides with the signal word "DANGER" or "WARNING" except as provided in 6738(i);
 - (3) Employees change out of their coveralls and wash at the end of the work day;
 - (4) Potentially contaminated coveralls removed at the worksite or headquarters are not taken home by employees; and
 - (5) Employees whose work day does not involve return to the employer's headquarters, remove and store potentially contaminated coveralls in a sealable container outside of their own living quarters for later return to the employer.
- (c) This Section does not apply to employees using fumigants unless the pesticide product labeling expressly requires the use of coveralls.

NOTE

Authority cited: Section 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6738. Personal Protective Equipment.

- (a) The employer shall:
 - (1) Provide all required personal protective equipment, provide for its daily inspection and cleaning (according to pesticide labeling instructions or, absent any instructions, washed in detergent and hot water), and repair or replace any worn, damaged, or heavily contaminated personal protective equipment. Leather gloves previously used to apply only aluminum phosphide or magnesium phosphide pesticides and which have been aerated for 12 hours or more shall be considered cleaned;
 - (2) Assure that all clean personal protective equipment, when not in use, is kept separate from personal clothing and in a pesticide free, specifically designated place;
 - (3) Assure that appropriate measures are taken to prevent heat related illness when necessary;
 - (4) Assure that personal protective equipment is used correctly for its intended purpose; Discard any absorbent materials that have been drenched or heavily contaminated with a pesticide with the signal word "DANGER" or "WARNING";
 - (5) Keep and wash potentially contaminated personal protective equipment separately from other clothing or laundry;
 - (6) Assure that all clean personal protective equipment is either dried thoroughly before being stored or is put in a well ventilated place to dry;
 - (7) Assure that personal protective equipment remains the property of the employer and that pesticide handlers are not allowed or directed to take potentially contaminated personal protective equipment into their homes;
 - (8) Assure that any person or firm assigned or hired to clean or repair potentially contaminated personal protective equipment is protected and informed in accordance with the requirements of Section 6744 (Equipment Maintenance).
- (b) The employer shall assure that:

- (1) Employees wear protective eyewear when required by pesticide product labeling (except as expressly provided in this section) or when employees are engaged in:
 - (A) Mixing or loading, except as provided in 6738(i);
 - (B) Adjusting, cleaning, or repairing mixing, loading, or application equipment that contains pesticide in hoppers, tanks, or lines;
 - (C) Application by hand or using hand held equipment, except when:
 - 1. Applying vertebrate pest control baits that are placed without being propelled from application equipment;
 - 2. Applying solid fumigants (including aluminum phosphide, magnesium phosphide, and smoke cartridges) to vertebrate burrows;
 - 3. Baiting insect monitoring traps; or
 - 4. Applying non-insecticidal lures.
 - (D) Ground application using vehicle mounted or towed equipment, except when:
 - 1. Injecting or incorporating pesticides into soil;
 - 2. Spray nozzles are located below the employee and the nozzles are directed downward; or
 - 3. Working in an enclosed cab; or
 - (E) Flagging, except when the flagger is in an enclosed cab. (c
- (c) The employer shall assure that:
 - (1) Gloves are worn when required by the pesticide product labeling (except as expressly provided in this section) or (unless the pesticide product labeling specifies that gloves must not be worn), when employees are engaged in:
 - (A) Mixing or loading, except as provided in 6738(i);
 - (B) Adjusting, cleaning or repairing contaminated mixing, loading, or application equipment; and
 - (C) Application by hand or using hand-held equipment, except when applying vertebrate pest control baits using long handled implements that avoid actual hand contact with the bait or potentially contaminated areas of equipment.
- (d) The employer shall assure that:
 - (1) When chemical resistant footwear is specified by the pesticide product labeling, one of the following types of footwear is worn:
 - (A) Chemical resistant shoes;
 - (B) Chemical resistant boots; or,
 - (C) Chemical resistant coverings worn over boots or shoes.
 - (2) For aircraft operation, chemical resistant footwear need not be worn.
- (e) The employer shall assure that when chemical resistant headgear is specified by the pesticide product labeling, either a chemical resistant hood or a chemical resistant hat with a wide brim is worn. For aircraft operation, a helmet may be substituted for chemical resistant headgear.
- (f) The employer shall assure that when a chemical resistant apron is specified by the pesticide product labeling, a garment that covers the front of the body from mid-chest to the knees is worn.
- (g) The employer shall assure that:
 - (1) When pesticide product labeling or regulations specify a chemical resistant suit, waterproof or impervious pants and coat or a rain suit, a chemical resistant suit that covers the torso, head, arms, and legs is worn.
 - (2) If the ambient temperature exceeds 80°F during daylight hours or 85°F during nighttime hours (sunset to sunrise) pesticides requiring a chemical resistant suit are not handled by employees unless they are handled pursuant to exceptions and substitutions permitted in (i) or employees use cooled chemical resistant suits or other control methods to maintain an effective working environment at or below 80°F during daylight hours or 85°F during nighttime hours (sunset to sunrise).
- (h) The employer shall assure that:
 - (1) Employees use approved respiratory protective equipment when pesticide product labeling or regulations require respiratory protection or when respiratory protection is needed to maintain employee exposure below an applicable exposure standard found in Title 8, California Code of Regulations, Section 5155.
 - (2) Respiratory protection required by these regulations or labeling is currently approved by the National Institute for Occupational Safety and Health (NIOSH) and/or the Mine Safety and Health Administration

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(MSHA) for the specific chemical and exposure condition. Proper selection of respirators shall be made following pesticide product labeling, or absent specific instruction, according to the guidance of National Standard Practices for Respiratory Protection: Z88.2-1980, or the American National Standard Practices of Respiratory Protection During Fumigation: Z88.3- 1983.

- (3) Written operating procedures for selecting, fitting, cleaning and sanitizing, inspecting and maintaining respiratory protective equipment are adopted.
- (4) Employees with facial hair that prevents an adequate seal are not assigned work requiring them to wear a respirator unless they are provided a respirator that does not rely on a face-to face piece seal for proper operation.
- (5) Respirators maintained for stand-by or emergency use are inspected monthly or before use if occasions for possible use are more than one month apart. A record of the most recent inspection shall be maintained on the respirator or its storage container.
- (6) (A) Employees are informed, prior to beginning work, that certain medical conditions may interfere with wearing a respirator while engaged in potential pesticide exposure situations. A statement in substantially the following form shall be on file for each employee assigned to work that requires wearing a respirator.

To the best of my knowledge, I have____, have no_____medical conditions which would interfere with wearing a respirator while engaged in potential pesticide exposure situations. I understand that heart disease, high blood pressure, lung disease or presence of a perforated ear drum are examples of conditions that require specific medical evaluation by a physician before safe use of a respirator can be determined.

Name	Date
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- B) If an employee checks that he or she has such a condition, a physician's report of evaluation and approval for respirator use is on file before work requiring respirator use is allowed. The following or substantially similar statement from a physician is acceptable.

On_____, I examined_____.

Date	Patient's name
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At this time there is no medical contraindication to the employee named above wearing a respirator to allow working in potential pesticide exposure environments. (Other comments)

Physician	Date
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- (7) Compressed air used in Self Contained Breathing Apparatus (SCBA) or for air-line type respirators meets or exceeds the requirements for Grade D breathing air as described in the Compressed Gas Association Commodity Specification G-7.1 (ANSI Z86.1-1973).
- (8) When air purifying-type respirators are required for protection against pesticides, the air purifying elements or entire respirator, if disposable, are replaced according to pesticide product labeling directions or respiratory equipment manufacturer recommendations, whichever provides for the most frequent replacement, or, absent any other instructions on service life, at the end of each day's work period. At the first indication of odor, taste, or irritation, the wearer leaves the area and checks the respirator for fit or function concerns or air purifying element replacement.
- (i) The following exceptions and substitutions to personal protective equipment required by pesticide product labeling or regulations are permitted:

- (1) Persons using a closed system to handle pesticide products with the signal word "DANGER" or "WARNING" may substitute coveralls, chemical resistant gloves, and a chemical resistant apron for personal protective equipment required by pesticide product labeling;
- (2) Persons using a closed system to handle pesticide products with the signal word "CAUTION" may substitute work clothing for personal protective equipment required by pesticide product labeling;
- (3) Persons using a closed system that operates under positive pressure shall wear protective eyewear in addition to the personal protective equipment listed in (1) or (2). Persons using any closed system shall have all personal protective equipment required by pesticide product labeling immediately available for use in an emergency;
- (4) Persons properly mixing pesticides packaged in water soluble packets are considered to be using a closed (mixing) system for the purposes of this subsection;
- (5) Persons occupying an enclosed cab (including cockpit) may substitute work clothing for personal protective equipment required by pesticide product labeling. If respiratory protection is required it must be worn, except in an enclosed cockpit;
- (6) Persons occupying an enclosed cab acceptable for respiratory protection may substitute work clothing for personal protective equipment required by pesticide product labeling;
- (7) Persons working in an enclosed cab, as specified in (5) and (6), other than an aircraft, shall have all personal protective equipment required by pesticide product labeling immediately available and stored in a chemical resistant container, such as a plastic bag. Labeling-required personal protective equipment shall be worn if it is necessary to work outside the cab and contact pesticide treated surfaces in the treated area. Once personal protective equipment is worn in the treated area, it shall be removed and stored in a chemical resistant container, such as a plastic bag, before reentering the cab;
- (8) A chemical resistant suit may be substituted for coveralls and/or a chemical resistant apron; and
- (9) Pest control aircraft pilots are not required to wear gloves during operation but gloves shall be worn by any person entering or exiting an aircraft contaminated with pesticide residues. While in the cockpit, gloves shall be carried in a chemical resistant container, such as a plastic bag.

INFORMATIONAL NOTE FOR Section 6738(e): ANSI Z86.1 specifies in summary: Oxygen 19.5 to 23.5 percent, Hydrocarbons less than 5 mg/m³ at normal temperature and pressure, Carbon Monoxide less than 20 ppm, no pronounced odor, Carbon Dioxide less than 1000 ppm.

NOTE

Authority cited: Sections 11456 and 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6740. Adequate Light.

Whenever natural light in a mixing/loading area is not adequate to allow an employee to read the label and work in a safe manner, artificial light shall be provided in such areas that is sufficient to perform these activities. NOTE

Authority cited: Sections 407 and 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6742. Safe Equipment.

(a) The employer shall assure that equipment used for mixing, loading, transferring, or applying pesticides is inspected before each day of use and equipment with any safety defect is repaired or altered to remove the hazard before further use.

(b)(1) All openings on tanks used for mixing or applying pesticides shall be equipped with covers that will prevent splashes and spills.

(2) Flexible hoses carrying liquid pesticides in toxicity categories one or two under pressure shall not pass unshielded through the cockpit of an airplane or helicopter.

- (3) Shut-off devices shall be installed on the exit end of all hoses carrying liquid pesticides in toxicity categories one or two from mixing tanks that are adequate to prevent splashes onto the employee doing the loading when filling operations are stopped and the filler hose is removed from the inlet to the tank of the application vehicle. As an alternative, a reversing action pump, or similar system, may be used that will empty the hose and eliminate dripping of liquid from the end of the hose when the filling operation is stopped.
- (4) Each tank, with a capacity of more than 49 gallons, that is used to mix or apply any liquid mixture derived from a pesticide in toxicity categories one or two, shall have either:
 - (A) A properly functioning means to indicate externally the internal liquid level in the tank such as a sight gauge; or
 - (B) The tank or the filler hose nozzle shall have a device that will automatically stop the filling operation before the pesticide liquid mixture spills over the top.

NOTE

Authority cited: Section 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6744. Equipment Maintenance.

Persons who own or operate pesticide mixing, loading, or application equipment shall inform each employee under their control who may be involved in the cleaning, servicing or repair of that equipment of the hazards of the pesticides that a person may encounter, and the methods of protecting against personal injury. If such cleaning, servicing or repairing is to be performed by persons not under the control of the owner or operator of the equipment, he/she shall so notify the person in charge of performing these services. Employees who clean, service, or repair mixing and application equipment shall be provided with any necessary protective equipment or clothing by their employer, and shall be instructed and supervised in the maintenance operation in a manner that will reduce work hazards.

NOTE

Authority cited: Sections 407 and 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6746. Closed Systems.

Employers shall provide closed systems for employees who mix or load liquid pesticides in toxicity category one, or load diluted liquid mixes derived from dry pesticides in toxicity category one, for the production of an agricultural commodity. No employee shall be permitted to transfer, mix, or load these pesticides except through a closed system. The system's design and construction shall meet the director's closed-system criteria.

- (a) The requirements of this Section do not apply to:
 - (1) Employees who handle a total of one gallon or less of pesticides in toxicity category one per day exclusively in original containers of one gallon or less; or
 - (2) Regulatory personnel collecting samples of pesticides according to official sampling procedures.

NOTE

Authority cited: Sections 407 and 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

Chapter 3. Pest Control Operations Subchapter
3. Pesticide Worker Safety Article 3. Field
Worker Safety

§6760. Employer Responsibility and Exceptions.

- (a) Employers shall comply with the requirements of this article to protect employees who may enter treated fields.
- (b) If only granular baits or attractants or repellents in traps have been applied in a field, the employer is exempt from the requirements of Sections 6762 (Field Work During Application), 6764 (Fieldworker Training), 6766(a) and (b) (Emergency Medical Care), 6768 (Decontamination Facilities), 6770 (Entry After Pesticide Application), 6771 (Requirements for Early Entry Fieldworkers), 6772 (Restricted Entry Intervals), 6774 (Restricted Entry Interval Adjustments), and 6776 (Field Posting).
- (c) Pesticide applications for areawide public pest control programs sponsored by governmental agencies, such as for fruit fly eradication, and those made by vector control agencies operating under cooperative agreements with the State Department of Health Services pursuant to Section 116180 of the Health and Safety Code, and contractors of those agencies, are exempt from the requirements of this article.
- (d) If only algaecides have been used to treat the irrigation system, the employer is exempt from the requirements of Sections 6762 (Field Work During Application), 6764 (Fieldworker Training), 6766(a) and (b) (Emergency Medical Care), 6768 (Decontamination Facilities), 6770 (Field Entry After Pesticide Application), 6771 (Requirements for Early Entry Fieldworkers), 6772 (Restricted Entry Intervals), 6774 (Restricted Entry Interval Adjustments), and 6776 (Field Posting).
- (e) If pesticides have been applied only by injection directly into plants the employer is exempt from the requirements of this article. Direct injection does not include "hack and squirt" methods.

NOTE

Authority cited: Section 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6762. Field Work During Pesticide Application.

- (a) The requirements of this Section are minimum requirements established by the U. S. Environmental Protection Agency and do not assure compliance with the general standard in Section 6614.
- (b) No employer shall direct or allow any person, other than the persons making the application, to enter or remain in a treated area of a farm or forest during the application.
- (c) No employer shall direct or allow any person, other than the persons making the application, to enter or remain in treated nurseries or greenhouses, as specified below.
 - (1) If the pesticide is applied in a nursery:
 - (A) By aircraft, in an upward direction, or at a pressure of more than 150 pounds per square inch, or is applied as a fumigant, smoke, fog, or aerosol, the prohibited area is the treatment site plus 100 feet in all directions within the confines of the property.
 - (B) If the pesticide is applied downward from a height greater than 12 inches from the soil or other planting medium, as a fine spray, or using a pressure of more than 40 pounds per square inch, but not more than 150 pounds per square inch, or which requires respiratory protection on the product labeling, the prohibited area is the treatment site plus 25 feet in all directions within the confines of the property.
 - (2) If the pesticide is applied in a greenhouse:
 - (A) As a space treatment (fumigant, smoke, fog, aerosol or mist) or is a pesticide for which the product labeling requires respiratory protection, the prohibited area, until ventilation criteria have been met, is the entire enclosed area plus any adjacent area that is not sealed (sufficient to prevent pesticide transfer) from the treatment site.
 - (B) As a spray from a height greater than 12 inches from the soil or other planting medium, as a fine spray, or using a pressure of more than 40 pounds per square inch, the prohibited area is the

treatment site plus 25 feet in all directions within the enclosed area.

- (3) Otherwise, in both nurseries and greenhouses, the prohibited area is the treatment site.

NOTE

Authority cited: Section 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6764. Fieldworker Training.

- (a) The employer shall assure that each employee assigned to work in a treated field has been trained within the last 5 years, in a manner the employee understands, before beginning work in the treated field.
- (b) The training shall include the following information:
- (1) Importance of routine decontamination and washing thoroughly after the exposure period;
 - (2) Restricted entry intervals and what posting means, including both California and federal field posting sign formats;
 - (3) Where pesticides are encountered, including treated surfaces in the field, residues on clothing, chemigation and drift;
 - (4) Routes of exposure;
 - (5) The hazards of pesticides, including acute effects, chronic and delayed effects, and sensitization effects;
 - (6) Common signs and symptoms of overexposure;
 - (7) First aid including decontamination, eye flushing, and obtaining emergency medical care;
 - (8) Warnings about taking pesticides or pesticide containers home;
 - (9) The hazard communication program requirements of Section 6761; and
 - (10) Employee rights, including the right:
 - (A) To personally receive information about pesticides to which he or she may be exposed;
 - (B) For his or her physician or employee representative to receive information about pesticides to which he or she may be exposed; and
 - (C) To be protected against retaliatory action due to the exercise of any of his or her rights.
- (c) An employee who holds a valid personal pesticide license or certificate issued by the department, a valid verification of training card issued under the authority of the U. S. Environmental Protection Agency, current documented pesticide handler training pursuant to Section 6724, or other valid certificate of pesticide training approved by the director is considered to be trained for the purposes of this Section.
- (d) The information shall be presented in a manner the employee can understand, orally from written materials or audio visually, using nontechnical terms. The trainer shall respond to employee questions.
- (e) The person conducting the training shall be qualified as one of the following:
- (1) A California certified applicator;
 - (2) A person holding any other valid license or certificate of personal pesticide qualification issued by the department;
 - (3) A person who has completed an "instructor training" program presented by one of the following:
 - (A) The University of California, Integrated Pest Management Program, after January 1, 1993;
 - (B) Other instructor training program approved by the director.
 - (4) A California Registered Professional Forester;
 - (5) A person holding a valid County Biologist License in Pesticide Regulation or Investigation and Environmental Monitoring issued by the California Department of Food and Agriculture;
 - (6) A farm adviser employed by the University of California Extension Office; or
 - (7) Other valid trainer qualification approved by the director.

NOTE

Authority cited: Section 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6766. Emergency Medical Care.

- (a) Emergency medical care for employees who enter fields that have been treated with pesticides shall be planned for in advance. The employer shall locate a facility where emergency care is available for employees who will be working in treated fields.
- (b) The employees, or their supervisor in the field, shall be informed of the name and location of a physician or medical facility where emergency medical care is available, and if the identified facility is not reasonably accessible from that work location, the procedures to be followed to obtain emergency medical care.
- (c) When there are reasonable grounds to suspect that an employee has a pesticide illness, or when an exposure to a pesticide has occurred that might reasonably be expected to lead to an employee's illness, the employer shall ensure that the employee is taken to a physician immediately.

NOTE

Authority cited: Sections 407 and 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6768. Fieldworker Decontamination Facilities.

- (a) The employer shall assure that sufficient water (of a quality and temperature that will not cause illness or injury when it contacts the skin or eyes or if it is swallowed), soap, and single use towels for washing of hands and face and for emergency eye flushing are reasonably accessible to all fieldworkers engaged in activities involving contact with treated surfaces in treated fields. The decontamination facilities shall be not more than 1/4 mile from the fieldworkers (or at the nearest point of vehicular access). Handwashing facilities provided in conjunction with toilet facilities pursuant to Title 8 California Code of Regulations, Section 3457 (Field Sanitation), shall be considered adequate for the purposes of this Section.
- (b) The decontamination facilities shall not be in an area under a restricted entry interval unless the fieldworkers for whom the site is provided are performing early entry activities. The facilities shall not be in an area under treatment.

NOTE

Authority cited: Section 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and agricultural Code.

§6770. Field Reentry After Pesticide Application.

- (a) The employer shall not allow or direct any employee to enter or remain in a treated field before the restricted entry interval stated on pesticide product labeling or listed in Section 6772 has expired except as provided in this Section or otherwise expressly authorized by the director pursuant to Title 40 Code of Federal Regulations, Part 170.112 (d) or (e).
- (b) Employees may enter a treated field during a restricted entry interval to conduct pesticide handling activities, including soil incorporation (mechanical or watered-in), provided they are wearing the personal protective equipment specified on the pesticide product labeling for handling activities.
- (c) An employee may enter a treated field during a restricted entry interval when there will be no contact with anything that has been treated, including soil, water, air, equipment, or plant surfaces, provided that inhalation exposure does not exceed any pesticide product labeling standard or, for greenhouses, the ventilation criteria in Section 6769 have been met. Operating tractors or other equipment from inside an enclosed cab or when shields or other control methods, such as operator placement, physically prevent contact of the employee with anything that has been treated is considered to be a "no contact" activity for the purposes of this Section.
- (d) An employee may enter a treated field during a restricted entry interval specified on pesticide product labeling to conduct limited contact activities (including limited contact irrigation) that are necessary and unforeseen, provided that:
 - 1. The restricted entry interval is not for a pesticide product with the requirement on the labeling for both oral notification of workers and the posting of treated fields (double notification);
 - 2. At least four hours have elapsed since the end of the application;
 - 3. Inhalation exposure does not exceed the applicable pesticide product labeling standard or the

- ventilation criteria in Section 6769 have been met;
4. Exposure is minimal and limited to the feet, legs (below the knees), hands, and forearms (below the elbows);
 5. The personal protective equipment specified on pesticide product labeling for early entry or the optional personal protective equipment of coveralls, socks, chemical resistant footwear, chemical resistant gloves, and protective eyewear (if required by the pesticide product labeling) is utilized;
 6. The time in treated fields under a restricted entry interval does not exceed eight hours in any 24-hour period for each employee entering under this exception; and
 7. The employees are informed that this exception is being used and about the provisions of (2), (3), and (6) orally or by posting notice.
 8. This exception may not be used if the supporting exception granted by the U.S. EPA is not in effect.
- (e) An employee may enter a treated field during a restricted entry interval specified on pesticide product labeling to conduct other activities, not included in (b), (c), and (d) that do not involve hand labor provided that:
1. At least four hours have elapsed since the end of the application;
 2. Inhalation exposure does not exceed any pesticide product labeling standard or the ventilation criteria in Section 6769 have been met;
 3. The personal protective equipment specified on pesticide product labeling for early entry is used; and
 4. Entry does not exceed one hour in any 24-hour period for any employee.
- (f) An employee may enter a treated field after the expiration of the restricted entry interval specified on pesticide product labeling and while a restricted entry interval specified in Section 6772 is in effect as provided below:
1. To conduct activities, other than hand labor, provided that employees are wearing work clothing with long sleeves and legs, shoes with socks, and gloves.

NOTE

Authority cited: Section 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6772. Restricted Entry Intervals.

- (a) The restricted entry intervals specified in this Section shall be applied according to the following:
- (1) Other restricted entry intervals are found on pesticide product labeling. In case of an inconsistency between the pesticide product labeling and this Section, the longer restricted entry interval shall be followed;
 - (2) If more than one restricted entry interval in this Section is applicable to a given situation, the longer restricted entry interval shall apply, except as provided in Section 6774;
 - (3) When reference is made to pounds of a pesticide in a restricted entry interval, the reference means pounds of active ingredient;
 - (4) A day is considered to be a 24-hour period beginning at the conclusion of the application to the identified field or portion of a field.
- (b) The restricted entry intervals in days in the following table apply to the pesticide/crop combinations listed.

Guidelines for Physicians
Appendix A

PESTICIDE	CROPS					OTHER CROPS
	APPLES	CITRUS	CORN	GRAPES	PEACHES/ NECTARINES	
Azinphos-methyl	14(B)	30		21	14(B)	14(A)(B)
Chlorpyrifos		2				
Diazinon		5		5	5	
Endosulfan	2	2	2	2	2	2
Malathion		1		1	1	
Methidathion (Supracide)		30				
Methomyl (Lannate)				7(C)		
Parathion-methyl (non-encapsulated)	14	14(D)	14(D)	14(E)	21	14(D)
Phorate (Thimet)			7			
Phosmet (Imidan)				5	5	
Propargite (Omite/Comite)	21	42	7	30	21	21(F)(G)
Sulfur				3(H)		

Footnotes:

- (A) This restricted entry interval applies to stone fruit only. Stone fruit does not include almonds.
- (B) If the total Azinphos-methyl applied in the current calendar year is 1.0 pounds per acre or less, thinning may be done after seven days.
- (C) Applications of methomyl made after August 15, have a 21-day restricted entry interval. This interval may be terminated after 10 days if leaf samples tested pursuant to Section 6774 (c)(4) show 0.1 micrograms per square centimeter or less of dislodgeable foliar residue of methomyl.
- (D) This restricted entry interval applies only when more than one pound per acre of non-encapsulated parathion-methyl is applied.
- (E) The restricted entry interval for non-encapsulated parathion-methyl on grapes in Monterey County is six days.
- (F) The restricted entry interval for strawberries and field grown roses treated with propargite is 3 days.
- (G) The restricted entry interval for cotton fields treated with propargite is seven days. However, from the end of the restricted entry interval until the beginning of harvest, the employer shall assure that employees entering propargite treated cotton fields wear work clothing with long sleeves and legs and gloves.
- (H) This restricted entry interval for sulfur applies from May 15 through harvest in the counties of: Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, and Tulare; and during March and April in Riverside County.

INFORMATIONAL NOTE FOR Section 6772: The inclusion of a restricted entry interval in this Section does not imply that the use of a pesticide is currently registered. Consult the pesticide product labeling for permitted registered uses.

NOTE

Authority cited: Section 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981 Food and Agricultural Code.

Chapter 3. Pest Control Operations Subchapter
3. Pesticide Worker Safety
Article 5. Minimal Exposure Pesticides

§6790. Minimal Exposure Pesticides

This article applies to the following:

- (a) Bromoxynil (Buctril, Bronate)
- (b) Folpet
- (c) Oxydemeton-methyl (Metasystox-R)
- (d) Propargite (Omite, Omite CR, Comite)

NOTE

Authority cited: Sections 407, 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code.

§6793. Minimal Exposure Pesticide Safety Use Requirements.

- (a) The employer shall provide a clothing change area and instructions, as required by Section 6732, for employees who handle minimal exposure pesticides for any period of time, regardless of the toxicity category of the product used.
- (b) The employer shall provide washing facilities, as specified in Section 6734, where minimal exposure pesticides are mixed or loaded, regardless of the toxicity category of the product used.
- (c) The employer shall provide and maintain work clothing, as specified in Section 6736, and require it to be worn, regardless of the toxicity category.
- (d) The employer shall provide a closed system, as defined in Section 6000.4, and require its use by all employees who mix, load, or transfer liquid formulations or load diluted liquid mixes derived from dry formulations of minimal exposure pesticides, regardless of the toxicity category of the product used. The requirements of this subsection do not apply to:
 - (1) Employees who handle a total of one gallon or less of these pesticides per day exclusively in original containers of one gallon or less; or
 - (2) Regulatory personnel collecting samples of these pesticides according to official sampling procedures.
- (e) The employer shall provide and require employees to wear full-body, chemical-resistant protective clothing, as specified in Section 6738(d), when handling minimal exposure pesticides. Employees working in the following situations are not required by this subsection to wear chemical-resistant, full-body protective clothing, but this clothing shall be present at the work site:
 - (1) Employees using a closed system, or sealed water soluble packets, while mixing, loading, or transferring these pesticides. These employees shall wear a chemical-resistant apron, chemical-resistant gloves, and chemical-resistant boots,
 - (2) Employees working as applicators in enclosed cabs;
 - (3) Employees working as flaggers in enclosed vehicles;
 - (4) Applicators using vehicle-mounted or towed equipment to inject or incorporate these pesticides into the soil; and
 - (5) Applicators using equipment with vehicle-mounted spray nozzles directed downward and located below the level of the employee.
- (f) The employer shall provide and require employees to wear respiratory protection, as specified in Section 6738(e), when engaged in:
 - (1) Hand application or ground application of minimal exposure pesticides, except:
 - (A) (Reserved);
 - (B) Applicators using vehicle-mounted or towed equipment to inject or incorporate these pesticides into the soil; and

- (C) Applicators using equipment with vehicle-mounted spray nozzles directed downward and located below the level of the employee;
- (2) Flagging during an application of a minimal exposure pesticide, except flaggers in enclosed vehicles; and
- (3) Mixing or loading dry formulations of minimal exposure pesticides, except mixers or loaders using sealed water-soluble packets.
- (g) All protective clothing and equipment shall be cleaned inside and out or discarded at the end of the day's use.

NOTE

Authority cited: Sections 407, 12981, Food and Agricultural Code. Reference: Sections 12980 and 12981, Food and Agricultural Code

APPENDIX B:
SUGGESTED FORM LETTER AND AGREEMENT

(For Medical Supervisor To Send To Pesticide Operator
Whose Employees Require Medical Supervision)

Dear Mr./Ms. _____ Address _____

First and Last Name _____

This letter is in response to your request that I provide medical supervision to those of your employees requiring such supervision, as described in the Pesticide Safety Regulations (Section 6728, Title 3, California Code of Regulations).

In agreeing to provide medical supervision, I expect your firm to abide by the provisions of those regulations and I intend to perform my functions in accordance with the specified *Guidelines* provided by the Office of Environmental Health Hazard Assessment.

The employees covered by this regulation are workers engaged in production agriculture who will be “regularly handling” specified types of pesticides during any part of more than six days during a 30 consecutive day period. The specific pesticides are organophosphates and carbamates bearing the signal word “DANGER” or “WARNING” on the label. “Regularly handle” is defined as working with the pesticide during any part of a day for more than six days in any 30 consecutive day qualifying period.

If you intend to have an employee work regularly as a mixer, loader, ground or aerial applicator, or flagger with the more toxic organophosphate or carbamate pesticides, it shall be your responsibility to have that employee come to me for an examination and at least two blood tests at least three days apart in order to set a cholinesterase baseline before exposure begins. If an employee has had any recent exposure to such pesticides, further exposures shall be avoided for as long as practicable, preferably at least 30 days before the baseline testing period begins. Employees will be required to have their baseline retested, or verified, every two years.

According to the regulations, the employer shall ensure that subsequent red blood cell and plasma cholinesterase determinations are conducted at least as frequently as recommended by the medical supervisor. In addition:

- a) Each new employee shall have red blood cell and plasma cholinesterase determinations within three working days after meeting the qualifying standard for regularly handling organophosphate or carbamate pesticides in Toxicity Categories I or II for the first three qualifying 30-day periods.
- b) After three tests at 30-day intervals, when any new employee continues to regularly handle organophosphate or carbamate pesticides in Toxicity Categories I and II, testing shall be

required at every second qualifying period (every 60 days) unless I indicate otherwise to you in writing.

- c) When the employee's work consists only of mixing and loading the above materials using closed mixing and loading systems, and does not involve any pesticide application, he or she is required to have only the pre-exposure baseline test.

The above testing intervals are subject to change. I will schedule more frequent tests and designate non-exposure periods as necessary, according to the test results. When work experience demonstrates little effect on cholinesterase values, I may schedule less frequent testing. With mutual cooperation we should be able to assure your employees a safe work situation.

Sincerely,

_____, M.D.

Date _____

Address _____

**APPENDIX C:
SAMPLE FORMS**

INITIATION OF MEDICAL SUPERVISION

NOTIFICATION BY EMPLOYER TO PHYSICIAN, AND BY PHYSICIAN TO EMPLOYER,
REGARDING NEW EMPLOYEE TO BE SUPERVISED.

Employer _____

Address _____

Employee _____ Job Title _____

Address and Phone _____

To: (Name of Physician) _____

Address _____

Date and Time of Appointment _____

The above named individual will be employed in the regular use of organophosphate or carbamate pesticides,
beginning on _____. Payment of any laboratory tests ordered by you is guaranteed.

Signed for Employer _____ Title _____

To: Employer _____

Name of Person Referred _____

1. [] is medically approved for employment as _____
using cholinesterase-inhibiting pesticides. (Job Title)

2. [] is not recommended for such employment.

3. [] is not approved for work with cholinesterase-inhibiting pesticides pending re-examination.

4. [] is to return for re-examination of cholinesterase level on _____

5. [] is to return for re-examination on call or _____

Subject to cancellation of this certificate by (Date) _____ and evidence that laboratory test(s)
ordered have been completed.

Signed _____, M.D.

Date _____

(Upper half, to laboratory attached to Request for Laboratory Work)
(Lower half, when countersigned by physician, is returned to employer by mail or via employee) (Copies --
retained by physician)

REQUEST FOR LABORATORY SERVICE
CLINICAL CHEMISTRY LAB
PLASMA AND RBC CHOLINESTERASE

To: _____
(Clinical Laboratory)

Address: _____ Phone (_____)

Employee: _____

Working for: _____
(Employer)

Employer's Address: _____

Is referred to you on: _____ for the following:
(Date)

baseline

routine

emergency laboratory test(s)

The employer's guarantee of payments is attached or is already in your possession. Please endorse this request, (retaining the copy) and return it to the employer as evidence that all samples have been received from the employee.

Signed _____, M.D.

Address _____

CERTIFICATION

The laboratory work ordered for the above named person has been completed. These are the reports to the physician and the employer named above.

Signed by the Laboratory _____

Lab. No(s) Assigned _____ Date _____

(Original and first copy to employee to take to laboratory. When countersigned by laboratory, original is for return to employer.)

(Second copy retained by physician.)

REQUEST FOR LABORATORY SERVICE
PHYSICIAN'S OFFICE
PLASMA AND RBC CHOLINESTERASE

To: _____
(Clinical Laboratory)

Address: _____ Phone (_____)

Employee: _____

Working for: _____
(Employer)

Employer's Address: _____

Is referred to you on: _____ for the following:
(Date)

baseline

routine

emergency laboratory test(s)

The employer's guarantee of payments is attached or is already in your possession. Please endorse this request, (retaining the copy) and return it to the employer as evidence that all samples have been received from the employee.

Signed _____, M.D.

Address _____

CERTIFICATION

The laboratory work ordered for the above named person has been completed. These are the reports to the physician and the employer named above.

Signed by the Laboratory _____

Lab. No(s) Assigned _____ Date _____

(Original and first copy to employee to take to laboratory. When countersigned by laboratory, original is for return to employer.)

(Second copy retained by physician.)

NOTIFICATION OF CHANGE OF HEALTH STATUS

PHYSICIAN'S CONFIRMATION OF TELEPHONED OR VERBAL INSTRUCTIONS TO EMPLOYEE AND/OR EMPLOYER.

To: _____
(Employer's Name)

(Address)

RE: _____
(Employee)

As stated by telephone on (Date) _____, the above named employee has shown evidence of excessive exposure to cholinesterase-inhibiting pesticides. Therefore:

1. Work practices surrounding his or her job and attention to personal hygiene should be reviewed immediately and errors corrected.
2. The employee is to have a routine, or emergency laboratory test at:

(Laboratory) (Date & Time)

3. The employee is to be restricted from any further exposure to organophosphate injurious materials (including cleaning or repair of mixing or application equipment) at least until he or she has reported to this office on (Date) _____ and until:

The employee has been released by me to resume work;

The employee has had a new laboratory test to be performed on

(Date) _____

The employee has had both of the above.

4. The employee is to be hospitalized under the care of:
_____, M.D.

5. Other special directions (specify): _____

Signed _____, M.D.

Date _____

(Original and second copy to employer)
(Original by mail, copy by employee, if seen)
(First copy retained by phys)

**NOTIFICATION THAT EMPLOYEE NO LONGER REQUIRES
MEDICAL SUPERVISION**

To: Physician and Laboratory _____
(Physician)

(Laboratory)

(Name of Person) _____ is no longer involved in regular use of organophosphate and carbamate pesticides labeled with the signal words "DANGER" and "WARNING" for this company.

Employer _____

Signed by _____

Title _____

Date Effective _____

(Original to physician; copy to laboratory)

**APPENDIX D:
CHOLINESTERASE TESTING INFORMATION**

CONDITIONS DESCRIBING WORKERS COVERED UNDER MEDICAL SUPERVISION
(CALIFORNIA CODE OF REGULATIONS, SECTION 6728)

<u>Type of work</u>	<u>Pesticides used</u>	<u>Duration of exposure</u>
Mixers, loaders, applicators (ground & air), and flaggers involved in agricultural production	Organophosphates and carbamates carrying the signal word "DANGER" or "WARNING" on label (Category I or II).	More than 6 days in any 30-day period.

REQUIRED FREQUENCY OF MONITORING BLOOD CHOLINESTERASE

<u>Employee who regularly handles testing Toxicity Category I or II organophosphate or carbamate pesticides¹</u>	<u>Frequency of</u>
New Employee	Test ² once in every 30-day period for first 90 days
Employee (after 3 tests)	Test once in every 60-day period unless medical supervisor specifies otherwise in writing
All employees	Immediate examination and retesting is indicated in the event of accidental exposure such as splashes and spills

¹ Persons who work only with closed mixing and loading systems, and do not apply the pesticides, are only required to have pre- exposure baseline testing.

² First test is to be conducted within three days after the conclusion of a qualifying period of working for more than six days in any 30 consecutive day period with these pesticides. The next two tests are at 30-day intervals when regularly handling pesticides.

APPENDIX E: TREATMENT OF PESTICIDE POISONING

Treatment of Organophosphate Poisoning

From: *Recognition and Management of Pesticide Poisonings*. 5th ed. Reigert JR and Roberts JR. EPA-735-R-98-003. U.S. Environmental Protection Agency, Washington, D.C. March 1999. Copies are available by contacting: Tel: 703-305- 7666 or Fax: 703-308-2962. Available in electronic format at: <http://www.epa.gov/oppfead1/safety/healthcare/handbook/handbook.htm>

Caution: Persons attending the victim should avoid direct contact with heavily contaminated clothing and vomitus. Wear rubber gloves while washing pesticide from skin and hair. Vinyl gloves provide no protection.

1. Airway protection. Ensure that a clear airway exists. Intubate the patient and aspirate the secretions with a large-bore suction device if necessary. Administer oxygen by mechanically assisted pulmonary ventilation if respiration is depressed. **Improve tissue oxygenation as much as possible before administering atropine, so as to minimize the risk of ventricular fibrillation.** In severe poisonings, it may be necessary to support pulmonary ventilation mechanically for several days.

2. Atropine sulfate. Administer atropine sulfate intravenously, or intramuscularly if intravenous injection is not possible. Remember that atropine can be administered through an endotracheal tube if initial IV access is difficult to obtain. Depending on the severity of poisoning, doses of atropine ranging from very low to as high as 300 mg per day may be required or even continuous infusion.

Dosage of Atropine:

In *moderately severe poisoning* (hypersecretion and other end-organ manifestations without central nervous system depression), the following dosage schedules have been used:

- *Adults and children over 12 years:* 2.0-4.0 mg, repeated every 15 minutes until pulmonary secretions are controlled, which may be accompanied by other signs of atropinization, including flushing, dry mouth, dilated pupils, and tachycardia (pulse of 140 per minute).
Warning: In cases of ingestion of liquid concentrates of organophosphate pesticides, hydrocarbon aspiration may complicate these poisonings. Pulmonary edema and poor oxygenation in these cases will not respond to

atropine and should be treated as a case of acute respiratory distress syndrome.

- *Children under 12 years:* 0.05-0.1 mg/kg body weight, repeated every 15 minutes until atropinization is achieved. There is a minimum dose of 0.1 mg in children. Maintain atropinization by repeated doses based on recurrence of symptoms for 2-12 hours or longer depending on severity of poisoning.

Maintain atropinization with repeated dosing as indicated by clinical status. Crackles in the lung bases nearly always indicate inadequate atropinization. Pulmonary improvement may not parallel other signs of atropinization. Continuation of, or return of, cholinergic signs indicates the need for more atropine. When symptoms are stable for as much as six hours, the dosing may be decreased.

Severely poisoned individuals may exhibit remarkable tolerance to atropine; two or more times the dosages suggested above may be needed. The dose of atropine may be increased and the dosing interval decreased as needed to control symptoms. Continuous intravenous infusion of atropine may be necessary when atropine requirements are massive. **The desired end-point is the reversal of muscarinic symptoms and signs with improvement in pulmonary status and oxygenation**, without an arbitrary dose limit. Preservative-free atropine products should be used whenever possible.

Note: Persons not poisoned or only slightly poisoned by organophosphates may develop signs of atropine toxicity from such large doses. Fever, muscle fibrillations, and delirium are the main signs of atropine toxicity. If these appear while the patient is fully atropinized, atropine administration should be discontinued, at least temporarily, while the severity of poisoning is reevaluated.

The objective of atropine antidotal therapy is to antagonize the effects of excessive concentrations of acetylcholine at end-organs having muscarinic receptors. Atropine does not reactivate the cholinesterase enzyme or accelerate disposition of organophosphate. Recrudescence of poisoning may occur if tissue concentrations of organophosphate remain high when the effect of atropine wears off. Atropine is effective against muscarinic manifestations, but it is ineffective against nicotinic actions, specifically muscle weakness and twitching, and respiratory depression.

Despite these limitations, atropine is often a life-saving agent in organophosphate poisonings. Favorable response to a test dose of atropine (1 mg in adults, 0.01 mg/kg in children under 12 years) can help differentiate poisoning by anti-cholinesterase agents from other conditions. However, lack of response, with no evidence of atropinization (atropine refractoriness) is typical of more severe poisonings. The adjunctive use of nebulized atropine has been reported to improve respiratory distress, decrease bronchial secretions, and increase oxygenation.

3. Glycopyrolate has been studied as an alternative to atropine and found to have similar outcomes using continuous infusion. Ampules of 7.5 mg of glycopyrolate were added to 200 mL of saline and this infusion was titrated to the desired effects of dry mucous membranes and heart rate above 60 beats/min. During this study, atropine was used as a bolus for a heart rate less than 60 beats/min. The other apparent advantage to this regimen was a decreased number of respiratory infections. This may represent an alternative when there is a concern for respiratory infection due to excessive and difficult to control secretions, and in the presence of altered level of consciousness where the distinction between atropine toxicity or relapse of organophosphate poisoning is unclear.

4. Pralidoxime. Before administration of pralidoxime, draw a blood sample (heparinized) for cholinesterase analysis (since pralidoxime tends to reverse the cholinesterase depression). Administer pralidoxime (Protopam, 2-PAM) a cholinesterase reactivator, in cases of severe poisoning by organophosphate pesticides in which respiratory depression, muscle weakness, and/or twitching are severe. When administered early (usually less than 48 hours after poisoning), pralidoxime relieves the nicotinic as well as the muscarinic effects of poisoning. Pralidoxime works by reactivating the cholinesterase and also by slowing the “aging” process of phosphorylated cholinesterase to a non-reactivable form.

Dosage of Pralidoxime:

- *Adults and children over 12 years:* 1.0-2.0 g by intravenous infusion at a rate of no more than 0.2 g per minute. Slow administration of pralidoxime is strongly recommended and may be achieved by administering the total dose in 100 mL of normal saline over 30 minutes, or longer.
- *Children under 12 years:* 20-50 mg/kg body weight (depending on severity of poisoning) intravenously, mixed in 100 mL of normal saline and infused over 30 minutes.

Note: Pralidoxime is of limited value and may actually be hazardous in poisonings by the cholinesterase-inhibiting carbamate compounds. Dosage of pralidoxime may be repeated in 1-2 hours, then at 10-12 hour intervals if needed. In very severe poisonings, dosage rates may be doubled. Repeated doses of pralidoxime are usually required. In cases that involve continuing absorption of organophosphate (as after ingestion of large amount), or continuing transfer of highly lipophilic organophosphate from fat into blood, it may be necessary to continue administration of pralidoxime for several days beyond the 48 hour post-exposure interval usually cited as the limit of its effectiveness. Pralidoxime may also be given as a continuous infusion of approximately 500 mg/hour based on animal case studies and adult patient reports.

Blood pressure should be monitored during administration because of the occasional occurrence of hypertensive crisis. Administration should be slowed or stopped if blood

pressure rises to hazardous levels. Be prepared to assist pulmonary ventilation mechanically if respiration is depressed during or after pralidoxime administration. intravenous injection is not possible, pralidoxime may be given by deep intramuscular injection.

5. Skin decontamination. In patients who have been poisoned by organophosphate contamination of skin, clothing, hair, and/or eyes, decontamination must proceed concurrently with whatever resuscitative and antidotal measures are necessary to preserve life. Flush the chemical from the eyes with copious amounts of clean water. If no symptoms are evident in a patient who remains alert and physically stable, a prompt shower and shampoo may be appropriate, provided the patient is carefully observed to insure against any sudden appearance of poisoning. If there are any indications of weakness, ataxia, or other neurologic impairment, clothing should be removed and a complete bath and shampoo given while the victim is recumbent, using copious amounts of soap and water. Attendants should wear rubber gloves as vinyl provides no protection against skin absorption. Surgical green soap is excellent for this purpose, but ordinary soap is about as good. Wash the chemical from skin folds and from under fingernails. Contaminated clothing should be promptly removed, bagged, and laundered before returning. Contaminated leather shoes should be discarded. Note that the pesticide can contaminate the inside surfaces of gloves, boots, and headgear.

6. Gastrointestinal decontamination. If organophosphate has been ingested in quantity probably sufficient to cause poisoning, consideration should be given to gastrointestinal decontamination. If the patient has already vomited, which is most likely in serious exposures, further efforts at GI decontamination may not be indicated. In significant ingestions, diarrhea and/or vomiting are so constant that charcoal adsorption and catharsis are not indicated.

A joint position statement has recently been released by the American Academy of Clinical Toxicology and the European Association of Poisons Centres and Clinical Toxicologists on various methods of gastrointestinal decontamination. A summary of the position statement accompanies the description of each procedure.

A. Gastric Lavage

If the patient presents within 60 minutes of ingestion, lavage may be **considered**. Insert an orogastric tube and follow with fluid, usually normal saline. Aspirate back the fluid in an attempt to remove any toxicant. If the patient is neurologically impaired, airway protection with a cuffed endotracheal tube is indicated prior to gastric lavage.

Lavage performed more than 60 minutes after ingestion has not proven to be beneficial and runs the risk of inducing bleeding, perforation, or scarring due to additional trauma to already traumatized tissues. It is almost always necessary first to control seizures before attempting gastric lavage or any other method of GI decontamination.

Studies of poison recovery have been performed mainly with solid material such as pills. There are no controlled studies of pesticide recovery by these methods. Reported recovery of material at 60 minutes in several studies was 8 percent to 32 percent. There is further evidence that lavage may propel the material into the small bowel, thus increasing absorption.

Note on Specific Pesticides: Lavage is contraindicated in hydrocarbon ingestion, a common vehicle in many pesticide formulations.

Position Statement: Gastric lavage should not be routinely used in the management of poisons. Lavage is indicated only when a patient has ingested a potentially life-threatening amount of poison and the procedure can be done within 60 minutes of ingestion. Even then, clinical benefit has not been confirmed in controlled studies.

B. Catharsis

Sorbitol and magnesium citrate are commonly used cathartic agents. Because magnesium citrate has not been studied as much, its use is not described here. Sorbitol is often included in charcoal formulations. It will increase gut motility to improve excretion of the charcoal-poison complex. The dosage of sorbitol is 1-2 g/kg as a one-time dose. Repeat doses of cathartics may result in fluid and electrolyte imbalances, particularly in children, and are therefore not recommended. Sorbitol is formulated in 70 percent and 35 percent solutions and usually packaged in 100 mL bottles. The gram dosage of sorbitol in a 100 mL bottle can be calculated by multiplying 100 (mL) x 0.7 (for 70 percent solution) x 1.285 g sorbitol/mL. Therefore the dose in mL is as follows:

Dosage of Sorbitol:

- *Adults:* 70 percent sorbitol, 1-2 mL/kg.
- *Children:* 35 percent sorbitol, 1.5-2.3 mL/kg (maximum dosage: 50 g).

Note on Specific Pesticides: Significant poisoning with organophosphates, carbamates, and arsenicals generally results in a profuse diarrhea. Poisoning with diquat and to a lesser extent paraquat results in an ileus. The use of sorbitol is not recommended in any of the above pesticide poisonings.

Position Statement: The administration of a cathartic alone has no role in the management of the poisoned patient. There are no definite indications for the use of cathartics in the management of the poisoned patient. Data are conflicting with regard to use in combination with activated charcoal, and its routine use is not endorsed. If a cathartic is used, it should be as a single dose in order to minimize adverse effects. There are numerous contraindications, including absent bowel sounds, abdominal trauma or surgery, or intestinal perforation or obstruction. It is also contraindicated in volume depletion, hypotension, electrolyte imbalance, or the ingestion of a corrosive substance.

C. Activated Charcoal Adsorption

Activated charcoal is an effective absorbent for many poisonings. Volunteer studies suggest that it will reduce the amount of poison absorbed if given within 60 minutes. There are insufficient data to support or exclude its use if time from ingestion is prolonged, although some poisons that are less soluble may be adsorbed beyond 60 minutes. Clinical trials with charcoal have been done with poisons other than pesticides. There is some evidence that paraquat is well adsorbed by activated charcoal. Charcoal has been anecdotally successful with other pesticides.

Dosage of Activated Charcoal:

- *Adults and children over 12 years:* 25-100 g in 300-800 mL water.
- *Children under 12 years:* 25-50 g per dose.
- *Infants and toddlers under 20 kg:* 1 g per kg body weight.

Many activated charcoal formulations come premixed with sorbitol. Avoid giving more than one dose of sorbitol as a cathartic in infants and children due to the risk of rapid shifts of intravascular fluid.

Encourage the victim to swallow the adsorbent even though spontaneous vomiting continues. Antiemetic therapy may help control vomiting in adults or older children. As an alternative, activated charcoal may be administered through an orogastric tube or diluted with water and administered slowly through a nasogastric tube. Repeated administration of charcoal or other absorbent every 2- 4 hours may be beneficial in both children and adults, but use of a cathartic such as sorbitol should be avoided after the first dose. Repeated doses of activated charcoal should not be administered if the gut is atonic. The use of charcoal without airway protection is contraindicated in the neurologically impaired patient.

Note on Specific Pesticides: The use of charcoal without airway protection should be used with caution in poisons such as organophosphates, carbamates, and organochlorines if they are prepared in a hydrocarbon solution.

Position Statement: Single-dose activated charcoal should not be used routinely in the management of poisoned patients. Charcoal appears to be most effective within 60 minutes of ingestion and may be considered for use for this time period. Although it may be considered 60 minutes after ingestion, there is insufficient evidence to support or deny its use for this time period. Despite improved binding of poisons within 60 minutes, only one study exists to suggest that there is improved clinical outcome. Activated charcoal is contraindicated in an unprotected airway, a GI tract not anatomically intact, and when charcoal therapy may increase the risk of **aspiration** of a hydrocarbon-based pesticide.

D. Syrup of Ipecac

Ipecac has been used as an emetic since the 1950s. In a pediatric study, administration of ipecac resulted in vomiting within 30 minutes in 88 percent of children. However, in light of the recent review of the clinical effectiveness of ipecac, it is **no longer recommended for routine use** in most poisonings. Most clinical trials involve the use of pill form ingestants such as aspirin, acetaminophen, ampicillin, and multiple types of tablets. No clinical trials have been done with pesticides. In 1996, more than 2 million human exposures to a poisonous substance were reported to American poison centers. Ipecac was recommended for decontamination in only 1.8 percent of all exposures.

Dosage of Syrup of Ipecac:

- *Adolescents and adults:* 15-30 mL followed immediately with 240 mL of water.
- *Children 1-12 years:* 15 mL preceded or followed by 120 to 240 mL of water.
- *Infants 6 months to 12 months:* 5-10 mL preceded or followed by 120 to 240 mL of water.

Dose may be repeated in all age groups if emesis does not occur within 20-30 minutes.

Position Statement: Ipecac syrup should not be administered routinely in poisoned patients. If ipecac is used, it should be administered within 60 minutes of the ingestion. Even then, clinical studies have demonstrated no benefit from its use. It should be considered only in an alert conscious patient who has ingested a potentially toxic ingestion. Contraindications to its use include the following: patients with diminished airway protective reflexes, the ingestion of hydrocarbons with a high aspiration potential, the ingestion of a corrosive substance, or the ingestion of a substance in which advanced life support may be necessary within the next 60 minutes.

7. Observation. Observe patient closely for at least 72 hours to ensure that symptoms (sweating, visual disturbances, vomiting, diarrhea, chest and abdominal distress, and sometimes pulmonary edema) do not recur as atropinization is withdrawn. In very severe poisonings by ingested organophosphates, particularly the more lipophilic and slowly hydrolyzed compounds, metabolic disposition of toxicant may require as many as 5-14 days. In some cases, this slow elimination may combine with profound cholinesterase inhibition to require atropinization for several days or even weeks. As dosage is reduced, the lung bases should be checked frequently for crackles. If crackles are heard, or if there is a return of miosis, bradycardia, sweating, or other cholinergic signs, atropinization must be re-established promptly.

8. Furosemide may be considered if pulmonary edema persists in the lungs even after full atropinization. It should not be used until the maximum benefit of atropine has been realized. Consult package insert for dosage and administration.

9. Pulmonary ventilation. Particularly in poisonings by large ingested doses of organophosphate, monitor pulmonary ventilation carefully, even after recovery from muscarinic symptomatology, to forestall respiratory failure. In some cases, respiratory failure has developed several days following organophosphate ingestion, and has persisted for days to weeks.

10. Hydrocarbon aspiration may complicate poisonings that involve ingestion of liquid concentrates of organophosphate pesticides. Pulmonary edema and poor oxygenation in these cases will not respond to atropine and should be treated as a case of acute respiratory distress syndrome.

11. Cardiopulmonary monitoring. In severely poisoned patients, monitor cardiac status by continuous ECG recording. Some organophosphates have significant cardiac toxicity.

12. Seizure control. Rarely, in severe organophosphate poisonings, convulsions occur despite therapy with atropine and pralidoxime. Insure that causes unrelated to pesticide toxicity are not responsible: head trauma, cerebral anoxia, or mixed poisoning. Drugs useful in controlling convulsions are discussed below. The benzodiazepines (diazepam or lorazepam) are the agents of choice as initial therapy.

Lorazepam is increasingly being recognized as the drug of choice for status epilepticus, although there are few reports of its use with certain pesticides. One must be prepared to assist ventilation with lorazepam and any other medication used to control seizures.

Dosage of Lorazepam:

- *Adults:* 2-4 mg/dose given IV over 2-5 minutes. Repeat if necessary to a maximum of 8 mg in a 12 hour period.
- *Adolescents:* Same as adult dose, except maximum dose is 4 mg.
- *Children under 12 years:* 0.05-0.10 mg/kg IV over 2-5 minutes. Repeat if necessary 0.05 mg/kg 10-15 minutes after first dose, with a maximum dose of 4 mg.

Dosage of Diazepam:

- *Adults:* 5-10 mg IV and repeat every 5-10 minutes to maximum of 30 mg.
- *Children:* 0.2-0.5 mg/kg IV every 5 minutes to maximum of 10 mg in children over 5 years and 5 mg in children under 5 years.

Caution: Be prepared to assist pulmonary ventilation mechanically if respiration is depressed, to intubate the trachea if laryngospasm occurs, and to counteract hypotensive reactions.

Phenobarbital is an additional treatment option for seizure control. Dosage for **infants, children, and adults** is 15-20 mg/kg as an IV loading dose. An additional 5 mg/kg IV may be given every 15-30 minutes to a maximum of 30 mg/kg. The drug should be pushed no faster than 1 mg/kg/minute.

For seizure management, most patients respond well to usual management consisting of benzodiazepines, or phenytoin and phenobarbital.

13. Contraindications. The following drugs are contraindicated in nearly all organophosphate poisoning cases: morphine, succinylcholine, theophylline, phenothiazines, and reserpine. Adrenergic amines should be given only if there is a specific indication, such as marked hypotension.

14. Re-exposures. Persons who have been clinically poisoned by organophosphate pesticides should not be re-exposed to cholinesterase-inhibiting chemicals until symptoms and signs have resolved completely and blood cholinesterase activities have returned to at least 80 percent of pre-poisoning levels. If blood cholinesterase was not measured prior to poisoning, blood enzyme activities should reach at least minimum normal levels before the patient is returned to a pesticide-contaminated environment.

15. Do not administer atropine or pralidoxime prophylactically to workers exposed to organophosphate pesticides. Prophylactic dosage with either atropine or pralidoxime may mask early signs and symptoms of organophosphate poisoning and thus allow the worker to continue exposure and possibly progress to more severe poisoning. Atropine itself may enhance the health hazards of the agricultural work setting: impaired heat loss due to reduced sweating and impaired ability to operate mechanical equipment due to blurred vision. This can be caused by mydriasis, one of the effects of atropine.

Treatment of N-Methyl Carbamate Poisoning

From: *Recognition and Management of Pesticide Poisonings*. 5th ed. Reigert JR and Roberts JR. EPA-735-R-98-003. U.S. Environmental Protection Agency, Washington, D.C. March 1999. Copies are available by contacting: Tel: 703-305-7666 or Fax: 703-308-2962. Available in electronic format at: <http://www.epa.gov/oppfead1/safety/healthcare/handbook/handbook.htm>

Caution: Persons attending the victim should avoid direct contact with heavily contaminated clothing and vomitus. Wear rubber gloves while washing pesticide from skin and hair. Vinyl gloves provide no protection.

1. Airway protection. Ensure that a clear airway exists. Intubate the patient and aspirate the secretions with a large-bore suction device if necessary. Administer oxygen by mechanically assisted pulmonary ventilation if respiration is depressed. **Improve tissue oxygenation as much as possible before administering atropine, to minimize the risk of ventricular fibrillation.**

In severe poisonings, it may be necessary to support pulmonary ventilation mechanically for several days.

2. Atropine. Administer atropine sulfate intravenously or intramuscularly if intravenous injection is not possible. Remember that atropine can be administered through an endotracheal tube if initial IV access is difficult to obtain. Carbamates usually reverse with much smaller dosages of atropine than those required to reverse organophosphates.

The objective of atropine antidotal therapy is to antagonize the effects of excessive concentrations of acetylcholine at end-organs having muscarinic receptors. Atropine does not reactivate the cholinesterase enzyme or accelerate excretion or breakdown of carbamate. Recrudescence of poisoning may occur if tissue concentrations of toxicant remain high when the effect of atropine wears off. Atropine is effective against muscarinic manifestations, but is ineffective against nicotinic actions, specifically, muscle weakness and twitching, and respiratory depression.

Despite these limitations, atropine is often a life-saving agent in N-methyl carbamate poisonings. Favorable response to a test dose of atropine (1 mg in adults, 0.01 mg/kg in children under 12 years) given intravenously can help differentiate poisoning by anticholinesterase agents from other conditions such as cardiogenic pulmonary edema and hydrocarbon ingestion. However, lack of response to the test dose, indicating no atropinization (atropine refractoriness), is characteristic of moderately severe to severe poisoning and indicates a need for further atropine. If the test dose does not result in mydriasis and drying of secretions, the patient can be considered atropine refractory.

Dosage of Atropine:

In *moderately severe poisoning* (hypersecretion and other end-organ manifestations without central nervous system depression), the following dosage schedules have proven effective:

- *Adults and children over 12 years:* 2.0-4.0 mg, repeated every 15 minutes until pulmonary secretions are controlled, which may be accompanied by other signs of atropinization, including flushing, dry mouth, dilated pupils, and tachycardia (pulse of 140 per minute).
Warning: In cases of ingestion of liquid concentrates of carbamate pesticides, hydrocarbon aspiration may complicate these poisonings. Pulmonary edema and poor oxygenation in these cases will not respond to atropine and should be treated as a case of acute respiratory distress syndrome.
- *Children under 12 years:* 0.05-0.1 mg/kg body weight, repeated every 15 minutes until pulmonary secretions are controlled, which may be accompanied by other signs of atropinization as above (heart rates vary depending on age of child with young toddlers having a rate approaching 200). There is a minimum dose of 0.1 mg in children.

Maintain atropinization by repeated doses based on recurrence of symptoms for 2-12 hours or longer depending on severity of poisoning. Crackles in the lung bases nearly always indicate inadequate atropinization and pulmonary improvement may not parallel other signs. Continuation or return of cholinergic signs indicates the need for more atropine.

Severely poisoned individuals may exhibit remarkable tolerance to atropine; two or more times the dosages suggested above may be needed. Reversal of muscarinic manifestations, rather than a specific dosage, is the object of atropine therapy. However, prolonged intensive intravenous administration of atropine sometimes required in organophosphate poisonings is rarely needed in treating carbamate poisoning.

Note: Persons not poisoned or only slightly poisoned by N-methyl carbamates may develop signs of atropine toxicity from such large doses. Fever, muscle fibrillations, and delirium are the main signs of atropine toxicity. If these signs appear while the patient is fully atropinized, atropine administration should be discontinued, at least temporarily, while the severity of poisoning is reevaluated.

3. Skin decontamination. In patients with contaminated skin, clothing, hair, and/or eyes, **decontamination must proceed concurrently with whatever resuscitative and antidotal measures are needed to preserve life.** Flush the chemical from eyes with copious amounts of clean water. For asymptomatic individuals who are alert and physically able, a prompt shower and shampoo may be appropriate for thorough skin decontamination, provided the patient is carefully observed to insure against sudden appearance of poisoning. If there are any indications of weakness ataxia or other neurologic impairment, clothing should be removed and a complete bath and shampoo

given while the victim is recumbent, using copious amounts of soap and water. Attendants should wear rubber gloves as vinyl provides no protection against skin absorption. Wash the chemical from skin folds and from under fingernails. Contaminated clothing should be promptly removed, bagged, and laundered before returning. Contaminated leather shoes should be discarded. Note that the pesticide can contaminate the inside surfaces of gloves, boots, and headgear.

4. Gastrointestinal decontamination. If N-methyl carbamate has been ingested in a quantity probably sufficient to cause poisoning, consideration should be given to gastrointestinal decontamination as outlined above. If the patient has presented with a recent ingestion and is still asymptomatic, adsorption of poison with activated charcoal may be beneficial. In significant ingestions, diarrhea and/or vomiting are so constant that charcoal adsorption and catharsis are not indicated. Attention should be given to oxygen, airway management, and atropine.

5. Urine sample. Save a urine sample for metabolite analysis if there is need to identify the agent responsible for the poisoning.

6. Pralidoxime is probably of little value in N-methyl carbamate poisonings, because atropine alone is effective. Although not indicated in isolated carbamate poisoning, pralidoxime appears to be useful in cases of mixed carbamate/organophosphate poisonings, and cases of an unknown pesticide with muscarinic symptoms on presentation. See Chapter 4, Treatment section, p. 41 (above).

7. Observation. Observe patient closely for at least 24 hours to ensure that symptoms (sweating, visual disturbances, vomiting, diarrhea, chest and abdominal distress, and sometimes pulmonary edema) do not recur as atropinization is withdrawn. The observation period should be longer in the case of mixed pesticide ingestion, because of the prolonged and delayed symptoms associated with organophosphate poisoning. As the dosage of atropine is reduced over time, check the lung bases frequently for crackles. Atropinization must be re-established promptly, if crackles are heard, or if there is a return of miosis, sweating, or other signs of poisoning.

8. Furosemide may be considered for relief of pulmonary edema if crackles persist in the lungs even after full atropinization. It should not be considered until the maximum effect of atropine has been achieved. Consult package insert for dosage and administration.

9. Pulmonary ventilation. Particularly in poisonings by large doses of N-methyl carbamates, monitor pulmonary ventilation carefully, even after recovery from muscarinic symptomatology, to forestall respiratory failure.

10. Cardiopulmonary monitoring. In severely poisoned patients, monitor cardiac status by continuous ECG recording.

11. Contraindications. The following drugs are probably contraindicated in nearly all N-methyl carbamate poisoning cases: morphine, succinylcholine, theophylline,

phenothiazines, and reserpine. Adrenergic amines should be given only if there is a specific indication, such as marked hypotension.

12. Hydrocarbon aspiration may complicate poisonings that involve ingestion of liquid concentrates of some carbamates that are formulated in a petroleum product base. Pulmonary edema and poor oxygenation in these cases will not respond to atropine and should be treated as cases of acute respiratory distress syndrome.

13. Do not administer atropine prophylactically to workers exposed to N-methyl carbamate pesticides. Prophylactic dosage may mask early symptoms and signs of carbamate poisoning and thus allow the worker to continue exposure and possibly progress to more severe poisoning. Atropine itself may enhance the health hazards of the agricultural work setting: impaired heat loss due to reduced sweating and impaired ability to operate mechanical equipment due to blurred vision (mydriasis).

APPENDIX F: LISTS OF SOME COMMON CHOLINESTERASE-INHIBITING PESTICIDES

INTRODUCTION

The lists below of cholinesterase-inhibiting pesticides are taken from *Recognition and Management of Pesticide Poisonings*, Fifth Edition, by J. Routt Reigart, M.D. and James R. Roberts, M.D., Ph.D., U. S. Environmental Protection Agency, September 1999 (EPA 735-R-98-003). This listing does not imply current registration in California. Information for current registration in California can be obtained from the California Department of Pesticide Regulation at (916) 445-4300 or at: www.cdpr.ca.gov. Trade names and products are shown in parentheses, active ingredients in lower-case letters.

There are hundreds of common and trade names for pesticides on the market. Physicians who have questions about pesticides should contact their local agricultural commissioner or poison control center.

ORGANOPHOSPHATE PESTICIDES

Toxicity Category I Signal Word "Danger" (Highly Toxic)

azinphos-methyl (Guthion)	isofenphos (Amaze, Oftanol)
carbophenothion (Trithion)	methamidophos (Monitor)
chlorthiophos (Celathion)	methidathion (Supracide)
dialifor (Torak)	methyl parathion (Dalf, Penncap-M)
dichlorvos (DDVP, Vapona)	mevinphos (Phosdrin)
dicrotophos (Bidrin)	monocrotophos (Azodrin)
disulfoton (Di-Syston)	phorate (Thimet)
EPN	phosphamidon (Dimecron)
ethyl parathion (Parathion, Thiophos)	propylthio-pyrophosphate (Aspon)
fenamiphos (Nemacur)	sulfotepp (Bladafum, Dithione)
fensulfathion (Dasanit).	tetraethyl pyrophosphate (TEPP)
fonophos (Dyfonate)	

Toxicity Category II
Signal Word “Warning”
(Moderately Toxic)

acephate (Orthene)	malathion (Cythion)
bromophos (Nexion)	merphos (Folex)
chlorpyrifos (Lorsban, Dursban)	naled (Dibrom)
coumaphos (Co-Ral)	oxydemeton-methyl (Metasystox-R)
cyanophos (Cyanox)	phenthoate
DEF (De-Green, E-Z-off D)	phosalone (Zolone)
diazinon (Spectracide)	phosmet (Imidan, Prolate)
dimethoate (Cygon, De-Fend)	phoxim (Baythion)
dioxathion (Delnav)	profenofos (Curacron)
ethion	propetamphos (Safrotin)
ethoprop (Mocap)	sulprofos (Bolstar)
fenitrothion (Agrothion, Sumithion)	temephos (Abate, Abathion)
fenthion (Baytex, Tiguvon, Entex, Lysoff, Spotton) iodofenphos (Nuvanol-N)	tetrachlorvinphos (Gardona, Rabon)
	trichlorfon (Dylox, Dipterex, Neguvon)

CARBAMATE PESTICIDES

Toxicity Category I
Signal Word “Danger”
(Highly Toxic)

aldicarb (Temik)
carbofuran (Furadan)
formetanate HCL (Carzol, Dicarzol)
methomyl (Lannate, Nudrin)
oxamyl (Vydate)

Toxicity Category II
Signal Word “Warning”
(Moderately Toxic)

bufencarb (Bux)
carbaryl (Sevin)
methiocarb (Mesurol, Draza)
pirimicarb (Pirimor, Aphox,
Rapid) promecarb (Carbamult)
propoxur (Baygon)

APPENDIX G: EXCERPTS FROM SELECTED CALIFORNIA LAWS

Health and Safety Code

Section 105200. Any physician and surgeon who knows, or has reasonable cause to believe, that a patient is suffering from pesticide poisoning or any disease or condition caused by a pesticide shall promptly report that fact to the local health officer by telephone within 24 hours and by a copy of the report required pursuant to subdivision (a) of Section 6409 of the Labor Code within seven days, except that the information which is available to the physician and surgeon is all that is required to be reported as long as reasonable efforts are made to obtain the information.

Each local health officer shall immediately notify the county agricultural commissioner and, at his or her discretion, shall immediately notify the Director of Environmental Health Hazard Assessment of each report received and shall report to the Director of Pesticide Regulation, the Director of Environmental Health Hazard Assessment, and the Director of Industrial Relations, on a form prescribed by the Director of Environmental Health Hazard Assessment, each case reported to him or her pursuant to this section within seven days after receipt of the report.

The Office of Environmental Health Hazard Assessment shall designate a phone number or numbers for use by local health officers in the immediate notification of the office of a pesticide poisoning report. The office shall from time to time establish criteria for use by the local health officers in determining whether the circumstances of a pesticide poisoning warrants the immediate notification of the office.

In no case shall the treatment administered for pesticide poisoning or a condition suspected as pesticide poisoning be deemed to be first aid treatment.

Any physician and surgeon who fails to comply with the reporting requirements of this section or any regulations adopted pursuant to this section shall be liable for a civil penalty of two hundred fifty dollars (\$250). For the purposes of this section, failure to report a case of pesticide poisoning involving one or more employees in the same incident shall constitute a single violation. The Division of Occupational Safety and Health of the Department of Industrial Relations shall enforce these provisions by issuance of a citation and notice of civil penalty in a manner consistent with Section 6317 of the Labor Code. Any physician and surgeon who receives a citation and notice of civil penalty may appeal to the Occupational Safety and Health Appeals Board in a manner consistent with Section 6319 of the Labor Code.

Each local health officer shall maintain the ability to receive and investigate reports of pesticide poisoning at all times pursuant to Section 12982 of the Food and Agricultural Code.

Section 105205. The Office of Environmental Health Hazard Assessment shall develop and implement, in cooperation with local health officers and state and local medical associations, a program of medical education to alert physicians and other health care professionals to the symptoms, diagnosis, treatment, and reporting of pesticide poisoning.

Labor Code

Section 6409. (a) Every physician as defined in Section 3209.3 who attends any injured employee shall file a complete report of every occupational injury or occupational illness to the employee with the employer, or if insured, with the employer's insurer, on forms prescribed for that purpose by the Division of Labor Statistics and Research. A portion of the form shall be completed by the injured employee, if he or she is able to do so, describing how the injury or illness occurred. The form shall be filed within five days of the initial examination. Inability or failure of an injured employee to complete his or her portion of the form shall not affect the employee's rights under this code, and shall not excuse any delay in filing the form. The employer or insurer, as the case may be, shall file the physician's report with the Department of Industrial Relations, through its Division of Labor Statistics and Research, within five days of receipt. Each report of occupational injury or occupational illness shall indicate the social security number of the injured employee. If the treatment is for pesticide poisoning or a condition suspected to be pesticide poisoning, the physician shall also file a complete report, which need not include the affidavit required pursuant to this section, with the Division of Labor Statistics and Research, and within 24 hours of the initial examination shall file a complete report with the local health officer by facsimile transmission or other means. If the treatment is for pesticide poisoning or a condition suspected to be pesticide poisoning, the physician shall not be compensated for the initial diagnosis and treatment unless the report is filed with the employer, or if insured, with the employer's insurer, and includes or is accompanied by a signed affidavit which certifies that a copy of the report was filed with the local health officer pursuant to the requirements of this section.

(b) As used in this section, "occupational illness" means any abnormal condition or disorder caused by exposure to environmental factors associated with employment, including acute and chronic illnesses or diseases which may be caused by inhalation, absorption, ingestion, or direct contact.