

**CPAL**Central Pennsylvania Alliance  
Laboratory

# Technical Bulletin

**No. 33**

February 10, 2003

**New Test - Whole Blood Lead, Lead Group(Lead and ZPP), ZPP****Starting****Date:** February 17, 2003

**Medical Use:** Lead affects the central and peripheral nervous systems, the heme biosynthetic pathway, and the renal system. The clinical signs and symptoms of lead poisoning are nonspecific. Lead inhibits aminolevulinic acid dehydratase, necessary for the synthesis of heme from porphyrin. As a result, erythrocyte protoporphyrin levels are increased, and heme-deficient anemia may then ensue. Irritability, anorexia, malaise, headache, constipation, attacks of abdominal pain (lead colic), and renal toxicity are common symptoms of early toxicity. Therefore, a venous blood lead measurement is essential for diagnosis.<sup>1, 2, 3</sup> Whole blood lead levels lower than 10 µg/dL are considered normal in children by the CDC. The WHO has defined whole blood lead levels greater than 30 µg/dL in adults as indicative of significant exposure. Lead levels greater than 60 µg/dL require chelation therapy. Erythrocyte protoporphyrin levels greater than 60 µg/dL are a significant indicator of lead exposure<sup>2</sup>.

**Method:** Graphite furnace atomic absorption spectrometry for whole blood lead.  
Hematofluorometer for zinc protoporphyrin. (Send to AML temporarily)

<b>Reference Intervals:</b>	Whole blood Lead:	Children (0-15):	< 10 µg/dL
		Adult (≥ 16 yr.):	< 25 µg/dL
	Zinc protoporphyrin:	Adult (≥ 16 yr.):	< 50 µg/dL (AML Reference Interval)

**Supportive Data:** The accuracy of the method was verified by a method comparison study. The lead levels of 119 patient specimens (from The Reading Hospital and Medical Center) were determined at CPAL using atomic absorption. The results ranged from 0 to 29 µg/dL. These results were compared with those obtained by anodic stripping voltametry method at Reading Hospital. The results correlate well with a slope of 0.92, and an intercept of 0.17.  $R^2 = 0.89$ . Considering the differences in the two methodologies and the total allowable error for lead being 10% at lead levels greater than 20µg/dL, the accuracy is verified.

**Permit** CPAL has been approved by the Pennsylvania Department of Health to do blood lead testing.

**Specimen** In a clean and secure environment, collect blood aseptically by venipuncture into lead free EDTA

Issued on: January 12, 2004

For question about this, and other, information, call Central Pennsylvania Laboratory at 1-888-480-1422

**Collection** tubes or BD Lead tubes (brown top tubes). Powder-free gloves should be worn during collection and if several tubes of blood are to be drawn together, draw the tube for lead analysis first so as not to contaminate the needle by puncture of the other Vacutainer stoppers. Venipuncture is preferred over capillary specimen collection. Cleansing the site is needed to avoid contamination if capillary collection is required. The minimum acceptable volume is 0.5 mL of whole blood. EDTA whole blood specimens should be stored at 2 - 8 °C and are stable refrigerated for up to 7 days. Specimens for ZPP or lead group should be protected from light by wrapping the tube with aluminum foil. Three kinds of blood collection tubes have been tested lead free at CPAL. They are: **BD EDTA Lavender Top, 3 mL**  
**BD EDTA Lavender Top, 7 mL**  
**EDTA Microtainer 0.5 mL.**

**Cautions:** Specimens collected for lead testing, particularly blood collected by fingersticks, are notoriously prone to contamination by exogenous lead; contamination should be suspected in specimens with elevated whole-blood lead levels that do not show concordance with zinc protoporphyrin (ZPP) measurements. In an occupation setting, the Occupational Safety and Health Administration currently requires both whole blood lead and ZPP testing. ZPP is not currently recommended by the CDC for lead screening in children 6 years of age and younger.

**References:**

1. Analytical Procedure For The Determination Of Lead In Blood And Urine; Approved Guideline, NCCLS, C40-A, V 21, No.9, 2001.
2. T. Moyer, Toxic Metals, Chapter 28, Tietz Textbook of Clinical Chemistry, 3<sup>rd</sup> edition, pp989-991, 1999.
3. M. Ottlinger, R. Zumwalde, R. Roscoe, M. Kosnett, K. Hipkins, R. Meister, and A Materna, Adult Blood Lead Testing, Clin. Lab. News, June 2002

**Appendix A: Blood Lead in Children According to CDC Screening Young Children for Lead Poisoning Program (1997)**

<b>Result</b>	<b>Comment</b>
0 - 9 µg/dL	No action unless exposure sources change.
10 -14 µg/dL	Consider at least one follow-up test within 3 months. Provide family lead education regarding preventive actions.
15 -19 µg/dL	Consider one follow-up test within 2 months. Provide family lead education. Refer for Social Services, if necessary. If blood levels (BLLs) persist (i.e., two venous BLLs in this range at least 3 months apart) or worsen, proceed according to actions for BLLs 20-44.
20 -44 µg/dL	Consider clinical management, environmental investigation, and lead-hazard control.
45 -69 µg/dL	Begin coordination of care (case management), clinical management, environmental investigation, and lead-hazard control.
≥ 70 µg/dL	This is a critical concentration. A second venous test, hospitalization, appropriate chelation

	therapy, and removal from lead exposure are urgently recommended.
Elevated results from non-certified lead-free tubes may be due to contamination. Elevated levels of blood lead should be confirmed with a second specimen collected in a metal-free tube.	

**Appendix B: Blood Lead in Adults**

Result	Comment
< 10 µg/dL	No action required unless exposure sources change.
10 - 24 µg/dL	Identify and minimize exposure.
25 - 49 µg/dL	Remove from exposure, if symptomatic.
50 -79 µg/dL	Remove from lead exposure. Immediate medical evaluation. Excessive chelation therapy is discouraged.
≥ 80 µg/dL	Chelation may be indicated if symptomatic. Seek consultation.
<b>Note:</b> Blood lead in adults, occupationally exposed: Refer to OSHA and/or industrial standards.	

**Appendix C: Lead, Industrial Exposure Panel**

Components	Reference Interval
Lead, Whole Blood	0-16 years: 0.0-9.9 µg/dL 16-150 years: 0.0-24.9 µg/dL
Zinc Protoporphyrin (ZPP), Whole Blood	0-69 µmol ZPP/mol heme
Zinc Protoporphyrin (ZPP), Whole Blood	0-40 µg/dL

**Appendix D: Action Required for Workers with Elevated Lead Values (OSHA, Occupational Exposure to Lead, 1978)**

Number of Tests	µg/dL	Action Required
1	≥ 40.0	Notification of workers in writing; medical examination of worker and consultation.
3	≥ 50.0	Removal of worker from job with potential lead exposure.
1	≥ 60.0	Removal of worker from job with potential lead exposure.
2	≤ 40.0	Reinstatement of worker in job with potential lead exposure is based upon symptoms and medical evaluation.
OSHA requirements in effect since 1978 call for the measurement of whole blood lead and zinc protoporphyrins (ZPP) (NCCLS document C42-A, November 1996) to evaluate the occupational exposure to lead. OSHA requires ZPP whole blood testing reported in units of µg/dL. Federal lead construction standards require worker to be notified and removed from the job at levels of 50 µg/dL and higher until physician authorizes return.		

**Laboratory** Lu Song, Ph.D. , Technical Director, CPAL Lab  
**Contact:** 717-851-1422

1803 Mt. Rose Avenue  
 York, Pa. 17403  
**Controlled Copy, Do Not Duplicate**  
**Only**  
 l:\cpal\bulletin\...\029\_iPTH.doc

*For Internal Use*