

TOXIC HEAVY METALS TASKFORCE TASMANIA (THMTT)

Media Release Friday 3rd September 2010

Arsenic and Lead in drinking water – flawed advice on testing

Residents notified of alarming levels of arsenic and lead in drinking water at Royal George, but poor advice given to doctors on how to test for exposure

At a meeting in Royal George (an ex-tin mining town in north-east Tasmania), on the 29th of August, Dr Chrissie Pickin, Deputy Director of Tasmania's Department of Health and Human Services, advised local residents that levels of Arsenic in the drinking water taken from the St Pauls River were two hundred (200) times higher than the guidelines (drinking water), and for Lead, the levels were fifty (50) times higher than the guidelines. The known association between increased risk of cancer to exposure of high levels of metals makes the implications of this data extremely serious.

It is therefore disturbing that Dr Pickin has given poor advice on testing methodologies to doctors likely to treat patients from Royal George says Toxic Heavy Metals Taskforce (THMT) spokesperson, Kay Seltitzas. Additionally, says Ms Seltitzas, no mention was made of the need for testing for other heavy metals commonly associated with tin mining in Tasmania.

In a recent letter sent to doctors in Campbelltown, St Marys, Bicheno and St Helens, advising about testing procedures for residents with health concerns from Royal George, Dr Pickin stated:

"Measuring arsenic in hair and nails is not useful, as interpretation will be confounded by external contamination i.e.; if they showered in the contaminated water".

www.dhhs.tas.gov.au/peh/current_public_health_issues/royal_george

Ms Seltitzas says that "Based on considerable evidence from both Australian and international research, Dr Pickin's comments would appear to be encouraging doctors to not provide the best diagnostic tools for assessment of arsenic exposure for Royal George residents who have been exposed to arsenic and other metals in drinking water and from other sources."

"Arsenic levels in urine can only generally be detected for up to 3-5 days after acute exposure. Blood arsenic levels are only elevated for between one and two days. After approximately 30 days, Lead will reduce by approximately 50% in blood if all sources of exposure have been removed. As blood and urine testing was not undertaken prior to provision of clean treated tank water to Royal George residents, routine follow-up testing will be required to ascertain any decrease in any blood metal levels over time."

Ms Seltitzas says that testing for heavy metal poisoning is a very complex issue and expert advice is required.

"Toenail and hair testing for arsenic and other metals is being conducted by many researchers throughout the world and is the most reliable methodology to assess for chronic exposure over time."

“The Royal George contamination issues are beginning to look like another failure by the Department of Health to conduct proper and thorough health investigations for a community exposed to serious levels of toxic heavy metals, such as arsenic, lead, cadmium - and perhaps uranium, especially in drinking water.”

“The Taskforce calls on the Director of Public Health, Dr Roscoe Taylor, to immediately review all measures currently planned by the Public and Environmental Health Service to assess the health status of residents exposed to heavy metals in Royal George, and of people using water from the St Pauls and affected sections of the South Esk Rivers.” ###

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Elizabeth O'Brien, President of The LEAD Group Inc (02) 97160014**

References

Dr. Mohammad Mahmudur Rahman, *Research Fellow*, Centre for Environmental Risk Assessment and Remediation (CERAR) University of South Australia.

Dr Michael James Watts, British Geological Survey, Nottingham Trent University, United Kingdom.

ABC Television Catalyst on 11 March 2010 on Arsenic Toenails -

Transcript Extracts from Dora Pearce University of Ballarat

www.abc.net.au/catalyst/stories/2843289.htm

US Agency for Toxic Substances and Disease Registry (ATSDR)

www.atsdr.cdc.gov/tfacts2.html#bookmark09

www.atsdr.cdc.gov/csem/lead/pbbiologic_fate2.html

Australian And International References On Arsenic Toenail And Hair Testing

Elizabeth O'Brien, President of The LEAD Group Inc., recently asked 6 questions about methodologies for testing of toenails and hair for arsenic. Questions and Answers are provided below:

**From Dr. Mohammad Mahmudur Rahman, *Research Fellow*
Centre for Environmental Risk Assessment and Remediation (CERAR)
University of South Australia**

Q. 1. what methodologies are best for testing arsenic in nails or hair (if any)?

Reply: A number of methodologies can be used for the determination of total arsenic concentration in biological samples such as hair and nail. These are:

1. Hot plate digestion followed by the flow injection hydride generation atomic absorption spectrometry (FI-HG-AAS) (Smanta et al. 1999)/ ICP-MS analysis,
2. Teflon bomb digestion followed by FI-HG-AAS/ICP-MS measurement (Smanta et al. 1999),
3. Microwave assisted digestion followed by ICP-MS analysis (Uchino et al. 2006).

Reference

Samanta G, Roychowdhury T, Mandal BK et al (1999). Flow injection hydride generation atomic absorption spectrometry for determination of arsenic in water and biological samples from arsenic-affected districts of West Bengal, India and Bangladesh. *Microchem J* 62:174-191.

Uchino, T., Roychowdhury, T., Ando, M and Tokunaga, H. (2006). Intake of arsenic from water, food composites and excretion through urine, hair from a studied population in West Bengal, India. *Food and Chemical Toxicology* 44, 455–461.

Q. 2. are there any special storage requirements for, for instance, nail clippings collected a year ago? Would it be worth testing them if they've been stored without following those requirements?

Reply: Unfortunately there is no storage procedure for hair and nail samples for the measurement of arsenic. I think, the total concentration of nail does not decrease significantly if we store for long.

Q. 3. for the methodology/ies you recommend, what do you compare the results to?

Reply: I think method 1 is most suitable for routine analysis. Please see Samanta et al. 1999 for the SRM/CRM and inter-laboratory results.

Q. 4. can you advise as to which labs can do these tests and the approximate costs?

Reply: In Australia, CERAR, University of South Australia could analyse hair and nail samples and the cost per sample is AUD 50 (Cleaning plus digestion plus ICP-MS analysis).

Q.5. is there any value to the resident of testing arsenic in nails or hair or is it something that would only be done for research purposes in case there is ever a body of research results that can associate particular health effects with nail or hair arsenic levels?

Reply: Arsenic accumulates in keratin-rich tissues such as skin, hair and nails as a consequence of its affinity for sulfhydryl groups. Arsenic levels in hair and nails may be used as an indicator of past arsenic exposure. Arsenic levels in hair and nail will decrease with time but it is a long process and even takes 1-2 years to decline. So, it is important to determine the arsenic level in hair and nail to find out the past arsenic exposure. Even, the exposed subjects may not exhibit any arsenical symptoms, but high levels of As in hair and nail confirm that the subjects are sub-clinically affected. Please see article of Mandal et al. 1998 (Impact of safe water for drinking and cooking on five arsenic-affected families for 2 years in West Bengal, India, *The Science of the Total Environment* 218, 185-201).

Q.6. what arsenic testing would you recommend that is of most value to the resident and their doctor in managing their arsenic exposure?

Reply: Urinary As (Inorganic arsenic and its metabolites) analysis is an important parameter to find out the recent arsenic exposure to the exposed resident. Blood arsenic is typically used as an indicator of very recent or relatively high-level exposure (e.g. in cases of poisoning), or chronic stable exposure. Arsenic is rapidly cleared from blood. So, it is important to analyse the blood As level within 6 hours to know the exposure level.

For Australian community, I think arsenic speciation of urine, hair and nail is important as seafood (which contains non-toxic organic arsenic) is very common in Australia.

From Dr Michael James Watts from the British Geological Survey, Nottingham Trent University, United Kingdom

1. "1. See Button et al 2009 for methods. We will have a paper released shortly on hair from Argentina.
2. I would expect toenails to be fine if stored in a sealable bag. Your problem will be having enough sample, generally 100mg or at least 4-6 weeks growth from all toes.
3. We check the analytical methods using certified reference materials of equivalent samples, and a number of other standard statistical tests including replicate analyses. You would generally compare data with the scientific literature for non-exposed and exposed communities.
4. We could do the analyses at BGS. Costs would depend on the amount of sample, need for removing surface contamination from hair/toenails and number of samples. We could provide you with up data for up to 50 elements, rather than just As. This would be important in defining any health effects as caused by As or a combination of other toxins.
5. Measurement of an individual would require care in drawing any conclusions, again this is where a questionnaire is very important. Better to consider groups of people in order to draw any conclusions and you should have an epidemiologist involved in the interpretation. It would be a useful exercise to build a body of data for the research community to build some consensus. I'm not so sure you could define particular health effects, it would be more a case of comparing occurrence and exposure routes to uptake. This is also where numbers provide greater confidence in the statistical relevance of measurements.
6. Arsenic testing - urine and blood give an immediate indication of exposure, urine being mainly dietary exposure, although apparently a good indication of inhaled dust-As. Toenails and hair provide an indicator of exposure over several weeks or months and is less susceptible to daily fluctuations. A doctor could compare concentrations of As toenails and hair with control populations and other exposed sites reported in the literature."

From ABC Television Catalyst on 11 March 2010 on Arsenic Toenails - Transcript Extracts from Dora Pearce University of Ballarat

www.abc.net.au/catalyst/stories/2843289.htm

"When you generally take a measure of the arsenic in the toenail clippings what you're getting is an average reading. And so the arsenic concentration at one time point can be much higher than it is at a different time point. So what we really need to be able to measure is arsenic concentration at a given time point so we know we can relate that back to the actual exposure that caused that.

We found that about 10 per cent of children in our study had levels of arsenic in their toenails higher than what might be considered a "normal" dose and also we found about half had levels greater than the highest value recorded in a non gold mining area — but we do need a larger study to confirm those findings.

The arsenic species that we detected in the children's toenail clippings suggested that the arsenic was possibly taken up in two different ways. One way is that the arsenic is absorbed systemically through

the body when the kids are out there playing in the dirt or they can also inhale the arsenic from dust when they're playing out there especially on the mine waste.

We really don't know what a safe level of arsenic in toenails is, especially not in children because the baseline study's really haven't been able to provide us with that information. Far more work needs to be done in unexposed populations so that we can tell what a background level is.”

From the US Agency for Toxic Substances and Disease Registry

www.atsdr.cdc.gov/tfacts2.html#bookmark09

Is there a medical test to show whether I've been exposed to arsenic?

There are tests available to measure arsenic in your blood, urine, hair, and fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels of arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict whether the arsenic levels in your body will affect your health. www.atsdr.cdc.gov/csem/lead/pbbiologic_fate2.html

Lead in the Blood

Although the blood generally carries only a small fraction of total lead body burden, it does serve as the initial receptacle of absorbed lead and distributes lead throughout the body, making it available to other tissues (or for excretion).

- The half-life of lead in adult human blood has been estimated to be from 28 days (Griffin *et al.* 1975 as cited in ATSDR 2005) to 36 days. (Rabinowitz *et al.* 1976 as cited in ATSDR 2005)
- Approximately 99% of the lead in blood is associated with red blood cells; the remaining 1% resides in blood plasma. (DeSilva 1981; EPA, 1986a; Everson and Patterson, 1980, as cited in ATSDR, 1999)
- In addition, the higher the lead concentration in the blood, the higher the percentage partitioned to plasma. This relationship is curvilinear –as blood lead levels (BLLs) increase as the high-end plasma level increases more.

Blood lead is also important because the BLL is the most widely used measure of lead exposure.

- These tests, however, do not measure total body burden—they are more reflective of recent or ongoing exposures (see “*Laboratory Evaluation*” section).