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**Hearing on
Perchlorate: Health and Environmental Impacts of Unregulated Exposure
Before the
House of Representatives
Subcommittee on Environment and Hazardous Materials
of the
Committee on Energy and Commerce
Wednesday, April 25, 2007, at 10 am**

Submitted for the Record

Mr. Chairman, distinguished Members of the Subcommittee: my name is Anila Jacob, and I am a Senior Scientist at the Environmental Working Group (EWG), a nonprofit research and advocacy organization based in Washington, DC, and Oakland, California. I am also a practicing internist. I would like to start by thanking the members of the committee for this opportunity.

Today, I will present data from research studies conducted by the Centers for Disease Control and Prevention (CDC) and academic scientists and published in highly respected peer reviewed journals that demonstrate that exposure to perchlorate is widespread and especially harmful to vulnerable populations. I will also outline why the current US Environmental Protection Agency (EPA) Reference Dose (RfD) of 24.5 parts per billion (ppb) is not protective of public health and why, as a physician, I believe that a maximum contaminant level (MCL) of no higher than 1 ppb for drinking

water is a necessary public health measure.

Summary

A series of major studies by the CDC and other scientists have confirmed what many in the public health community have suspected for years – that perchlorate contamination in the environment has become a significant threat to public health. These studies establish that exposure to perchlorate is widespread and that the levels of perchlorate that are found in people are associated with significant decreases in thyroid hormone levels.

Perchlorate has been long established in the medical literature as a potent compound with known capacity to lower thyroid hormone levels. Low thyroid hormone levels in pregnant women and infants, in turn, are an established risk factor for abnormal brain development in the fetus and intellectual deficits in children.

The question that has challenged public health professionals for the past decade is establishing the significance of the public health threat presented by the levels of perchlorate to which people are actually exposed. In the past year, this question has been largely resolved.

We now know that perchlorate in the environment and, more importantly, perchlorate levels detected in women of childbearing age and in breast milk are associated with statistically significant, measurable, and adverse changes in thyroid hormone levels that present very real health risks to infants and children.

These findings elevate perchlorate from the ranks of potential health threats into the first tier of known environmental hazards, along with compounds like mercury and lead, where the science clearly justifies strong protective measures by public health agencies.

These findings also demonstrate that the current EPA RfD of 24.5 ppb is not protective of public health; it is not “safe.” Therefore, I strongly support the efforts of Representative Solis and the cosponsors of the *Safe Drinking Water for Healthy Communities Act of 2007*, H.R. 1747. This legislation is a critical step in establishing a health protective drinking water standard for perchlorate. As a physician, I believe that a safe drinking water standard (or MCL) of no higher than 1 ppb is a necessary measure.

Mechanism of Action of Perchlorate

Iodine is the main building block of thyroid hormone. Perchlorate is a chemical contaminant that inhibits the uptake of iodine into the thyroid gland, thereby interfering with normal thyroid hormone production. Thyroid hormone is critical for normal growth and cognitive development in the fetus, infants, and young children. Inadequate thyroid hormone levels during the fetal period and infancy can result in intellectual deficits that persist throughout life (1).

Evidence of Exposure

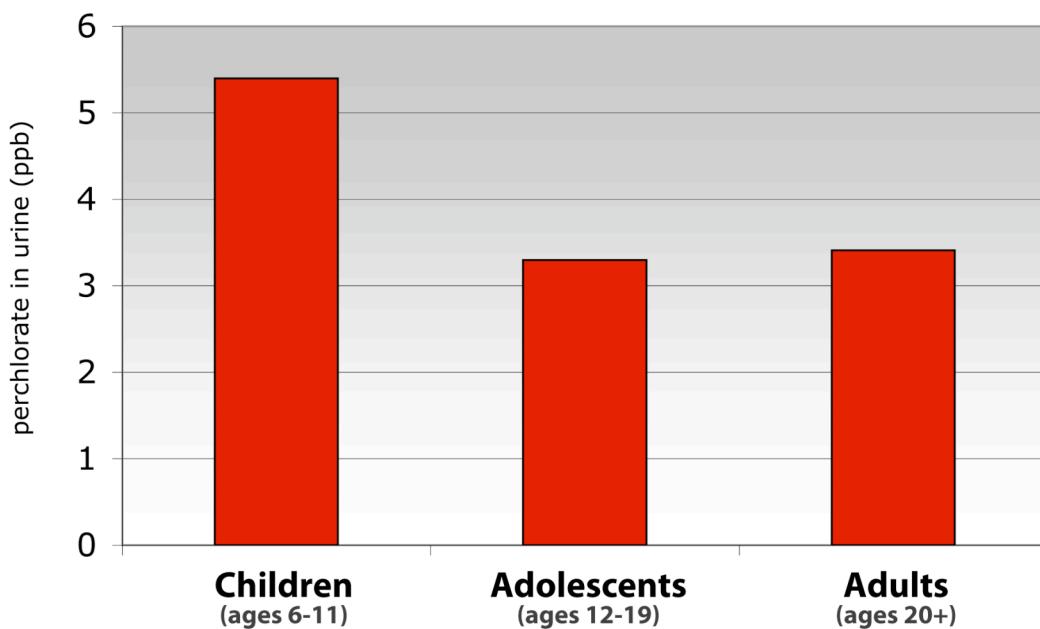
In a recent study by scientists at the CDC, detectable levels of perchlorate were found in the urine of every one of 2,820 US residents (ages 6 and older) in a nationally representative sample, demonstrating that exposure to perchlorate is

ubiquitous in the US (2).

The findings in this study raise concerns. Urinary perchlorate levels in children ages 6 to 11 were 1.6 times higher than levels in adults, showing that children carry more perchlorate in their bodies than adults and, therefore, have higher exposures.

Children are exposed to an average of 1.6 times more perchlorate than adults

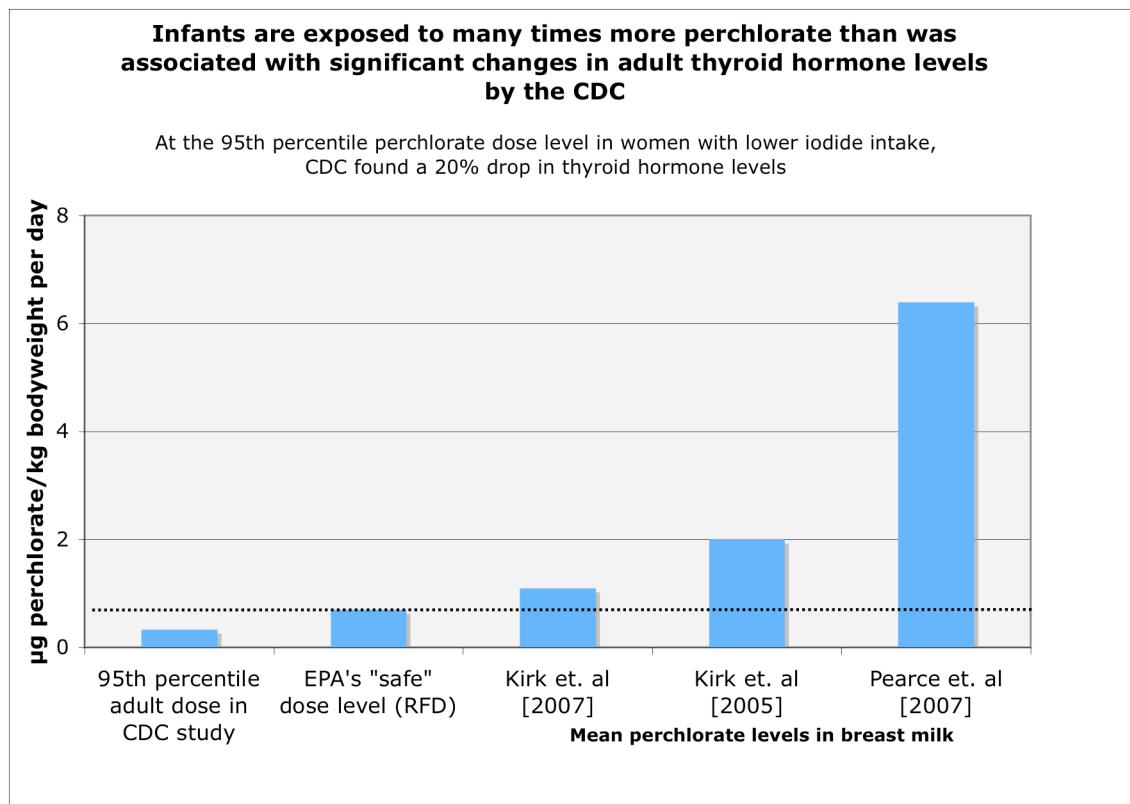
This figure shows the adjusted geometric mean of urinary perchlorate found in the CDC study. It is not adjusted for bodyweight.



Blount BC, Valentin-Blasini L, Osterloh JD, Mauldin JP, Pirkle JL. 2006. Perchlorate exposure of the U.S. population, 2001-2002. Journal of Exposure Science and Environmental Epidemiology. Oct 18: epub ahead of print.

In three additional studies from CDC and academic scientists published in the past two years, samples of breast milk from different parts of the country were tested. Every single sample of breast milk in all three studies was positive for perchlorate. While this is startling in itself, what is more troubling is that average levels of perchlorate in breast milk in these studies would expose a significant number of

breast fed infants to perchlorate levels above the EPA's recommended dose, or RfD (3,4,5).



Further, in all three breast milk studies, a significant number of samples contained insufficient levels of iodine to meet the requirements of breast fed infants, meaning that not only would babies drinking this breast milk be exposed to hazardous levels of perchlorate by EPA's standards, but they would also be deficient in the iodine necessary to counteract the thyroid hormone lowering effects of the compound, thereby magnifying potential health effects of perchlorate in these infants.

Evidence of Effect on Thyroid Hormone Levels

In another study from 2006, CDC scientists analyzed both perchlorate and thyroid hormone levels in more than 1,000 American women (6). They found that in those women with lower iodine levels (one third of American women), perchlorate exposure far below the EPA RfD of 24.5 ppb was associated with significant changes in thyroid hormone levels.

For a subset of women in the study with lower iodine, exposure to perchlorate as low as 5 ppb in drinking water was associated with decreases in thyroid hormone levels to the extent that the women would require treatment with thyroid hormone if they became pregnant in order to prevent abnormal brain development in their fetus.

When the findings from this study are extrapolated to the US population, our analysis finds that 2 million women of childbearing age are at risk for abnormal thyroid hormone levels during pregnancy (see attached figure). This CDC study is the first to identify women with lower iodine levels as particularly susceptible to the effects of perchlorate exposure (6).

In other words, exposures at levels significantly lower than the EPA RfD of 24.5 ppb, the level EPA presumes is “safe,” were linked with a lowering of thyroid hormone levels that can cause significant adverse health effects in exposed women and their fetus.

Vulnerable Populations

Developing Fetus

Adequate thyroid hormone levels are critical for normal brain development in the

fetus (1,9). The developing fetus is completely dependent on maternal thyroid hormone during the first trimester. After that, the fetus begins to produce its own thyroid hormone, but still receives about 30 percent of its total from the mother for the remainder of the pregnancy. Any thyroid hormone deficiency in the mother has repercussions for her fetus.

As mentioned earlier, women with lower iodine levels that are exposed to perchlorate levels as low as 5 ppb in drinking water can have significant decreases in T4, a critical thyroid hormone (6). If this happens during pregnancy, they may not be able to provide adequate levels of thyroid hormone to their developing fetus. Given that maternal contribution of thyroid hormone to the fetus is so significant throughout pregnancy, any maternal shortage can have long-term consequences for her fetus. Studies have shown that even subtle fluctuations in maternal thyroid hormone levels during pregnancy can have long-term impacts on the IQ of her child (7,8).

Infant

Breast milk does not contain a significant amount of thyroid hormone, so infants are completely reliant on their own production of the hormone. Infants also have higher turnover of thyroid hormone and have very little of the hormone in reserve when compared with adults. Therefore, infancy is a unique time in development during which increased production and rapid turnover of thyroid hormone, coupled with a lack of stored hormone, combine to make infants particularly vulnerable to any factors which impact thyroid hormone production. Exposure to perchlorate during this critical stage could result in shortages of thyroid hormone, prompting one study author to note "given these demands of the neonatal thyroid, it is likely that

perchlorate induced inhibition of iodide uptake has a greater impact in neonates...."

(1). Adequate levels of thyroid hormone are critical to normal growth and cognitive development in infants (1,9).

Iodine

The status of iodine nutrition in the United States has a direct bearing on susceptibility of the population to perchlorate since perchlorate is a direct inhibitor of iodine uptake by the thyroid gland and higher iodine levels can overcome the effects of perchlorate. In the US, only 60 percent of the population currently uses iodized salt. Urinary iodine levels, an indicator of iodine nutrition, have decreased significantly in the US population in the last several decades. However, even with these decreases, CDC scientists noted in a recent analysis that iodine nutrition for the country is considered to be adequate (10).

There have been some suggestions that increasing iodine intake through iodized salt and vitamins may be an effective antidote to the health effects of perchlorate contamination. There are several problems with this strategy. Almost 40 percent of the population currently does not use iodized salt, and public health campaigns to change consumer habits could take years before any significant changes are seen. People with certain health conditions such as hypertension, congestive heart failure, and chronic kidney disease must restrict their salt intake, making salt a poor source of iodine for them. In addition, infants, a high risk population for perchlorate exposure, do not eat solid foods to which iodized salt could be added. Finally, universal salt iodization can expose a significant proportion of the population to excess iodine, which has been linked to autoimmune thyroid disease and certain types

of thyroid cancer. Iodine fortification of foods was decreased in the 1970's because of these health concerns related to excessive iodine intake (10).

In summary, iodine nutrition in the US is considered to be adequate. Even so, exposure to perchlorate at environmentally relevant doses has been associated with decreases in thyroid hormone levels in women with lower, but not abnormal, iodine levels. Increasing iodine intake in these women could help counteract the effects of perchlorate but it would be impossible to selectively identify them within the general population. Therefore, at a time when iodine nutrition in the US is considered to be adequate and there are known adverse effects associated with excessive iodine intake, it is difficult to justify asking the whole population to increase its collective iodine intake to counteract the effects of a chemical pollutant in a selective, vulnerable population. A health protective MCL for perchlorate in drinking water that takes into account vulnerable populations would serve the same purpose without adverse effects.

Perchlorate in Food

Perchlorate has been found in a variety of produce items and cows milk. The source of perchlorate in food is thought to be, in part, contaminated irrigation water and forage crops (2), but the source of much of the perchlorate in food remains uncertain. One of the breast milk studies mentioned earlier was done in a city where there is no known exposure to perchlorate in drinking water (5). Even so, every sample in the study contained perchlorate, and the average level of perchlorate in this breast milk would expose infants to doses well above what the EPA considers safe. This suggests that food is an important source of perchlorate exposure, but

more information of food contamination is needed.

In light of additional CDC work showing universal perchlorate contamination for all individuals tested, it is reasonable to assume that women and infants in communities where there is additional exposure to perchlorate through the combination of contaminated drinking water and food may have even higher levels of the contaminant in their breast milk when compared with those women with exposure through food only. It is imperative that the EPA act to protect women and children in these communities from what all data indicate is a hazardous combination of exposure to perchlorate from food and water. The first step in that process is a tough, protective drinking water MCL.

State Actions on Perchlorate:

Several states, including New Jersey, Massachusetts, and California have already addressed the issue of perchlorate in drinking water by either already setting or planning to set a MCL that is far lower than the current EPA recommendation. While none of these states have proposed a MCL as low as 1 ppb, their standards would still be far more protective of public health than the current EPA recommendation. But beyond these state borders, millions of people drink perchlorate contaminated water and live in states with little regulatory capacity. They depend on the federal government to protect them and EPA must fulfill this responsibility.

Summary Points

Evidence that Current EPA RfD is Not Protective of Public Health

- A recent CDC study shows that perchlorate exposure at levels far below EPA RfD is

associated with significant changes in thyroid hormone levels in women with lower iodine levels.

- Studies on US breast milk by CDC and academic scientists indicate that breast fed infants may be regularly exposed to perchlorate levels which exceed EPA RfD, prompting the question "If perchlorate exposure far below EPA RfD are associated with significant thyroid hormone changes in women with lower iodine, what are levels in breast milk that exceed EPA RfD doing to the health of breast fed infants?"

Implications

- Millions of women of childbearing age may have inadequate thyroid hormone levels when they become pregnant, putting their fetus at risk for abnormal brain development.
- Millions of breast fed infants may be at risk for thyroid insufficiency due to perchlorate contamination of breast milk, which can interfere with normal development.

Conclusion

- Recent research from respected CDC and academic scientists demonstrate that exposure to perchlorate at environmentally relevant levels poses a significant health threat to millions of US residents, particularly pregnant women and young infants. We must find the political will to enact legislation to address this issue as soon as possible; what is at stake is entirely too important for this action to be delayed any longer.

Recommendations

- The EPA must set a federal MCL for perchlorate that takes into account the most recent research, including the CDC study from last fall (2) and the recent breast milk studies (3,4,5). The MCL must also account for the contribution from contaminated food to daily perchlorate exposure. It is technologically feasible to treat contaminated water sources to levels below 1 ppb. As a physician, I feel that the public health measure that would reduce exposure in the shortest amount of time and reach the greatest number of people is to set the MCL for perchlorate in drinking water no higher than 1 ppb.

References

- 1) Zoeller RT, Dowling ALS, Herzig CTA, Iannaccone EA, Gauger KJ, Bansal R. 2002. Thyroid hormone, brain development, and the environment. *Environmental Health Perspectives* 110(3) 355-361.
- 2) Blount BC, Valentin-Blasini L, Osterloh JD, Mauldin JP, Pirkle JL. 2006. Perchlorate exposure of the U.S. population, 2001-2002. *Journal of Exposure Science and Environmental Epidemiology*. Oct 18: epub ahead of print.
- 3) Kirk AB, Martinelango PK, Tian K, Dutta A, Smith EE, Dasgupta PK. 2005. Perchlorate and iodide in dairy and breast milk. *Environmental Science and Technology* 39(7) 2011-17.

- 4) Kirk AB, Dyke JV, Martin CF, Dasgupta PK. 2007. Temporal patterns in Perchlorate, thiocyanate, and iodide excretion in human milk. *Environmental Health Perspectives* 115(2) 182-86.
- 5) Pearce EN, Leung AM, Blount BC, Bazrafshan HR, He X, Valentin-Blasini L, Braverman LE. Breast milk iodine and Perchlorate concentrations in lactating Boston-area women. *Journal of Clinical Endocrinology and Metabolism*. Feb 20, 2007 epub ahead of print.
- 6) Blount BC, Pirkle JL, Oserloh JD, Valentin-Blasini L, Caldwell KL. 2006. Urinary Perchlorate and thyroid hormone levels in adolescent and adult men and women living in the United States. *Environmental Health Perspectives* 114(12): 1865-71.
- 7) Haddow JE, Palomaki GE, Allan WC, Williams JR, Knight GJ, Gagnon J, O'Heir CE, Mitchell ML, Hermos RJ, Waisbren SE, Fair JD, Klein RZ. 1999. Maternal thyroid deficiency during pregnancy and subsequent neuropsychological development of the child. *New England Journal of Medicine* 341: 549-555.
- 8) Pop VJ, Kuijpers JL, van Baar AL, Verkerk G, van Son MM, de Vijlder JJ, Vulsmma T, Wiersinga WM, Drexhage HA, Vader HL. 1999. Low maternal free thyroxine concentrations during early pregnancy are associated with impaired psychomotor development in early infancy. *Clinical Endocrinology* 50: 149-155.

- 9) Ginsberg GL, Hattis DB, Zoeller RT, Rice DC. 2007. Evaluation of the U.S. EPA/OSWER preliminary remediation goal for Perchlorate in groundwater; focus on exposure to nursing infants. *Environmental Health Perspectives* 115(3) 361-369.
- 10) Caldwell KL, Jones R, Hollowell JG. 2005. Urinary iodine concentration: United States National Health and Nutrition Examination Survey 2001-2002. *Thyroid* 15(7) 692-699.

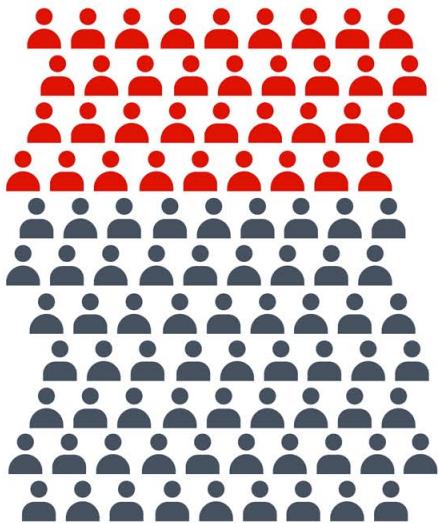
CDC study found exposure to perchlorate associated with disruption of thyroid hormone levels in women



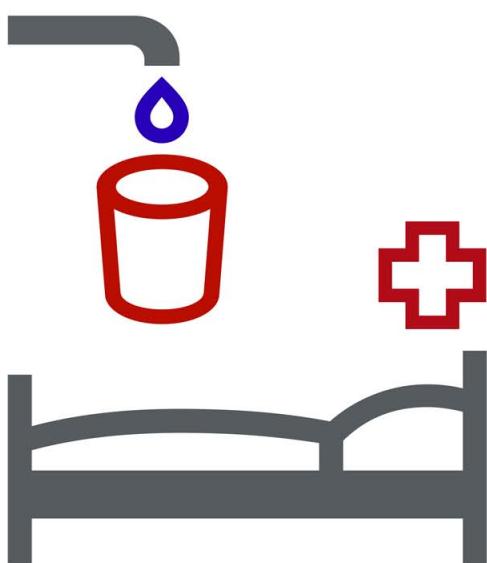
36% of American women have lower iodine intake and are at higher risk for perchlorate-related health effects.

Number of women of childbearing age (15-44) with lower iodine intake

United States
22,167,719



10% of these low iodine women could become subclinically or clinically hypothyroid if they ingested water with 5 ppb perchlorate.



United States
2,216,772

If these women became pregnant, they would be treated to restore thyroid hormones to normal levels.