



# UNITED KINGDOM WATER TREATMENT ASSOCIATION

## UKWTA POSITION PAPER

### World Health Organisation Publication:

### Calcium and Magnesium in Drinking-water, Public health significance

In March 2009, the World Health Organisation (WHO) published a booklet: **Calcium and Magnesium in Drinking-water**, Public health significance. The booklet presents the current position of the WHO following several years of investigation and, specifically, a Symposium on Health Effects of Calcium and Magnesium in Drinking Water, held in Baltimore in April 2006.

The publication is relevant to UKWTA members in that the booklet makes several references to domestic water treatment and, not only is it intended to inform the 2010 revision of the WHO Guidelines for Drinking Water Quality, but some national regulators are already quoting reference to the statements in the “Expert Consensus” section in relation to the acceptability of reducing hardness minerals in drinking water.

### The Evidence

Consideration by the WHO of the hypothesised health benefit from hardness minerals in drinking-water was originally prompted by enquiries about re-constitution of desalinated water – particularly in the Eastern-Mediterranean areas – and based on a number of ecological epidemiological studies conducted over the last 50 years, some of which indicate an inverse association between water hardness and cardiovascular disease (CVD). Ecological studies are prone to confounding by other factors and cannot be used for conclusive recommendations. Attention was therefore turned to the more reliable analytical studies which track, or trace, health outcomes for individuals against measured, relevant exposure levels. Evaluation of nine analytical studies which were regarded as “acceptable quality”, revealed no statistically significant association between water hardness or calcium in drinking water and CVD but, 5 case-control studies, when considered collectively, showed a similar trend in inverse association between magnesium and death from CVD – although this does not necessarily demonstrate causality.

Supporting chapters in the booklet concentrate on the medical and physiological evidence which supports the potential benefit of magnesium, with the implicit circumstantial argument that magnesium in drinking water would be expected to provide nutritional benefit – even though the direct evidence is weak and inconsistent. It makes the point that calcium and magnesium are essential nutrients, that diet is the primary source and that populations around the world are deficient in intake of these nutrients compared to recommended levels. But the recommended levels also lack consistency which challenges the extent of the deficiency and the potential benefit from water minerals – particularly for magnesium for which the dietary contribution from hard water would typically be about 3%. Other expert opinion has described such contribution to any health benefit as trivial and cites intervention trials employing substantial dietary supplementation of Ca and Mg with minimal measurable health outcome.

### Interpretation

Although most sources of drinking water are addressed within the “Expert Consensus”, with the common recommendation that “authorities may wish to further modify drinking water composition in the light of overall mineral nutrition”, the coverage of POE/POU devices (particularly domestic water softeners and reverse osmosis water treatment equipment) is comparatively extensive and even singles out these devices for advice to the users on “the consequences for total mineral intake and human health”!

It seems disproportionate to single out POE/POU applications for “human health implications” when the health implications are so obscure. Also, when it is considered that probably half of the world’s population consumes naturally soft water, which contains little or no calcium and magnesium (and all of the ecological epidemiological studies were carried out on naturally soft, not artificially softened water), the maximum “World Health” benefit would be achieved by addressing that source – if the association is valid.

Although it does recognise the essentiality of adequate hydration, it does not seem to address the potential damage to public perception and confidence by casting highly questionable doubt about the “health implications” from certain drinking water sources. Equally importantly, it trivialises benefits of POE/POU devices by referring to “several aesthetic benefits” of softened water which grossly understates the established health, economic, environmental and ecological benefits of soft water. It is not until the final chapter by Dr Regunathan, that the practice and benefits of municipal softening are identified, together with concern about potential harm to consumer perception and health from this unsubstantiated correlation.

Hard water can cause:

1. Scale on heat transfer surfaces causing waste of energy, increased fuel costs, pollution and equipment failure.
2. Corrosion - some hard waters have been found to be corrosive, particularly towards aluminium in boilers or heating systems for example.
3. Increased detergent and soap consumption, with associated higher costs and adverse impact of the detergent chemicals on sewage treatment plant operation and, ultimately, the environment.
4. Eczema - epidemiological studies (and numerous anecdotal reports) associate hard water with childhood eczema. A government funded trial on water softeners is currently ongoing in the UK.
5. Legionella growth within scale in the distribution system resists thermal and chemical disinfection.
6. Quality of life - aesthetics and cleaning frequency are impacted by hardness scum deposition on kitchen and bathroom sanitary ware – as well as kettles and hot beverages.

Because the booklet refers to statements from a number of different sources, the content is often contradictory and, as a result, extracted statements are being misused. The true position is, perhaps, most accurately reflected by the opening sentence of the Preface which states:

*“This document identifies knowledge gaps and recommends research priorities in order to build an evidence base to inform decisions on managing “processed” drinking-water. This is important because of increasing consumption of water arising from advanced treatment processes such as desalination and uncertainty about the resulting health implications.”*

The extensive list of “knowledge gaps and research recommendations” listed at the end of the “Expert consensus” delineates the need for more positive evidence of any association, rather than specific advice or action at this stage.

## **Conclusion**

The conclusion of the UKWTA is that the evidence for a potential health benefit from water hardness is very weak and confined to magnesium content, for which the contribution to dietary intake would be trivial. The justification for any informative action is, at this stage, highly questionable and, when balanced against the benefits of soft (or softened) water, and against the benefits of optimum hydration, positive statement or action is inappropriate unless and until there are definitive conclusions from the recommended research.

Perhaps, the biggest concern is that isolated comments from the document will be given disproportionate significance and used for publicity purposes or to support current and future health policy/regulation to the ultimate disadvantage of the consumer.