DATA SHEET
LEAD: Effects on Adults & Children

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We are all exposed to small amounts of lead from before birth (from our mother's blood through the placenta) and every day of our lives after birth from pollution in the air, water, soil, and home environment. If we also are exposed to lead on the job, the risk of health damage increases. We should have regular lead tests and be able to interpret these tests if we work with lead.

CANCER. In 2004, the National Toxicology Program's *Report on Carcinogens*[1] listed "Lead and Lead Compounds as "R" (reasonably anticipated to be human carcinogens). Two lead compounds, lead phosphate and lead acetate have been listed as "R" since the early 1980s. Now there is enough data from human and animal studies on many lead compounds to list them all.

POLLUTION LEAD LEVELS. The average (geometric mean) blood lead level in the U.S. is about 1.5 micrograms/deciliter (µg/dL.)[2] Doctors used to consider blood lead levels up to 10 µg/dL to be "normal." Now the Centers for Disease Control suggests sending information to any adult whose blood is found to be at 10 µg/dL on how to find and reduce daily exposures to lead. For example, they can test tap water, old paint, soil near the house, or substance used in hobby activities.

A study has shown a significant risk of mortality in adults associated even with rather low lead levels.[3] The study reported in the *Journal of the American Heart Association*, 2006 was the Third National Health and Nutrition Examination Survey Mortality Follow-Up Study. It involved 13,946 adults whose blood lead levels were collected and measured between 1988 and 1994. When researchers studied those who died by December 31, 2000, they found that death from any cause, cardiovascular disease, heart attack and stroke increased progressively at higher lead levels.

Compared to participants with blood lead below 1.9 µg/dL, participants with blood lead between 3.6 µg/dL and 10 µg/dL had:

- a 25% higher risk of death from any cause;
- a 55% higher risk of death from cardiovascular diseases;
- an 89% higher risk of death from heart attack; and
- a two and a half times the risk of death from stroke.

Then studies[4] in the Journal of *Epidemiology* in 2007 and in a follow up study in 2009, showed that lead levels in bone, rather than blood, are an even more accurate indicator of mortality. Researchers found the risk of death from cardiovascular disease was almost six times higher in study participants with the highest levels of bone lead and death from all causes was related to bone lead levels.

Dr. Marc Weisskopf, the lead researcher in these studies also concluded that by the time the lead has deposited in the bone, the damage has been done. He questions the benefit of chelation treatments to remove the lead. It may also be that mobilizing bone lead back into the blood stream may actually cause additional damage.

LEAD LEVELS IN YOUR BLOOD. If you are exposed to lead at work or at home, your blood lead level is likely to rise considerably above the amounts expected from pollution. Some adult levels of concern are in the table below:

ADULT BLOOD LEAD LEVELS (BLL) IN MICROGRAMS/DECILITER (µg/L)

BLL (µg/L)	significance
~1.5	The geometric mean level in the U.S. is: women aged 20-59=1.2; men aged 20-59=2.0; children aged 1-5=1.9). If your levels are higher, exposure to lead in your daily life is above average. Look for and eliminate those sources.
≥ 5	Intervention for pregnant women is recommended to lessen fetal effects.*
0-10	These levels are considered "normal" for adults. A study indicates adults with levels from 3.6-10 µg/dL have higher mortality from many causes (see above). If your levels are 5 µg/dL or higher, have young children living in your home tested.
25-30	These levels are ones at which about half of the states require labs to report results to health departments. May cause reproductive problems in men and women.
30	OSHA's 1978 Lead Standard suggests that men and women planning families keep below this level.[7] The Standard has not been properly updated since.
40-50	OSHA allows these levels in workers in lead industries and construction. OSHA proposed lowering this level. Almost all experts believe these levels are harmful.

* Assoc. of Occupational & Environmental Clinics, see: http://www.aocc.org/documents/positions/mmg_final.pdf

SYMPTOMS OF LEAD POISONING IN ADULTS. Most people know that lead poisoning causes vomiting, diarrhea, coma and death. But these symptoms only occur at extremely high levels. Low and moderate levels produce no symptoms at all in many people. For others, the early symptoms may include irritability, indigestion, fatigue, headaches, and/or hypertension. These symptoms are so common that physicians often misdiagnose their cause. Even when there are no symptoms, permanent damage may be occurring. For example, brain and kidney damage can occur silently until the damage is significant and irreversible. Lead probably also causes cancer.[5] Lead can interfere with almost every phase of male and female reproduction.

SYMPTOMS IN CHILDREN. Lead causes devastating effects on children including retardation, hearing loss, and kidney damage depending on the amounts the child takes in. The effects that occur at the lowest doses are subtle effects on mental acuity. Studies have shown a measurable reduction in IQ in children whose blood lead levels are at 10 µg/dL. For years, experts thought that reduction of mental acuity probably occurs at even lower lead levels. Now this has be shown to be true.

In 2003, a study in the *New England Journal of Medicine* confirmed that significant effects occur below 10 µg/dL.[6] The researchers found that for blood-lead concentrations between 1 and 10 µg/dL, the total decrease in IQ averaged 7.4 points, a drop of 0.82 points for each 1 µg/dL. However, the decrease in IQ associated each increase of 10 µg/dL at levels above 10 µg/dL was only 4.6 points, that is, 0.13 points lost for each additional 1 µg/dL.

This data demonstrates a dose-response for lead at levels lower than 10 µg/dL and establishes lead as causative at these lower levels rather than merely an association. It also shows that microgram for microgram, lead at levels below 10 µg/dL causes damage in greater increments than above. It is now clear that there is no known level of lead that does not have some degree of adverse effect on the mental acuity of children.

POLICY FOR TESTING CHILDREN. The Centers for Disease Control and Prevention considers children at "high risk" of having high blood lead levels if their parents are exposed to lead on the job or through hobbies (e.g., stained glass or ceramics). It is well-known that people working with lead bring small amounts of lead home on their clothing, shoes, hair and skin and can contaminate the house. The worst effects are seen in the children of parents who work with lead materials in the home.

For this reason, the Centers for Disease Control recommends that children of lead-using parents be tested several times between the ages of six months and six years. Depending on the results of these tests, you should follow the guidelines in the table below.[7]

TESTING STRATEGIES FOR CHILDREN OF LEAD-EXPOSED PARENTS

BLL(µg/dL)	Strategy
0 ≤ 9	Retest within two years-small loss of IQ at all levels.
10-14	Loss of IQ significant in children at 10µg/dL and higher. Retest every 3 to 4 months and observe the child's habits and environment to look for ways to reduce exposure.
15-19	Retest every 3 to 4 months and obtain help in reducing the child's environmental sources of lead. In some states, tests this high will result in home visits and assistance from local health departments case workers.
20-44	Have a complete medical evaluation of the child and eliminate environmental sources. Health Department case workers will probably be in contact to help you.
45-69	Begin medical treatment and environmental assessment within 48 hours. Health Department case workers will almost surely be in contact to help you.
≥ 70	Begin medical treatment immediately.

WORKPLACE SAFETY STANDARDS. The Occupational Safety and Health Administration (OSHA) requires workers' blood lead levels to be between 50 and 40µg/dL or lower. However, this level will not protect your reproductive abilities. OSHA makes this clear in the preamble to their Lead Standard. It is worth while reading OSHA's exact words:

> *OSHA believes that the evidence overwhelmingly indicates the blood lead level of workers who wish to plan pregnancies should be maintained below 30 µg/100 g* in order to prevent adverse effects from lead on the worker's reproductive abilities. To minimize the risk of genetic damage, menstrual disorders, interference with sexual function, lowered fertility, difficulties in conception, damage to the fetus during pregnancy, spontaneous miscarriage, stillbirth, toxic effect on the newborn, and problems with the healthy development of the newborn or developing child [,] blood lead levels should be kept below 30 µg/100 g in both males and females exposed to lead who wish to plan pregnancies*.[8] * µg/100 g = µg/dL

OSHA wrote statement this over 30 years ago. Now, the Association of Occupational and Environmental Clinics recommends intervention for pregnant women at 5 µg/dL.

SPECIAL ADVICE FOR PREGNANT WOMEN. Maternal and fetal BLLs are nearly identical because lead crosses the placenta unencumbered.[9] So if the blood lead level of the fetus of a pregnant woman whose blood lead level is 5µg/dL would also be at 5µg/dL–a level known to impair mental acuity in young children.

Since studies also show that lead is more damaging to younger children, it is likely that the fetus would be most vulnerable of all. However, it is impossible to prove this because IQ can't be tested in the womb. For this reason, it remains a highly informed speculation. More over, the reduction in IQ seen in the studies is a statistical average and may not apply to an individual child. The question remains: is pregnancy the time to challenge these data by exposing women to lead?

EXPOSURES IN THE PAST. A mother's lead exposures, even when she was a child, also may affect her baby. A significant amount of the lead we ingest or inhale is stored in our bones. Some of this lead is released back into the blood stream during pregnancy.[10] If you have been exposed to lead in the past, talk to your obstetrician. Your doctor may suggest additional tests and dietary calcium to reduce uptake of lead by the fetus.

If all this causes you to worry: welcome to motherhood! Worry is about to become permanent. But it is counter-productive to obsess about the problem. Stress is known to be bad for you and the fetus! Instead, understand how dangerous lead is and take positive actions to keep your own and your baby's exposure as low as possible.

POSITIVE ACTIONS. Past exposures to lead cannot be undone. Instead, focus your attention on minimizing further exposure to lead with the following actions:

1. If you know there is lead on the job, make sure the employer is following the OSHA lead regulations. If the regulations are being followed you should see posters about lead, be attending mandatory training meetings, see some workers being personally monitored (an air pump attached to their belt), and see other precautions. If these things are not happening, talk to your Union Representative.

2. Never remove untested old paint from walls or stay at a job site where such paints are being removed by ordinary workers. If any layer of paint on the walls could have been applied prior to 1980, the law requires that it be tested for lead before it is disturbed. And workers must be shown a copy of this test. If the paint contains lead, the OSHA Lead in Construction Standard requires that only workers with special training can remove it. In many states, only Certified Lead Abatement Workers are allowed to remove lead paint.

3. All cleaning in the workplace should be done by wet mopping or with specially filtered (HEPA) vacuums. Never sweep. If lead dust is present at home, also clean by wet mopping or HEPA vacuuming. HEPA vacuums can be purchased or rented for home or shop use.

4. Never eat, smoke, drink, apply cosmetics, or even store your food in an area where lead dust may be present. Wash hands carefully before eating or performing any hygiene activity.

5. If there are no provisions for showering and changing clothes on site, do this as soon as you get home. Bag your work clothes and wash them separately from other laundry. Make every effort to keep lead dust particles from contaminating your home.

6. If the employer is not providing blood lead tests, get one on your own. In fact, the ideal time to get a baseline blood lead test is just before or very shortly after you start on a job where there may be a problem. Otherwise, the employers may try to claim later that you had a high blood lead before you came to their job.

7. Never allow children to visit the workplace. If you have young children at home, have them tested.

8. Never work at home with lead-containing hobby/craft materials. I you must use lead in your hobby, set up a studio separate from your home and use all the same precautions you would on the job to avoid bringing the dust home.

9. Employ experts for home remodeling if old paint is present.

10. If you are pregnant and exposed to lead or have had lead exposure in the past, get a blood lead test. If your blood lead level is above 2 µg/dL (the level for unexposed adults), it is either because 1) you are still being exposed to lead or 2) lead stored in your bones from previous exposures is re-entering your blood. Some physicians increase calcium supplements in such patients to reduce the amount of lead taken up by the fetus.

10. If you have any questions about lead exposures at work or at home, don't hesitate to call your union Safety Officer.

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1. ***11th Report on Carcinogens***, US DH&HS, NTP, 2004, released 1/05

2. ***Mortality and Morbidity Weekly Report***, Centers for Disease Control and Prevention, Blood Lead Levels -- United States, 1999-2002, Vol. 54 No. 20, 2005, pp. 513-516. The 1.6µg/dL level is the geometric mean average for all ages who are not work or hobby lead-exposed. Children aged 1-5 are a little higher (1.9µg/dL).

3. Andy Menke; MPH, Paul Muntner, PhD; Vecihi Batuman, MD; Elen K. Silbergeld, PhD; Eliseo Guallar, MD, DrPH, ***Circulation: Journal of the American Heart Association,*** 2006; 114:1388-1394

4. Weisskopf, M; Jain, N; Nie, H; Sparrow, D; Schwartz, J; Hu, H. Bone Lead and Death From All Causes, Cardiovascular Diseases, and Cancer: The Normative Aging Study. *Epidemiology*, 2007; Vol 18, Issue 5, p S151, and updated in *Epidemiology and Prevention* in 2009 (2009;12:1056-1064)

5. Lead and lead compounds are listed as "reasonably anticipated to cause cancer" by the National Toxicology Program in their ***11th Report on Carcinogens*** (2005).

6. ***New England Journal of Medicine***, Vol.348:1517-1526, Apr. 17, 2003, No.16

7. Table 4 is modified and adapted from advice in "Preventing Lead Poisoning in Young Children," a statement by the Centers for Disease Control, October 1991.

8. ***Federal Register*** [43 FR 52960] November 14, 1978, Final Lead Standard.

9. Goyer RA, Transplacental transport of lead. ***Environmental Health Perspectives***, 1990:89:101-5.

10. ***NY Times***, Susan Gilbert, June 18, 1996, p. C7 reporting the results of a study at Macquarie University in Sidney, Australia. Thirteen women who had recently immigrated to Australia from the former Yugoslavia and then became pregnant were studied. The lead they were exposed to in the Balkans, and which was stored in their bones, has a different molecular weight from the lead in Australia. As their pregnancies progressed, their blood contained greater amounts of the Balkan lead, peaking during the second and third trimesters. By the end of the pregnancy, as much as 60 percent of the total amount of lead in the blood came from the women's own bones. This data was supported by similar results in studies of pregnant monkeys.