



Cholinesterase Monitoring of Pesticide Handlers in Agriculture: 2013 Report

Division of Occupational Safety and Health (DOSH)

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If you have questions about this report, please contact Pam Cant, Industrial Hygienist, at 360-902-6457 or edwp235@lni.wa.gov

Executive Summary

The Division of Occupational Safety and Health (DOSH) administers an agriculture worker blood cholinesterase monitoring program under WAC 296-307-148¹, Cholinesterase Monitoring. During the 2013 cholinesterase monitoring season (January – September), ~328 growing operations and 1994 pesticide handlers participated in baseline cholinesterase testing. Two hundred and twenty six of these pesticide handlers were tested again (periodic testing) at least once during the pesticide application season. The great majority of handlers submitting periodic tests met the testing requirement threshold of handling toxicity class I or II organophosphate or N-methyl-carbamate pesticides for ≥ 30 hours in any consecutive 30 day period. However, in some cases employers scheduled testing regardless of number of handling hours.

Of these 226 handlers, 13 (6.0%) received at least one test indicating a cholinesterase activity depression of $>20\%$ (action level) requiring the employer to evaluate pesticide handling practices. There were nine action level cholinesterase depressions requiring temporary removal from handling organophosphate and n-methyl carbamate pesticides. All action level cholinesterase depressions occurred in Labor & Industries (L&I) Region 5². Six growing operations (all separate employers) accounted for the 9 action level cholinesterase depressions.

The number of pesticide handlers establishing baselines in 2013 decreased from 2012 (1994 vs. 2091), while the number of handlers undergoing periodic testing remained relatively stable. Yearly testing numbers are believed to be affected by variations in factors including, but not limited to:

- a) Pest control strategies
- b) Use of class I and II cholinesterase inhibiting pesticides
- c) Employer actions resulting in limiting handler exposure (e.g., employee rotation).

All handlers with cholinesterase depressions at the action level were employed in the tree fruit industry were characterized as mixer/loader/applicators. DOSH worksite field evaluations of action level cholinesterase depressions identified multiple Pesticide Worker Protection Standard violations that may have contributed to over-exposure including, but not limited to, training, respiratory protection, and personal protective equipment requirements. Toxicity class I and II cholinesterase inhibiting pesticides handled within the 30 days prior to periodic testing included Lorsban 4E, and Guthion (Sevin 4F a Class III N-methyl-carbamate was also handled).

Pathology Associates Medical Laboratories (PAML) continues to conduct all laboratory analyses. Quality control indicators were well within limits and customer satisfaction remains high. PAML will continue to serve as the sole laboratory approved by DOSH in 2014.

In conclusion, the 2013 cholinesterase monitoring program functioned as designed. The program continues to provide value by maintaining awareness of hazardous chemicals and worker protections, and bolsters DOSH's ability to work directly with agriculture employers to solidify pesticide worker protection programs.

Background

¹ <http://www.lni.wa.gov/WISHA/Rules/agriculture/HTML/part-j-1.htm>

² <http://www.lni.wa.gov/Safety/Basics/Assistance/Consultation/consultants.asp>

Acetylcholinesterase (AChE) is an enzyme that removes the chemical neurotransmitter acetylcholine from the junctions between nerve cells. AChE effectively serves as the nerve cell “off switch” and is essential to normal nervous system function. Certain pesticides, known as cholinesterase inhibitors, bind with AChE resulting in over-excitement of nervous system pathways.

Exposure to organophosphate or N-methyl-carbamate pesticides may lower the level of active cholinesterase in the nervous system. Depressed cholinesterase activity may lead to physical symptoms ranging from malaise, blurred vision, and diarrhea, and in extreme cases, coma and death. Laboratory monitoring of cholinesterase levels in the blood (both serum and red blood cell [RBC] cholinesterase) detects reductions in cholinesterase activity prior to the onset of symptoms (pesticide illness), as well as provides information regarding pesticide exposure and the effectiveness of exposure control measures. Cholinesterase levels may be affected by such factors as liver and blood disease, and certain medications; in the absence of such factors, cholinesterase depression is most likely caused by over-exposure to the cholinesterase inhibiting pesticides handled by these workers. Previous reports provide detailed background and describe cholinesterase monitoring experiences during the years 2004 through 2010³.

WAC 296-307-148, Cholinesterase Monitoring (the rule), was adopted in December 2003 and has remained unchanged after amendments were made in 2005. The rule requires agriculture employers to: a) record hours employees handle⁴ toxicity class I and II organophosphate and N-methyl-carbamate pesticides (covered pesticides); b) provide cholinesterase blood testing to employees who handle covered pesticides for 30 or more hours in any consecutive 30 day period; and c) follow health care provider recommendations regarding pesticide handling practices and medical evaluation. A copy of the licensed health care provider’s (LHCP) written recommendation is provided to the handler by the employer. Health care provider recommendations include verification of testing, actions to be taken based on cholinesterase activity, and any recommendations regarding further medical evaluation.

DOSH offers consultation services to agriculture employers with pesticide handlers who experience a cholinesterase depression >20% (action level cholinesterase depression). In addition to assisting with an evaluation of the employer’s pesticide worker protection program and the pesticide handler’s work practices, information on pesticide handling practices and equipment is gathered. DOSH compliance inspections are opened in certain circumstances such as clusters of action level cholinesterase depressions, and employer refusal to accept consultation services.

DOSH continued to provide reimbursement to employers for testing services and related administrative program costs⁵. Forty-two employers requested and were granted reimbursements totaling approximately \$115,000.

³ Previous reports can be found at <http://www.lni.wa.gov/Safety/Topics/AtoZ/Cholinesterase/default.asp>

⁴ Pesticide handling is defined in WAC 296-307-11005

⁵ The Cholinesterase Monitoring reimbursement request form can be found at <http://www.lni.wa.gov/forms/pdf/413062af.pdf>

The following table outlines participation and monitoring outcomes for the years 2008-2013 of the cholinesterase monitoring program.

	2008	2009	2010	2011	2012	2013
# growing operations*	218	217	315	388	307	328
# Handlers submitting baseline tests	2013	2056	1989	2017	2091	1994
# Handlers declining testing	192	229	Data not collected	Data not collected	Data not collected	Data Not collected
# Working baselines	71	29	51	43	47	44
# Handlers with ≥ 1 periodic test	314	249	257	186	148	
# Periodic tests	495	286	316	202	216	226
# Handlers with ChE depression to work evaluation level	21(6.7%)	15(6.1%)	8(3.1%)	6(3.2%)	13 (6.0%)	4(2.0%)
# Handlers with ChE depression to exposure removal level	1(0.1%)	7(2.8%)	0	0	5(2.3%)	9(4.0%)
Total # handlers with AL ChE depression	22(7.0%)	22(8.8%)	8(3.1%)	6(3.2%)	18 (8.3%) **	13(6.0%) **
# Handlers reporting pesticide illness symptoms	0	0	0	0	0	0

*A growing operation is defined as a specific site or orchard. An employer may have multiple growing operations

**1 serum and 12 RBC cholinesterase depressions

Medical Services

Sixteen medical clinics provided blood collection and medical evaluation services. Thirteen clinics are located in Region 5, and three in Region 1⁶. In preparation for the 2013 monitoring season, DOSH contacted all participating clinics and provided guidance with the rule and

⁶ <http://www.lni.wa.gov/Main/FindAJob/regions.asp?WT.svl=3>

cholinesterase medical monitoring guidelines. All clinics reported satisfaction with the laboratory services and support provided by DOSH.

Pathology Associates Medical Laboratories (PAML) in Spokane is the sole laboratory approved to provide testing services. There were no changes in Standard Operating Procedures⁷ from 2012 to 2013. Blood samples are packed in ice and picked up at the clinic using same-day courier services. Samples are analyzed within 24 hours of collection and reported to both the clinic and DOSH that same day.

PAML is required to provide evidence of a robust quality assurance program including but not limited to:

- Maintaining a written quality assurance plan.
- Participation in the College of American Pathologists serum cholinesterase proficiency testing program.
- Allowing independent review of quality assurance data.
- Demonstration of proficiency through analysis of blinded samples.

The DOSH industrial hygiene laboratory regularly reviews PAML quality control reports and conducts onsite visits. All quality control indicators demonstrated good precision throughout the season.

DOSH chemists regularly review PAML quality control reports and conduct onsite visits. All quality control indicators demonstrated good precision throughout the season.

Monitoring Summary

As in previous years, the vast majority of employers participating in the cholinesterase monitoring program had operations located in Central Washington (West Adams, Benton, Chelan, Columbia, Douglas, Franklin, Grant, Kittitas, Okanogan, Walla Walla, and Yakima counties). North and Southwest Washington counties accounted for the remainder of the samples submitted.

During the 2013 cholinesterase testing season (January – September), ~338 growing operations participated in testing and 1994 handlers submitted cholinesterase baseline samples, with baseline submissions decreasing from 2012 (2091).

Of the 226 pesticide handlers who received at least one periodic test, 4 (2.0%) received a periodic test result having a >20 percent cholinesterase activity depression from baseline (action level cholinesterase depression) requiring the employer to evaluate handling practices for possible deficiencies. 9(4.0%) handlers experienced cholinesterase depression levels requiring temporary removal from handling organophosphate and N-methyl-carbamate pesticides a serum cholinesterase depression of $\geq 40\%$ or RBC cholinesterase depression of $\geq 30\%$). The 13 handlers (one serum and 12 RBC action level cholinesterase depression) worked for six different growing operations.

L&I Consultation and Compliance Findings

All six of the growing operations with handlers who had experienced action level cholinesterase depression received site visits from DOSH. One of the operations were visited by L&I consultants and three received enforcement visits due to multiple handler action level ChE

⁷ Available upon request

depressions or having a handler(s) experience an action level ChE depression within the previous three years.

Conclusion

In conclusion, the 2013 cholinesterase monitoring program functioned well. The 13 action level cholinesterase depressions found represent similar trend in amount of depression for the previous year. While it is not possible to identify definitive reasons for the continuing trend in action level cholinesterase depressions, the sustained awareness of pesticide hazards and protections and feedback loop that monitoring provides, are certainly factors in maintaining low level depression events. .

More work is still needed as evidenced by finding multiple rule violations during worksite evaluations and also the fact that some handlers still do not consistently receive copies of health care provider written recommendations. One concern consistently noted during worksite evaluations was often finding the employer provided handler training to be of limited quality. This area will likely receive additional attention in the future.

Laboratory testing is conducted in accordance with Standard Operating Procedures finalized in 2009. Quality control parameters for both serum and RBC cholinesterase testing remain within acceptable limits. PAML will continue to be the sole laboratory providing testing services through 2014.