

FACT SHEET

Perchlorate and IQ: A Connection in Theory, But Not Reality

In its June 2020 Final Action not to regulate perchlorate at the federal level, the US Environmental Protection Agency (US EPA) relied on a unique, two-staged approach¹ to analyze potential risks. Stage One, a “Biologically-Based Dose Response (BBDR) Model” examined the possible effects of perchlorate on human thyroid hormone production. While EPA’s assumptions in this stage were extremely conservative, the BBDR model represents the best available science.

EPA took a novel approach by linking the BBDR model results to neurological outcomes (IQ measurements) from populations studies rather than clinical research, leading to a hypothesis that perchlorate exposure could lead to a risk of 1–3-point reductions in IQ.

There is no clinical data in any study supporting this hypothesis, nor could levels of perchlorate found in drinking water possibly have such an effect on IQ.

This IQ hypothesis was put forward by US EPA based on selected studies linking reductions in thyroid hormone during pregnancy to effects on neurodevelopment, but there was no data suggesting perchlorate can cause this effect, and there was no comprehensive review of the literature. The following are the basic facts that should be considered for any regulatory decisions:

- 1. The levels of perchlorate found in drinking water are below the threshold at which perchlorate can have any effect, and therefore pose no threat of adverse effects to human health, even for the most sensitive populations.**
 - In 2005 the National Research Council of the National Academy of Sciences (NAS) determined, after reviewing the entire body of perchlorate research, that levels of perchlorate below 245 parts per billion (ppb)² have no measurable effect on human health. NAS further concluded that any adverse effects from perchlorate are “only proposed” and have not been demonstrated in humans³.
 - It is unlikely anyone is drinking water containing perchlorate at levels above 245 ppb considering that the levels detected are below 10 ppb⁴ and declining in 99 percent of the water systems where perchlorate has been found.
 - In putting the IQ hypothesis forward, US EPA described a biological chain of events where “decreased maternal thyroid hormone levels during pregnancy . . . have been linked to decrements in neurocognitive function in offspring.” However, there is no finding that perchlorate at concentrations found in drinking water will cause decreased maternal thyroid hormone levels, or the possible decrements.

¹ <https://www.epa.gov/sdwa/perchlorate-drinking-water>

² One ppb is roughly equal to a half teaspoon of material diluted in an Olympic-sized pool.

³ National Research Council: *Health Implications of Perchlorate Ingestion*. National Academy Press, 2005. http://books.nap.edu/catalog.php?record_id=11202 See pp. 165-166.

- The scientific database on perchlorate dates to its use as a medicine to treat Graves' disease in the 1950's and includes nearly 70 years of scientific study. No cases of adverse effects from exposure to perchlorate at levels found in drinking water have ever been documented.
- It is scientifically accepted that no adverse health effects will occur when humans are exposed to levels below the No Observed Effect Level (NOEL) of a compound. Theoretical changes in thyroid hormones or subsequent effects on neurodevelopment and IQ cannot occur if no one is being exposed to levels below the perchlorate NOEL.

2. EPA did not utilize all available scientific literature in deriving its IQ hypothesis, mostly relying on a single study that objectively is not representative of the scientific database, contains unverified conclusions, and is unlikely to be representative of the US population.

- EPA used a mathematical relationship derived from a 2016 study by Korevaar, et al., to hypothesize an association between thyroid hormone changes and a 1–3-point decrease in IQ. Setting aside that levels of perchlorate in drinking water are too low to trigger these hormone changes, EPA apparently did not perform a systematic review of the scientific literature. There is at least one study that shows no such association.⁴
- The tests used to measure IQ lack the sensitivity to evaluate a 1, 2, or 3-point IQ change. IQ measurement can be affected, or “confounded” by several factors, including socioeconomic status, parental interaction, and variance in testing methods, among others.⁵
- The purpose of IQ testing is to identify individuals who need specialized care due to a developmental delay or disability – and it is not intended to be used to define the possible effects of small changes in thyroid hormones. It's well recognized, for example that IQ, as a variable, has a standard deviation of 15 points, demonstrating that a variance of as much as 4 points, if it occurs, is still the “natural background variability.”⁶ In other words, it is biologically insignificant.
- The Korevaar study examined a population of women in the Netherlands, however, the American Thyroid Association specifically suggests women in the Netherlands may have differences in key aspects of the thyroid gland.⁷ Moreover, the population of the Netherlands has known differences in iodine status compared to the United States, and there may be significant demographic, ethnic, nutritional, and genetic differences between the study population and the population to which these data are applied.⁸ Given the long-recognized relationship between thyroid sufficiency and thyroid hormones, the Korevaar study is likely not representative of the US population. At a minimum, these differences require more analysis.

⁴ See Peer Review Summary Report *supra* note 34 at 16, and EPA Proposed approaches Vol.1 at 5-5

⁵Hart, B & Risley, T.R., Meaningful differences in the everyday experience of young American Children (1995)

⁶ Slikker, et al., Cognitive Tests: Interpretation for Neurotoxicity? (Workshop Summary), 58 *Toxicological Scis.* 222, 231-32 (2000) (Citing Bellinger, 1995).

⁷ Alexander, et al., 2017 Guidelines of the American Thyroid Association for the Diagnosis and Management of Thyroid Disease During Pregnancy and the Postpartum, 27 *Thyroid* 315, 319 (2017).

⁸ Ibid