Appendix B: LABORATORY-BASED REPORTING OF CHOLINESTERASE TESTING

2. Evaluation of the Process of Laboratory-Based Reporting

A. Laboratories approved for cholinesterase testing for occupational health surveillance

The Program requires that ChE tests ordered by medical supervisors shall be performed by a clinical laboratory approved by the State Department of Health Services (SDHS). On July 1, 2007, SB 162 (California Public Health Act) established the California Department of Public Health (CDPH) and transferred certain programs from SDHS to CDPH. CDPH is responsible for maintaining the list of laboratories approved for ChE testing for occupational health surveillance (see page 48). A laboratory is approved to perform ChE tests if it complies with the use of the prescribed methods for their analysis (e.g., Ellman method), or a method approved by CDPH. The procedure for blood collection and storage, as well as the method for analysis, are outlined in 3CCR §6728 (Appendix A1).

In 2010, only six of the 13 laboratories on CDPH's list at that time confirmed that they still perform ChE analysis for occupational health surveillance (Table B2a). To the best of our knowledge, these laboratories do not go through proficiency assessments for ChE testing. Laboratories that perform similar analytical tests usually undergo regular evaluations by an independent 3rd party to ensure the quality and validity of their test methods.

Table B2a: Laboratories that perform cholinesterase test analysis	
ARUP	ARUP Laboratories, Salt Lake City, UT
MEDTOX	MEDTOX Laboratories Inc., St. Paul, MN
PACTOX	Pacific Toxicology Laboratory, Chatsworth, CA
PALI	Physicians Automated Laboratory, Inc., Bakersfield, CA
QDI- SAC	Quest Diagnostics Inc., Sacramento, CA
QDI- SJC	Quest Diagnostics Inc., Nichols Institute, San Juan Capistrano, CA

B. The roles and responsibilities of a medical supervisor

In addition to ordering the RBC and plasma ChE tests, a medical supervisor is also responsible for interpreting the results and making recommendations to ensure the safety of handlers as defined in the Program and HSC §105206. A more detailed description of the roles and responsibilities of a medical supervisor can be found in the *Guidelines for Physicians*.

C. Obtaining a blood specimen and transfer of data for cholinesterase testing

An employer sends an employee under the Program for ChE testing to a contracted medical supervisor who will order the ChE tests. The employee's blood is drawn at the medical supervisor's office or at a drawing laboratory. If the blood specimen is drawn at a physician's office or at a drawing laboratory that is not equipped to analyze ChE tests, the specimen is forwarded to a *reference laboratory* for analysis.

Any information indicated by the medical supervisor on a test order is recorded by the drawing laboratory and transmitted to the reference laboratory. The ChE test orders may contain missing or incomplete information on the employee, the ordering physician, or the employer (e.g. information left blank, partially completed or entered as "unavailable," missing first or last names, etc.). However, even though the ChE test order may not contain all the information required by HSC §105206, it does not prevent the ordering physician from submitting the test order.

The reference laboratories have little or no direct communication with the tested employee or ordering physician. These laboratories can submit to DPR only the information that have been provided to them and may not have, or are not able to obtain, the HSC §105206-specified data elements that are required in the ChE test reports.

The 6 laboratories submit ChE test results to DPR on, at a minimum, a monthly basis.

D. Reporting of cholinesterase test results to DPR

DPR modified its Secure Access Website (SAW) to develop a mechanism for electronic reporting. SAW is an online application used by DPR to transmit documents containing personal and confidential information related to pesticide illness investigations. SAW uses SSL (Secure Socket Layer) to encrypt network communication from a user to DPR. Microsoft Excel was chosen as the standard for submitting ChE test reports with each column header in the spreadsheet representing a data element. Laboratories are responsible for generating these Excel spreadsheets. We are unable to implement quality control measures on the submitted reports through data validation rules. Occasionally, the laboratories deviate from the prescribed reporting format.

Table B2b: Data Elements specified under HSC §105206	
1.	RESULTS of the ChE test in IU/mL
2.	PURPOSE of the test
3.	NAME of person tested
4.	DATE OF BIRTH of person tested
5.	NAME, ADDRESS and TELEPHONE NUMBER of medical supervisor who ordered the analysis
6.	NAME, ADDRESS, TELEPHONE of the analyzing laboratory
7.	ACCESSION NUMBER of the specimen
8.	COLLECTION DATE when blood specimen was drawn
9.	RESULT REPORT DATE
10.	PATIENT'S contact information
11.	EMPLOYER'S contact information (if known and readily available

In addition to the data elements specified under HSC §105206 (Table B2b), DPR requested additional information be included in the ChE test reports to assist in identifying unique patient records and rule out ChE tests not related to the Program (Table B2c).

Table B2c: Additional data elements requested by DPR	
1.	TEST TYPE – ChE RBC (Acetylcholinesterase) and ChE Plasma (Serum or Butyrylcholinesterase). Both test types are required for persons being tested for blood ChE in the Program.
2.	LOWER and UPPER LIMIT OF NORMAL RANGE – The reference range of normal ChE values vary amongst laboratories.
3.	DATE OF RECEIPT BY LABORATORY – when a reference laboratory received the blood specimen sample
4.	ANALYSIS DATE – when the blood specimen was processed using the prescribed analytic method (e.g., Ellman method)
5.	Drawing Laboratory's Name, Address, Telephone, Fax, Cellular Number, Email
6.	Medical supervisor's middle initial, fax number and email
7.	Employer's fax number, and email.

E. Purpose of Cholinesterase Test

Early in discussions with DPR, the laboratories communicated their concerns about meeting the requirements of HSC §105206. The laboratories stated that they may not be able to report the purpose of the tests since ordering physicians do not indicate this on the laboratory requisition slips. Without knowing the reason for the ChE test, it is difficult to interpret the test result in relation to the worker's activities and practices. Furthermore, this information is critical for accurately calculating the percent ChE depression of a worker.

Purpose of Test Terminology

- **BASELINE**: Pre-exposure test ordered to establish the normal ChE activity level of a worker under the Program.
- **ROUTINE MONITORING**: Test ordered for routine monitoring of a worker under medical supervision.
- **EVENT (Evaluation of suspected illness)**: Test ordered to identify effects of a suspected or reported pesticide exposure.

Early ChE test reports showed that there was no standard terminology used by physicians to indicate the purpose of the test. In 2011, DPR and OEHHA jointly sent a letter to 841[1] healthcare providers and/or drawing laboratories in an effort to improve the data quality of the reported ChE results (see page 51). The letter explained the requirements of HSC §105206 and the responsibilities of a medical supervisor in fulfilling these requirements. The reference laboratories were provided with the standard terminology for ChE reporting and were asked to disseminate this information to their clients (ordering physicians and drawing

[1] Total number of names of doctors and/or laboratories entered as "ordering physicians" on the 2011 ChE test reports.

laboratories). Some laboratories have made efforts to capture this information by modifying their requisition slips, or by contacting the medical supervisors' offices. To date, the true purpose of a ChE test or whether the test results were part of the Program remains unclear (Table B2d).

Table B2d: *Summary of Concerns/Issues Regarding the "Purpose of Test"*

Concerns/Issues	Action Taken	Status
• Physicians do not provide the laboratories the purpose of the test at time of order submission.	• 2011 – DPR and OEHHA jointly sent outreach letters to physicians reminding them to enter the purpose when ordering ChE tests. • OEHHA outreach to medical supervisors.	• Unresolved. • OEHHA's outreach efforts ongoing.
• Ambiguous purpose of test. Examples: "Close Contact," "989.9," "Annual Routine," "Blueprint for Wellness," "CA-Required," "CA Patient," "Draw 1," "HazMat," "ChE," etc.	• Discussed with the laboratories. • OEHHA outreach to medical supervisors.	• Unresolved. • OEHHA's outreach efforts ongoing.
• Laboratories are not able to provide the true purpose of the test (as it relates to the Program) in their reports.	• 2011 – DPR instructed laboratories to include the "purpose of test" in the reports • 2012 – DPR provided the laboratories with standard terminology to use in their reports for the purpose of the test.	• 2013-2014 – Two laboratories created "ask and order" entry online ordering systems. • Two laboratories pre-printed "purpose of test" options on their requisition slips. • Other reference laboratories have the ability to modify their Laboratory Information Systems (LIS) to capture the purpose of the ChE test. However, modifying a laboratory's LIS to capture the purpose of the test is not specified in the HSC §105206. • Unresolved.

B. Cholinesterase Data Acquisition and Clean-up

Laboratories transmit ChE test results through secure portals – four through DPR's SAW and two through the laboratories' own websites. The latter requires DPR to perform additional steps to obtain these reports.

A major challenge to effectively interpret the ChE monitoring data has been the missing and incorrect data reported by the laboratories. Without this information, we are unable to follow-up with the employers when the employee's ChE test results require action (see Table 1 for action levels of RBC and plasma ChE and the associated actions required under the Program).

Once the electronic files are received, staff manually review data and correct misspelled names, reconcile variations in the spelling of names when all other fields are the same, and reconcile birth dates for paired samples (e.g., 01/01/1991 for the RBC ChE test and 07/01/1991 for the plasma ChE test of the same person). DPR scientists seek clarification from the reporting laboratory on issues such as illogical dates (i.e. 01/01/1900) or a large number of test results from a single laboratory that exceed their normal reference range values by a wide margin. We continue to work with the laboratories to ensure that they provide consistent and complete ChE test results to the extent possible. Concerns and issues regarding the data are summarized in Table B2e.

Table B2e: *Summary of Concerns and Issues Regarding the Data*

Concerns/Issues	Action Taken	Status
• Report format variation across laboratories.	• DPR provides guidance to laboratories on the specific Excel spreadsheet format.	• 2012 – All laboratories began using the standardized format. • 2015 – One laboratory temporarily submits reports in a non-standard format due to a change in their laboratory information system.
• Missing, partially completed or incorrectly entered data. Also entered as "unavailable."	• DPR informs laboratories of missing or incomplete data.	• Laboratories contend that they can only report information that is provided to them. • Unresolved.
• Duplicate test results.	• DPR informs laboratories of duplicate test results.	• Laboratories implemented changes to their Quality Assurance procedures resulting in fewer duplicate records.

Concerns/Issues	Action Taken	Status
• Variations in Normal Reference Range values among the laboratories. These values are laboratory-specific. • One laboratory uses gender-specific normal ranges for their plasma ChE test, and enters "Unavailable" in the reference range if the gender is unknown.	• Coordinating with CDPH to ensure consistency and reliability of the test results values.	• Unresolved.
• Data entry errors.	• DPR asks the laboratories to verify or correct the information on the report.	• Laboratories review reports prior to submitting, resulting in fewer data entry errors.
• One laboratory thought that the reporting requirement ended in 2013.	• 2014 - DPR contacted the laboratory to continue reporting.	• The laboratory resumed reporting.
• DPR receives ALL ChE test results in California.	• Laboratories provided guidance on some test results that can be definitively excluded (e.g., HazMat, DTSC, if the ChE test type was reported as a ratio).	• Unresolved.

Laboratories Approved for Cholinesterase Testing for Occupational Health Surveillance, January 1, 2007

State of California—Health and Human Services Agency

Department of Health Services

California Department of Health Services

ARNOLD SCHWARZENEGGER
Governor

This List Dated **January 1, 2007,** Replaces and Supersedes
The Previous List Dated June 1, 2006.

Laboratories Approved for Cholinesterase Testing for Occupational Health Surveillance
Reference: California Code of Regulations, Title 3, Section 6728(f)

LABORATORY	COUNTY	TESTING DONE ON-SITE	METHOD
	Kern		
Physicians Automated Laboratory, Inc. 2801 H Street Bakersfield, CA 93301 Attn: C. Bruce Smith Phone: (661) 325-0744 FAX: (661) 327-9163		Yes	Colorimetric
	Kings		
Corcoran District Hospital Laboratory 1310 Hanna Avenue Corcoran, CA 93212 Attn: Ron A. Bico Phone: (559) 992-5051, x351 FAX: (559) 992-3972		(a.)	
	Los Angeles		
Pacific Toxicology Laboratories 9348 De Soto Avenue Chatsworth, CA 91311 Attn: Donald R. Simpson, M.D. Phone: (818) 598-3110 FAX: (818) 598-3116		Yes	Colorimetric

Footnote (a.) Corcoran District Hospital Laboratory performs the plasma cholinesterase test on-site using a colorimetric method. The RBC test is referred to a different approved laboratory.

Environmental Health Laboratory Branch, 850 Marina Bay Parkway, G365, Richmond, CA 94804-6403
Phone: (510) 620-2801 Fax: (510) 620-2825
Internet Address: www.dhs.ca.gov/ehlb

Monterey

George L. Mee Memorial Hospital 300 Canal Street King City, CA 93930 Attn: Judy Antonio Phone: (831) 385-7212 FAX: (831) 385-5399	Yes	Colorimetric
Salinas Valley Primecare Medical Group 909 Blanco Circle Salinas, CA 93901 Attn: Gerald Oehler, MD Phone: (831) 751-7070	Yes	Colorimetric

Orange

Quest Diagnostics Incorporated Nichols Institute 33608 Ortega Highway San Juan Capistrano, CA 92690-6130 Attn: Sandy Burns Phone: (949) 728-4629 FAX: (949) 728-4860	Yes	Colorimetric
U.C. Irvine Medical Center Department of Pathology 101 City Drive South Orange, CA 92868 Attn: Steven Sarandis Phone: (714) 456-5293 FAX: (714) 456-2200	Yes	Colorimetric

Sacramento

Quest Diagnostics 3714 Northgate Boulevard Sacramento, CA 95834 Attn: Sue Aitken Phone: (916) 927-9900 FAX: (916) 564-0847	Yes	Colorimetric

010107, p2

Tulare

Sierra View District Outpatient Laboratory 263 N. Pearson, Suite 102 Porterville, CA 93257 Attn: Dave Workman Phone: (559) 784-7852 FAX: (559) 784-0614	Yes	Colorimetric

OUT OF STATE

Kansas

Quest Diagnostics 10101 Renner Blvd. Lenexa, KS 66219 Attn: P. Patrick James, M.D. Phone: (913) 888-1770 FAX: (913) 894-9029	Yes	Colorimetric
Clinical Reference Laboratory, Inc. 8433 Quivira Road Lenexa, KS 66215 Attn: Robert Stout, Ph.D. Phone: (913) 492-3652	Yes	Colorimetric

Minnesota

MEDTOX Laboratories, Inc. 402 West County Road D St Paul, MN 55112 Attn: Jennifer A. Collins, Ph.D. Phone: (651) 636-7466	Yes	Colorimetric

Utah

ARUP Laboratories 500 Chipeta Way Salt Lake City, UT 84108 Attn: Margo Taylor Phone: (801) 583-2787, x3100 FAX: (801) 584-5108	Yes	Colorimetric

010107, p3

Letter to Physicians and Laboratories, 2011

Edmund G. Brown Jr.
Governor

December 21, 2011

<First name><Last name>, MD
<address>
<City>, California <zip>

RE: NEW REQUIREMENTS FOR PHYSICIANS WHO ORDER CHOLINESTERASE TESTS FOR THE MEDICAL SUPERVISION PROGRAM FOR AGRICULTURAL WORKERS EXPOSED TO CHOLINESTERASE-INHIBITING PESTICIDES

Dear Dr. <Last name>:

Effective January 1, 2011, physicians who order cholinesterase tests for the Medical Supervision Program for agricultural pesticide handlers exposed to cholinesterase-inhibiting pesticides must indicate the purpose of the test on the requisition form to the testing laboratory. This includes tests for establishing a baseline, for routine monitoring, or for evaluation of suspected pesticide illness. These requirements are specified in the newly adopted Section 105206, subsection (c) of the California Health and Safety Code.

In addition, the ordering physician must provide to the person tested a copy of the cholinesterase test results and any recommendations within 14 days of receiving the results.

The complete text of Section 105206 of the California Health and Safety Code is attached. This law came into existence in an effort to evaluate the effectiveness of the Medical Supervision Program for agricultural workers who regularly handle cholinesterase-inhibiting pesticides. The California Department of Pesticide Regulation (CDPR) and the Office of Environmental Health Hazard Assessment (OEHHA) are jointly responsible for the program evaluation. Your cooperation is crucial to this effort.

1001 I Street • P.O. Box 4015 • Sacramento, California 95812-4015 • www.cdpr.ca.gov

Departments of the California Environmental Protection Agency

Printed on recycled paper, 100% post-consumer-processed chlorine-free.

If you are currently contracted with an employer as a medical supervisor under this program, you are already required to be aware of the contents of the Guidelines for Physicians Who Supervise Workers Exposed to Cholinesterase-Inhibiting Pesticides (4th Edition, 2002 available at: http://oehha.ca.gov/pesticides/pdf/docguide2002.pdf). In addition, there is an online training course on the Medical Supervision Program that awards free CME credits and can be viewed at: https://www.mededpesticide.org/. The course is suitable for a review of the program or for a physician just starting in the program.

If you have any questions on the new cholinesterase reporting requirements, please feel free to contact either of us.

Thank you for your attention.

Sincerely,

William Ngai, MD, MPH
OEHHA / Pesticide and
Environmental Toxicology Branch
(510) 622-3221
William.ngai@oehha.ca.gov

Saturnino Yanga, DVM, MVPH
CDPR / Worker Health and Safety Branch
(916) 445-6387
syanga@cdpr.ca.gov

Attachment

cc: Dr. Anna Fan, Chief, Pesticide Environmental Toxicology Branch, OEHHA/Oakland
Susan Edmiston, Environmental Program Manager II, WHS Branch, CDPR
George Farnsworth, Environmental Program Manger I, WHS Branch, CDPR