

Medical Supervision of Pesticide Workers

Guidelines for Physicians

Who Supervise Workers Exposed to Cholinesterase- Inhibiting Pesticides

5th Edition

April 2015



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

MEDICAL SUPERVISION OF PESTICIDE WORKERS

GUIDELINES FOR PHYSICIANS

*WHO SUPERVISE WORKERS EXPOSED TO
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Preface

The California Medical Supervision Program, a surveillance program for pesticide workers exposed to certain cholinesterase-inhibiting pesticides, has been in effect since 1974. The program is designed to protect these workers by monitoring their blood cholinesterase activity levels and taking actions when cholinesterase inhibition exceeds specified allowed levels. The goal of the Program is to prevent cumulative inhibition of cholinesterase activity resulting from multiple exposures to highly toxic organophosphate and carbamate pesticides.

The supervising physician is required to possess a copy of and be aware of the contents of this document, pursuant to California Code of Regulations Section 6728. The purpose of this document is to inform and advise physicians on their medical supervision of pesticide workers, and not to constrain the exercise of sound medical judgment. The regulations cited set forth minimum requirements and do not restrict physicians from providing more intensive medical supervision.

This 5th edition of ***Guidelines for Physicians*** covers current legal requirements for medical supervisors, including Health and Safety Code Section 105206, effective January 1, 2011.

Questions about the program and requests for assistance in performing medical supervision can be directed to the Office of Environmental Health Hazard Assessment (OEHHA) of the California Environmental Protection Agency, at:

Email address: Pesticides@oehha.ca.gov Please indicate “medical supervision of pesticide workers” in the subject line.

Phone: (510) 622-3170. Please tell the attendant that you are calling about the Medical Supervision Program.

Now Available at www.mededpesticide.org

- An online course that reviews the essential elements of the Medical Supervision Program. This course reinforces the information provided in these *Guidelines* that medical supervisors are required to know.
- A Spanish version of the Medical Supervision Program course.
- Another online course, [Recognition, Management, and Reporting of Pesticide Illnesses](#), is available in English and Spanish.
- These courses are free to everyone and offer Continuing Medical Education credit for physicians and nurses.

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This document may be reproduced freely and can be found online at:

<http://www.oehha.ca.gov/pesticides/programs/Helpdocs1.html>

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Summary

California regulations require employers to arrange with a licensed physician for medical supervision of agricultural workers who regularly handle Toxicity Categories I and II organophosphate and carbamate pesticides (see Tables 1 and 2 on the following pages). The Medical Supervision Program is a surveillance program that monitors these workers and consists of periodic measurements of blood cholinesterase activity levels in these workers.

Medical Supervisor Responsibilities

The medical supervisor oversees the monitoring of cholinesterase activity levels in exposed workers and plays a critical role in ensuring the safety of these pesticide workers. In this program, the medical supervisor:

- Orders tests for baseline levels of plasma and red blood cell cholinesterase activity levels in these workers prior to their exposure to these pesticides. (All blood samples collected for cholinesterase activity measurement should be placed in ice or at 4°C until time of assay.)
- Orders periodic tests of plasma and red blood cell cholinesterase activity levels in these workers that are using these pesticides, within three working days after the conclusion of each 30-day qualifying period.
- **(NEW)** Must indicate the purpose of the cholinesterase activity test ordered for this program on the laboratory test requisitions, that is whether the test is a baseline, follow-up, recovery, or for a suspected pesticide illness. More details and information on this are on pages 11 and 12.
- **(NEW)** Must ensure that the tested worker receives a copy of these test results and any recommendations from the medical supervisor within 14 days of the medical supervisor receiving the results. More details and information on this are on pages 11 and 12.
- Compares the results of tests taken during periods of pesticide exposure to the baseline levels to evaluate the degree of cholinesterase activity inhibition.
- Based on test results, makes recommendations to the employer regarding whether a worker can continue working with cholinesterase-inhibiting pesticides or whether the worker should be temporarily removed from working with such pesticides.
- Determines when a worker who has been removed from working with these pesticides due to excessive exposure can resume working with these pesticides, and makes a recommendation in this regard to the employer.
- Signs a written agreement with the employer responsible for the employees stating that the physician agrees to provide medical supervision. A sample

agreement form is provided in Appendix B.

This document is intended to guide physicians who undertake medical supervision and explain how to carry out each of these steps as required in the Medical Supervision Program.

Medical supervision is important because it can detect excessive pesticide exposure before workers become clinically ill. Medical supervision as discussed in this document is separate from emergency and day-to-day medical care, and medical supervisors are not necessarily responsible for providing emergency or routine medical care. The employer may make arrangements with other physicians for those services if needed.

Cholinesterase Monitoring

Who is monitored and how often to monitor, as required by regulation (CCR, Section 6728) are outlined in Tables 1 and 2 below.

Table 1. Pesticide Workers Who Require Testing

Type of Work	Pesticides Used	Duration of Exposure
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

Table 2. Required Frequency and Timing of Testing

Employee Status for Pesticide ¹ Exposure	Test Purpose (Marked on lab requisition)	Test Frequency
New	Baseline	Optimal: Two tests spaced 3-14 days apart prior to any exposure to cholinesterase inhibiting pesticides
	Follow-up	Test ² once for the first three 30-day qualifying periods within three days after the end of each qualifying period
Regular (after the first three 30-day qualifying periods)	Follow-up	Test once in every 60-day period unless medical supervisor specifies otherwise in writing within three days after the end of second 30 day qualifying period.
	Baseline	Verify every two years
Removed from pesticide work due to depressed cholinesterase activity	Recovery (no current cholinesterase inhibiting pesticide exposure)	(Recommended) Retest weekly until plasma and RBC cholinesterase activity levels return to 80% or more of baseline. At that point, the employee can return to working with these pesticides
Accidentally exposed to pesticide	Suspected pesticide illness	Test as clinically indicated. (Immediate examination and retesting is indicated when an accidental exposure such as splashes or spills occur)

¹ Organophosphates and carbamates carrying the signal word “DANGER” or “WARNING” on label (Category I or II).

² 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.

Assistance

OEHHA offers a free online course (with Continuing Medical Education credit), The Medical Supervision Program, which can help reinforce the information in this document and can be accessed at: www.mededpesticide.org

OEHHA offers advice and consultation to physicians undertaking responsibility for medical supervision of pesticide workers. Please address inquiries to:

Office of Environmental Health Hazard Assessment
 Pesticide and Environmental Toxicology Branch
 1515 Clay St., 16th Floor
 Oakland, California 94612
 Attn: Pesticide Epidemiology Section

Telephone: (510) 622-3170

FAX: (510) 622-3218

Website: <http://www.oehha.ca.gov>

Consultation on the treatment of organophosphate poisoning can also be obtained from the following sources:

- Worker Health and Safety Branch, California Department of Pesticide Regulation at (916) 445-4222
- Environmental Health Investigations Branch, California Department of Public Health at (510) 620-3620
- Occupational Health Branch, California Department of Public Health at (510) 620-5757
- California Poison Control Center at (800) 411-8080.

GUIDELINES FOR PHYSICIANS WHO SUPERVISE WORKERS EXPOSED TO CHOLINESTERASE INHIBITING PESTICIDES

Pesticide Workers Who Require Medical Supervision Testing

Regulations administered by the California Department of Pesticide Regulation (DPR) require that employers provide medical supervision for agricultural employees who regularly handle 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 handle 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.** The term “handle” means mixing, loading, transferring, applying or assisting with the application of pesticides. Flaggers and persons who enter a treated field during a restricted entry interval are also covered under these regulations. A complete definition of this term can be found in Title 3 of the California Code of Regulations, Section 6000. (See Appendix A)

Employees who meet the requirements stated above require periodic testing 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.

Cholinesterase inhibiting pesticides

Information about health effects of cholinesterase inhibiting pesticides can be found in our online course, *Recognition, Management, and Reporting of Pesticide Illnesses*, which can be accessed at: www.mededpesticide.org

According to the DPR’s Pesticide Use Report for 2014, toxicity categories I and II cholinesterase inhibiting pesticides used in California in 2012 in amounts of more than 100 pounds are as follows:

Acephate	Dimethoate	Methiocarb	Phorate
Aldicarb	Disulfoton	Methomyl	Phosmet
Azinphos-methyl	Ethephon	Methyl Parathion	Propetamphos
Bensulide	Ethoprop	Naled	Propoxur
Carbaryl	Fenamiphos	Oxamyl	Tribufos
Chlorpyrifos	Formetanate-HCl	Oxydemeton-methyl	Tetrachlorvinphos
Dichlorvos (DDVP)	Malathion	Parathion	Thiodicarb
Diazinon	Methidathion		

Information for current registration in California can be obtained from the California Department of Pesticide Regulation at (916) 445-4300 or at <http://cdpr.ca.gov/docs/registration/regmenu.htm>

Usually there are several common and trade names for each pesticide. Physicians who have questions about the chemical identity of specific pesticides can try to locate the information on the internet (e.g., DPR or U.S. EPA web pages that address pesticides) or contact OEHHA, their local agricultural commissioner or poison control center for assistance (see page 4).

Medical Supervision

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 offered as guidelines and are not intended to constrain the exercise of sound medical judgment.

1. Mutual Understanding and Agreement 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 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 that are 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 negotiation. 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 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

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 force as a group. These functions include the following:

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. Further consultation on the treatment of organophosphate poisoning can be obtained from the following sources:

- Office of Environmental Health Hazard Assessment (OEHHA) at (510) 622-3170
- Worker Health and Safety Branch, California Department of Pesticide Regulation at (916) 445-4222
- Environmental Health Investigations Branch, California Department of Public Health at (510) 620-3620
- Occupational Health Branch, California Department of Public Health at (510) 620-5757
- California Poison Control Center at (800) 411-8080.

Clarification in writing of expectations and change in relationship with employer

Supervising physicians should, as good practice, provide the employers with written instructions concerning standard procedures, such as handling overexposures and emergencies, and scheduling cholinesterase tests. They should confirm in writing any verbal instructions they give to employees or recommendations given to 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 that the physician considers essential for medical supervision are to be authorized by the

employer and required of the employee. Furthermore, it should 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. (Sample forms that physicians can use to inform employers of their recommendations are provided in Appendix B.)

Each supervised employee should be authorized by their employer to contact or visit the designated physician whenever the employee:

1. believes he/she has been overexposed to an organophosphate or carbamate pesticide, or
2. experiences symptoms suggestive of poisoning by such pesticides.

Understanding Worker Practice and Pesticides

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 pesticides that are 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.

Employer responsibilities

- The employer should notify the medical supervisor in writing when a supervised employee permanently stops working with cholinesterase-inhibiting pesticides.
- DPR regulations¹ 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 form setting forth these instructions and a statement of services to be provided is offered for the employer and medical supervisor's use in Appendix B. The use of standard forms can facilitate medical supervision. Other forms to facilitate written confirmation of employee status, requests for laboratory testing, and notification that the employee no longer needs medical supervision are also offered in Appendix B.
- DPR regulations require that the employer follow the recommendations of the medical supervisor concerning matters of occupational health.

¹ California Code of Regulations, Section 6728(b)

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. The physician's 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 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, DPR, 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.

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 cholinesterase-inhibiting pesticides. Because individuals with significant respiratory, hepatic or cardiovascular impairment face special risks in jobs requiring exposure to cholinesterase-inhibiting pesticides, the physician should also inquire about a history of conditions that may be adversely affected by cholinergic reactions. Conditions in which complications may be anticipated include peptic ulcer, bronchial asthma, 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-inhibiting drugs. 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. A sample form in Appendix B can be used for fitness to work recommendations.

4. Cholinesterase Monitoring

Biological monitoring of workers is indicated in occupations where repeated exposures to toxic chemicals 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:

- to detect potentially serious individual exposures *before* the occurrence of clinical illness, and
- 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 there is some repeated, common, and correctable exposures.

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.

(All blood samples collected for cholinesterase activity measurement should be placed in ice or at 4°C until time of assay.)

Ordering the test pursuant to new requirements

New and important requirements since the 4th edition of the *Guidelines*

In accordance with legislation that took effect January 1, 2011 (Health and Safety Code Section 105206), medical supervisors in the Medical Supervision Program are required to:

- Indicate the purpose of the cholinesterase activity tests on the laboratory test requisitions when they are ordered for the pesticide workers they are monitoring.
- Ensure that the person tested receives a copy of these test results and any recommendations from the medical supervisor within 14 days of the medical supervisor receiving the results.

In addition:

- All physicians in California, not just medical supervisors, are also required to indicate the purpose of the cholinesterase activity tests if ordered for a possible pesticide illness due to any cholinesterase inhibiting pesticide.

Since this law went into effect, most cholinesterase activity test results received by DPR have not had the purpose indicated on them, and some that did had the purpose stated in terms not useable for evaluation of the Program. Therefore, OEHHA is recommending that only the following terms be used to indicate the purpose of the test when ordered for the Medical Supervision Program:

- a) Baseline** (for tests done on workers prior to monitoring to establish the levels to which follow-up tests are compared).
- b) Follow-up** (for tests done on workers who have handled cholinesterase-inhibiting pesticides more than six days in a 30-day period).
- c) Recovery** (for tests done on workers after they have been removed from working with these pesticides because their cholinesterase activity levels dropped below one of the action level thresholds).
- d) Suspected Pesticide Illness** (all physicians in California, not just medical supervisors, are also required to indicate the purpose of the cholinesterase test if

ordered for a possible or suspected pesticide illness due to exposure to any cholinesterase inhibiting pesticide).

These requirements are scheduled to expire on January 1, 2017 unless the law is extended.

Use of approved laboratories is required

Laboratory testing of cholinesterase levels has definite limitations and must be used with the qualifications described below.

- *A laboratory performing cholinesterase tests as part of medical supervision must be approved by 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 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 technique 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.
- All laboratories that run cholinesterase activity tests are required to send the results to DPR, per Health and Safety Code Section 105206. (This provision took effect on January 1, 2011.)

Plasma and RBC cholinesterase

- Plasma (or serum) and RBC cholinesterase should both 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 a mild exposure there can be 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. 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 established 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 inhibiting pesticides 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 possible, 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, 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 manifestations of toxicity. The margin of safety is especially important in the case of cholinesterase-inhibiting pesticides because of the insidious onset and nonspecific nature of early symptoms in cases of chronic exposure.

After a baseline value is established, working season testing (periodic follow-up testing) is begun if the worker handles Toxicity Category I or 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 the plasma or RBC cholinesterase activity level falls below the following percentage levels of their baselines, 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 work with these pesticides.

≤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 work with these pesticides.

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.

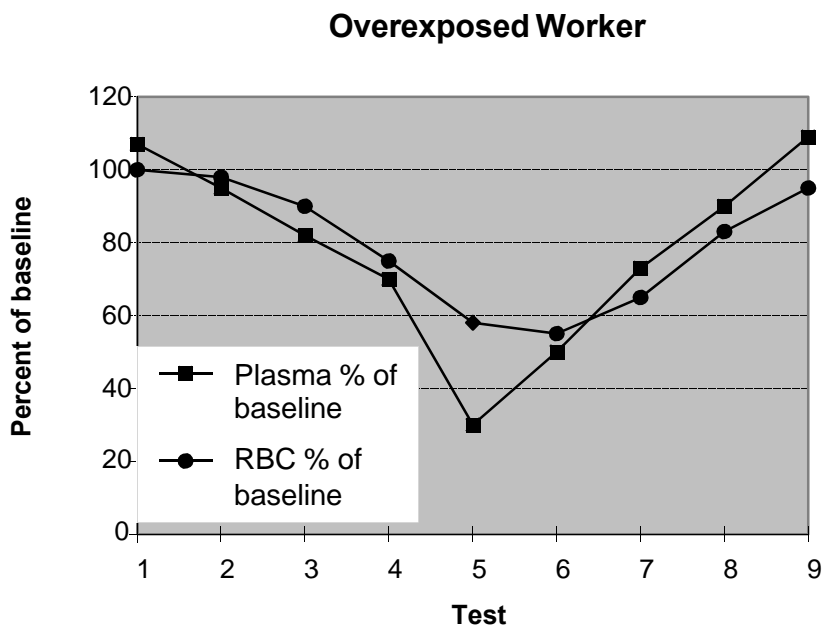
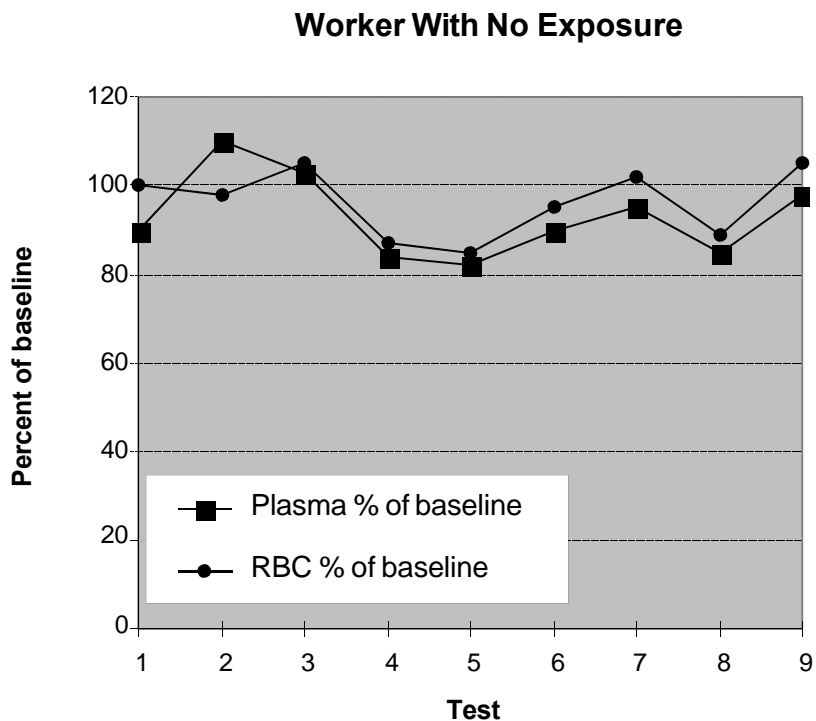


Figure 1. Illustrative cholinesterase monitoring charts. Data are shown for hypothetical tests taken at prescribed intervals. In the lower chart, the decline in both the plasma and RBC cholinesterase values following test 3 indicates significant exposure to cholinesterase-inhibiting pesticides, while the rise in enzyme activities 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-inhibiting pesticides 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 if the worker is not clinically ill. A pesticide illness report should be filed along with the Doctor's First Report of Occupational Injury or Illness (DFR) in this case.

Removal from exposure means avoidance of areas where organophosphate or carbamate pesticides 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 specified in regulation (California Code of Regulations, Section 6728(c)(2); see Appendix A, part 2). After a pre-exposure baseline is established, the first follow-up 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 follow-up 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 testing frequency requirements are presented in tabular form in the Summary, and in a pictorial in Figure 2 below. Also, some explanations on testing intervals have been included in the physician's sample letter to the employer in Appendix B.

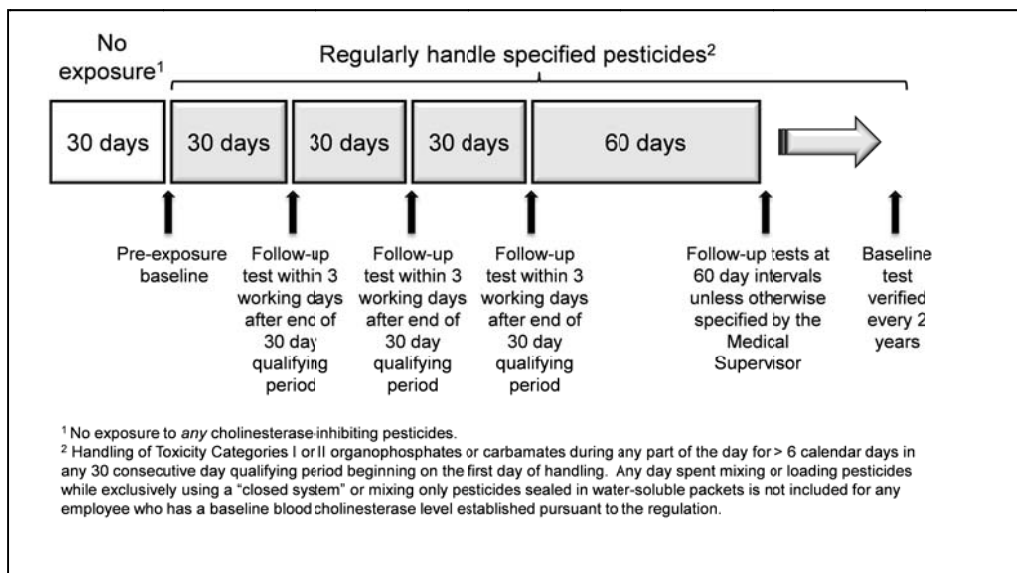


Figure 2. Summary diagram on the frequency of cholinesterase activity testing

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

- The frequency, duration 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 workers.
- 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 follow-up 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 self-administered by or provided to 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, and this 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 blood sample cannot be analyzed right away, it 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.)

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* during the interval between sample collection and analysis, 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 (see Appendix A), physicians must report to their local health officer by telephone within 24 hours any case that they know, or have reasonable cause to believe, is related to pesticide poisoning. All types of pesticide-related cases must be reported: skin and eye injuries, systemic poisonings, suicides and homicides, and home and occupational cases. More specific information on how to report pesticide illnesses can be viewed at <http://www.oehha.ca.gov/pesticides/programs/Pestrpt.html>

For occupational cases involving pesticides, Health and Safety Code Section 105200 and Labor Code Section 6409(a) (see Appendix A) 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 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 at <http://oehha.ca.gov/pesticides/pdf/dlsrform5021.pdf>

Pesticide illness reporting provides valuable information to the state for 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 of being 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, the cholinesterase test can detect excessive exposure before workers become sick. Second, antidotes for poisoning are available, and if they are administered early and in adequate amounts, they can save the lives of victims who have absorbed even several times the lethal 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 and Other Sources of Information

OEHHA offers advice and consultation to physicians undertaking responsibility for medical supervision of pesticide workers. Please address inquiries to:

Office of Environmental Health Hazard Assessment
Pesticide and Environmental Toxicology Branch
1515 Clay St., 16th Floor
Oakland, California 94612
Attn: Pesticide Epidemiology Section

Telephone: (510) 622-3170
FAX: (510) 622-3218

Website: <http://www.oehha.ca.gov>

A useful reference for recognizing pesticide illness is the 6th edition of *Recognition and Management of Pesticide Poisonings* by Reigart and Roberts, published in 2013. It has updated chapters on the treatment of organophosphate poisoning and N-methyl carbamate poisoning. These chapters can be viewed on an electronic version of the publication at:

http://www2.epa.gov/sites/production/files/documents/rmpp_6thed_final_lowresopt.pdf

This book has individual chapters on general categories of pesticides (insecticides, herbicides, fungicides, fumigants, etc.) with sub-sections on specific pesticide classes and widely used active ingredients. Toxicology, symptoms and signs of poisoning, procedures for confirmation of diagnosis, and treatment and antidotes are described. The book includes a special index to pesticide poisonings by symptoms and signs, coordinating symptoms with pesticides that could cause them. Hard copies can be obtained at:

<http://www.epa.gov/agriculture/awor.html>

Another source of information on pesticide illnesses due to cholinesterase-inhibiting pesticides is our online course, Recognition, Management, and Reporting of Pesticide Illnesses, which is available in English and Spanish at:

<https://www.mededpesticide.org>

Questions and Answers about the Medical Supervision of Workers Using Cholinesterase Inhibiting Pesticides

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 being further exposed 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 work environments or situations that may lead to additional exposure.

“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. (See Appendix A.)

2. Which employees are monitored?

The employees monitored are agricultural pesticide workers who “regularly handle” organophosphate or carbamate pesticides with the signal words “Danger” or “Warning” on the label. They include mixers, loaders, applicators (both ground and aerial application), and flaggers.

3. Why are these employees monitored?

The purpose of medical supervision is to prevent cumulative inhibition of cholinesterase activity resulting from multiple exposures to highly toxic organophosphate and carbamate 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 helps the medical supervisor determine when it will be safe for them to return to that work. Other benefits of monitoring are enhanced vigilance, increased worker and employer awareness of how toxic these chemicals are, and development of a common goal of handling highly toxic organophosphate and carbamate pesticides safely.

4. Do field workers need medical supervision?

Field workers do not participate in the Medical Supervision Program because there are other means to prevent excessive exposure such as restricted entry intervals and pre-harvest intervals. However, if field workers also handle the above-mentioned pesticides 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” Toxicity Categories I and II organophosphate and carbamate 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 results of all required cholinesterase tests for three years. A sample contract form is included in Appendix B of this publication.

7. Who does the actual medical supervision?

A physician contracted by the employer does the actual medical supervision. The employer must 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 one enzyme or the other. 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 intended 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 follow-up testing should be done for three 30-day qualifying intervals; if the medical supervisor has no written recommendations to the contrary during that period, the follow-up testing interval shall then be extended to 60 days. The follow-up 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 be tested 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 cholinesterase activity.

11. What does Section 105206 of the Health and Safety Code require of medical supervisors?

Section 105206 of the Health and Safety Code of California took effect on January 1, 2011. It requires that medical supervisors:

- Indicate the purpose of the cholinesterase activity tests on the laboratory test requisitions when they are ordered for the pesticide workers they are monitoring.
- Ensure that the person tested receives a copy of the test results and any recommendations from the medical supervisor within 14 days of the medical supervisor receiving the results.

In addition:

- All physicians in California, not just medical supervisors, are required to indicate the purpose of the cholinesterase activity tests if ordered for a possible pesticide illness due to any cholinesterase inhibiting pesticide.

12. Are there specific terms medical supervisors should use to indicate the purpose of the tests?

Yes. The State is recommending that only the following terms be used to indicate the purpose of the test:

1. **Baseline** (for tests done on workers prior to monitoring to establish the levels to which follow-up tests are compared).
2. **Follow-up** (for tests done on workers who have handled cholinesterase-inhibiting pesticides more than six days in a 30-day period).
3. **Recovery** (for tests done on workers after they have been removed from working with these pesticides because their cholinesterase activity levels dropped below one of the action level thresholds).
4. **Suspected Pesticide Illness** (all physicians in California, not just medical supervisors, are also required to indicate the purpose of the cholinesterase test if ordered for a possible or suspected pesticide illness due to any cholinesterase inhibiting pesticide).

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

Yes. Neither these **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. The regulations clearly state, "The employer shall follow the recommendations of the medical supervisor concerning matters of occupational health."

14. Can any laboratory do the cholinesterase tests?

No. The plasma and RBC cholinesterase tests ordered by the medical supervisor for this program 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>

15. 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. The regulations state 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.”

16. 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 cholinesterase 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 at least 90 percent correlation coefficient squared ($r^2 = 0.90$).

Since there is variability in results from different laboratories, it is recommended that the same laboratory and analytical method 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, incorrect calculation of follow-up test results relative to the baseline, and poor record keeping and organization.

17. What are baseline values?

Baseline values are the plasma cholinesterase and RBC cholinesterase determinations 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.

18. 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. 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 laboratory. (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. The average of the two closest values is designated as the baseline activity level.

19. What if circumstances don't allow the applicator to achieve a 30-day exposure free period from cholinesterase inhibiting pesticides?

If circumstances preclude collecting blood samples after a 30-day exposure-free period, then a "working baseline" should be obtained after the longest practicable exposure-free period possible with a notation indicating the date of the last exposure. If the "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. 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.

20. Why are two or three tests recommended to establish a baseline?

The reason that plasma and RBC cholinesterase levels should each be measured two or three times to establish the baseline is to reduce test-retest variability. This should 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.

21. 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 specific actions must be 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.

22. How is the baseline verified every two years?

Although the regulations state, "Baseline values shall be verified every two years," the term "verification" is not defined and a process for it is not specified. However, any recent monitoring test showing that no depression has occurred should be sufficient to verify the original baseline. Another simple method for verification is to repeat the baseline tests and reconstruct the baseline values every two years.

23. Can a cholinesterase activity 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 have baseline activity values that fall outside of the laboratory normal range. Therefore, the most accurate comparison is to each individual’s own baseline value, determined prior to any exposure to cholinesterase-inhibiting pesticides.

24. 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 Category I or 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 the plasma or RBC cholinesterase activity level falls below the following percentages of their baselines, 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 work with these pesticides.

≤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 work with these pesticides.

25. If an employee's cholinesterase activity levels fall below the removal levels, does it mean that the employee 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.

26. If the cholinesterase activity levels are *elevated* above baseline, 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.

27. 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.

28. Why does a physician have to interpret the results? Can't the laboratory 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 retesting is needed are clinical decisions. Furthermore, a physician supervisor is required by the regulations.

29. 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 county 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.

30. Who maintains the records for the medical supervision program and 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 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. These records are required to be maintained for three years and they must be available for inspection by the employee, the Director of DPR, the county agricultural commissioner, the 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.

31. If a worker has been made ill by pesticides at work, is the medical supervisor the physician this worker should see 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, 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.

32. 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 inhibiting pesticides, is reportable. Definitely diagnosed cases as well as suspected but not definitely diagnosed cases are reportable.

More information on reporting pesticide illnesses can be viewed at:

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

33. If a worker is removed from working with cholinesterase inhibiting pesticides because his/her cholinesterase activity level is 70 percent or less of the RBC cholinesterase baseline and/or 60 percent or less of the plasma cholinesterase baseline, does this have to be reported as a pesticide related illness? If it does, how, when, and to whom should it be reported?

If the removed employee is asymptomatic and is working at other duties that do not expose him/her to cholinesterase-inhibiting pesticides, then this does not have to be reported. 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 if the worker is not clinically ill. A pesticide illness report should be filed along with the Doctor's First Report of Occupational Illness and Injury (DFR) in this case. If the worker is ill with signs and symptoms consistent with 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 Section 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 DFR 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>

34. Besides the recommendations provided in these Guidelines, is there anything else the medical supervisor, the employer, and the employee can do to make the Medical Supervision Program more effective?

It is strongly recommended that the medical supervisor provide medical examinations for each employee to be sure they are fit for their occupational duties, be familiar with the

pesticides used by the employers, and know the signs and symptoms caused by exposure to these pesticides.

It would be desirable for the employer to inform the physician of the pesticides used, explain medical supervision to the employee, and inform the physician of the reason an employee is being seen. The employer is also required by the California Code of Regulations to provide employee training, send in employees for baseline cholinesterase determinations and working season (follow-up) testing, honor the physician's judgments and requests, and file the name of the medical supervisor with the county agricultural commissioner. The employer should file medical supervision records by work groups to facilitate contacting other similarly exposed workers, if needed.

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

35. 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 Tables 1 and 2 in the Summary, which is at the beginning of this document. However, the only way to understand this program and how it operates is by reading the ***Guidelines***, and understanding the elements and details of the Medical Supervision Program. A free online course with CME credit, *The California Medical Supervision Program*, reinforces the information provided in this document and is available at: www.mededpesticide.org

36. 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.

Appendix A: Excerpts from California Regulations and Statutes Pertaining to Medical Supervision

1. Definition of terms related to Medical Supervision (CCR² Title 3 Section 6000)

(Terms excerpted from regulation based on relevance to California's Medical Supervision Program)

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

"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.

"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.

"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.

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

"Organophosphates" means organophosphorus esters which inhibit cholinesterase.

"Pesticide" means:

² California Code of Regulations

- (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.

"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.

"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).

2. Medical Supervision of Workers Handling Cholinesterase Inhibiting Pesticides (CCR Title 3 Section 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 Office of Environmental Health Hazard Assessment). 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:
 - (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.

Additional regulations of pesticides and pest control operations from Title 3 of the California Code of Regulations can be viewed at:
http://www.cdpr.ca.gov/docs/legbills/calcode/chapter_.htm

3. Reporting Requirements for Cholinesterase Testing Laboratories and Form Completion by Medical Supervisor (H&SC³ Section 105206. Laboratory Reporting)

(Note: Emboldening and underlining of Section 105206(c) was added to emphasize the subsection pertaining specifically to the medical supervisor.)

- (a) A laboratory that performs cholinesterase testing on human blood drawn in California for an employer to enable the employer to satisfy his or her responsibilities for medical supervision of his or her employees who regularly handle pesticides pursuant to Section 6728 of Title 3 of the California Code of Regulations or to respond to alleged exposure to cholinesterase inhibitors or known exposure to cholinesterase inhibitors that resulted in illness shall report the information specified in subdivision (b) to the Department of Pesticide Regulation. Reports shall be submitted to the Department of Pesticide Regulation on, at a minimum, a monthly basis. For the purpose of meeting the requirements in subdivision (d), the reports shall be submitted via electronic media and formatted in a manner approved by the director. The Department of Pesticide Regulation shall share information from cholinesterase reports with the OEHHA and the State Department of Public Health on an ongoing basis, in an electronic format, for the purpose of meeting the requirements of subdivisions (e) and (f).
 - (b) The testing laboratory shall report all of the following information in its possession in complying with subdivision (a):
 - (1) The test results in International Units per milliliter of sample (IU/mL).
 - (2) The purpose of the test, including baseline or other periodic testing, pursuant to the requirements of Section 6728 of Title 3 of the California Code of Regulations, or evaluation of suspected pesticide illness.
 - (3) The name of the person tested.
 - (4) The date of birth of the person tested.
 - (5) The name, address, and telephone number of the health care provider or medical supervisor who ordered the analysis.
-

³ Health and Safety Code

- (6) The name, address, and telephone number of the analyzing laboratory.
 - (7) The accession number of the specimen.
 - (8) The date that the sample was collected from the patient and the date the result was reported.
 - (9) Contact information for the person tested and his or her employer, if known and readily available.
- (c) **The medical supervisor ordering the test for a person pursuant to subdivision (a) shall note in the test order the purpose of the test, pursuant to paragraph (2) of subdivision (b), and ensure that the person tested receives a copy of the cholinesterase test results and any recommendations from the medical supervisor within 14 days of the medical supervisor receiving the results.**
- (d) All information reported pursuant to this section shall be confidential, as provided in Section 100330, except that the OEHHA, the Department of Pesticide Regulation, and the State Department of Public Health may share the information for the purpose of surveillance, case management, investigation, environmental remediation, or abatement with the appropriate county agricultural commissioner and local health officer.
- (e) The OEHHA shall review the cholinesterase test results and may provide an appropriate medical or toxicological consultation to the medical supervisor. In addition to the duties performed pursuant to Section 105210, the OEHHA, in consultation with the Department of Pesticide Regulation and the local health officer, may provide medical and toxicological consultation, as appropriate, to the county agricultural commissioner to address medical issues related to the investigation of cholinesterase inhibitor-related illness.
- (f) By December 31, 2015, the Department of Pesticide Regulation and the OEHHA, in consultation with the State Department of Public Health, shall prepare a report on the effectiveness of the medical supervision program and the utility of laboratory-based reporting of cholinesterase testing for illness surveillance and prevention. The joint report may include recommendations to the Legislature that the Department of Pesticide Regulation and the OEHHA deem necessary. The Department of Pesticide Regulation and the OEHHA shall make the report publicly available on their Internet Web sites.
- (g) This section shall remain in effect only until January 1, 2017, and as of that date is repealed, unless a later enacted statute, that is enacted before January 1, 2017, deletes or extends that date.
-

4. General: Pesticide Illness Reporting (H&SC 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.

5. General: Requirements on Physicians Regarding Occupational Injury and Illness (Cal. Labor Code Section 6409)

Section 6409 Doctor's First Report of Occupational Injury or Illness

(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.

Appendix B: Sample Forms to Aid the Medical Supervisor

New Medical Supervisor - Employer Relationship

Initiation of Medical Supervision for New Employee

Request for Clinical Chemistry Laboratory Service

Notification of Change of Health Status of Pesticide Worker Exposed to Cholinesterase-Inhibiting Pesticides

Notification that Employee No Longer Requires Medical Supervision for Cholinesterase Inhibition

New Medical Supervisor - Employer Relationship

(Medical Supervisor sends to employer after receipt of request for services)

To: _____
(First and Last Name)

Company Name _____

Address _____

You have requested that I provide medical supervision to your employees that handle cholinesterase inhibiting pesticides requiring such supervision, as described in the Pesticide Safety Regulations (Section 6728, Title 3, California Code of Regulations). This involves testing for cholinesterase activity in red blood cells and plasma as outlined below.

The employees covered by this regulation are workers engaged in production agriculture who “regularly handle” specific pesticides. The specific pesticides are organophosphates and carbamates in Toxicity Categories I or II. They have the signal word “DANGER” or “WARNING” respectively 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 regularly handling these pesticides as a mixer, loader, ground or aerial applicator, or flagger, *it is your responsibility* to do the following:

1. **Before pesticide exposure begins**, have that employee come to me for an examination and at least two blood cholinesterase activity tests at least three days apart. The purpose of this first series of tests is to establish a 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.
 - It is required that employees have their baseline verified every two years.
2. Send a copy of this form to the County Agricultural Commissioner prior to the time when the employee begins to “regularly handle” these pesticides
3. Within three working days after meeting the qualifying standard for “regularly handling” the pesticides described above, ensure that the employee has cholinesterase activity tests, that is, ensure the employee obtains from me a requisition for laboratory testing and that the employee has the test performed.
4. If the employee continues to regularly handle the pesticides described above for the next two qualifying 30-day periods, ensure the employee has the cholinesterase activity tests.

5. After three tests at 30-day intervals, when any new employee continues to regularly handle the pesticides described above, ensure testing occurs at every second qualifying period (every 60 days), unless I indicate otherwise to you in writing.
6. Ensure that subsequent cholinesterase activity determinations are conducted at least as frequently as I recommend.

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 follow-up testing. With mutual cooperation we should be able to assure your employees a safe work environment.

The requirements I have outlined are as required by regulation and as explained in the *Guidelines for Physicians who Supervise Workers Exposed to Cholinesterase Inhibiting Pesticides*, 5th Edition by the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment. In agreeing to provide medical supervision, I expect your firm to abide by the provisions in regulation and I intend to perform my functions in accordance the regulation.

Signed: _____, M.D.

Date _____

Address: _____

Initiation of Medical Supervision for New Employee

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 _____

The above named employee will regularly handle Toxicity Categories I and II organophosphate and/or carbamate pesticides beginning on _____. The employee needs to be tested for baseline cholinesterase activity before he/she begins to handle these pesticides. .

Signed by Employer _____ Title _____

Date _____

To: Employer _____

Name of Employee 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 CLINICAL CHEMISTRY LABORATORY SERVICE

PLASMA AND RBC CHOLINESTERASE MEDICAL SUPERVISION OF PESTICIDE WORKER

To: _____
(Clinical Laboratory)

Address: _____ Phone: _____

Employee: _____

Working for: _____
(Employer)

Employer's Address: _____

Is referred to you on: _____ for assay of plasma and RBC cholinesterase activities
(Date)

Purpose of cholinesterase activity measurement:

- | | | | |
|--|---|--|--|
| <input type="checkbox"/> Baseline
(before exposure) | <input type="checkbox"/> Follow-up
(monitoring of
exposed worker) | <input type="checkbox"/> Recovery
(after removal from
work for overexposure) | <input type="checkbox"/> Suspected Pesticide Illness
(accidental overexposure
to pesticides) |
|--|---|--|--|

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 is retained by physician.

NOTIFICATION THAT EMPLOYEE NO LONGER REQUIRES MEDICAL SUPERVISION

To: Physician and Laboratory _____
(Physician)

(Laboratory)

(Name of Person) _____ is no longer involved in regular handling 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)