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CONTRIBUTION

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Subject:	Drinking Water Directive (recast): Revised Presidency compromise text - comments from delegations

Following the last WPE meeting on the above proposal and the request for comments, delegations will find attached the comments received from the Czech Republic.

CZECH REPUBLIC

Minimum concentration of calcium, magnesium and total dissolved solids in Annex I – Part B

Minimum required concentration of minerals in softened or demineralized (desalinated) water – addition to Annex I, Part B (new table 2):

Parameter	Unit	Minimum concentration required in softened or demineralized (desalinated) water (*)	Recommended optimum concentration from health point of view ¹
Calcium (Ca)	mg/L	30	40 – 80
Magnesium (Mg)	mg/L	10	20 – 40
Total Dissolved Solids (TDS)	mg/L	100	200 – 500

(*) Water containing lower concentration of Ca, Mg, or TDS should not be subject to softening or demineralization (desalination).

1. Current status – Drinking Water Directive

Contrary to the former Council Directive 80/778/EEC², neither current version of the Drinking Water Directive (98/83/EC), nor its proposed recast (2018) regulate the issue of minimum level of (naturally occurring) essential minerals in drinking water. The Czech Republic believes that there is a serious gap in determination of water safety as specified in Article 4 and Annex I, because it sets only maximum acceptable level of elements of toxicological concerns, but fails to set minimum necessary or optimum level of essential elements. **Water without any minerals (distilled, osmotic etc.) or very low in minerals, which is now in full compliance with Annex I (!), is much more hazardous for consumers if consumed regularly than water containing most of regulated toxic substances.**

2. Justification

Negative health impact of drinking low mineral drinking water on population (only due to low water magnesium and higher mortality on cardiovascular diseases, not speaking about other negative health impact) in Europe is much bigger than impact of all other regulated toxicological chemicals in drinking water together. It seems to be unjustifiable from public health point of view to include new chemical parameters with negligible health risk or not proved health risk at all in Annex I, and at the same time ignore well proved and multiple risk from low mineral water.

As desalination and softening is and will be increasingly used, minimum amount of beneficial essential elements like magnesium and calcium should be defined in desalinated or softened water to prevent deterioration of health of population supplied with desalinated water [1, 2].

¹ The values are based on epidemiological studies showing that incidence of related diseases is the lowest in these water quality ranges.

² Council Directive 80/778/EEC set up minimum required concentration of hardness for softened water intended for human consumption: □ 60 mg/l as calcium or equivalent cautions.

How to approach this health risk? **It is difficult and not feasible to increase substantially naturally low content of nutrients in drinking water – it is to large extent unavoidable natural risk like e. g. intensity of sunlight. However, it is feasible to prevent unnecessary removal or too high mineral removal by softening and desalination and to require keeping some minimum level of essential elements in treated water.**

Apart from the Drinking Water Directive (98/93/EC), not considering this risk, more than 10 European countries have established some form of minimum requirements on hardness (calcium, magnesium) level after softening or a generally optimum range (e.g. Austria, Belgium, Czech Republic, Denmark, Germany, Hungary, Italy, Netherlands, Poland, Slovakia, Sweden, Switzerland)³. Some countries have these requirements legally based, while others issued recommendations in form of technical standards or guidelines. Other countries try to educate the consumers through information leaflets or websites how to use any softening device in household with respect to keeping Ca and Mg in the water for drinking and cooking purposes.

Also the World Health Organization suggested to the European Commission that “*the Directive includes a recommendation that where drinking-water is derived from desalination or any reverse osmosis treatment that demineralizes the water, then Member States should, if possible, add calcium and magnesium salts to condition the water to reduce corrosion and improve taste*” [3].

Case study from the Czech Republic – illustrating magnitude of risk of regulated and nonregulated parameters: The town X. of 10,000 population uses local groundwater sources polluted by both tertachloroethene (PCE) and trichloroethene (TCE). Water is treated by aeration (stripping) and concentration of sum TCE+PCE in finished water is about the limit value 10 ug/l. The health risk from this level of pollution in this town is about 1 case of cancer per 25 years. The supply operator considered two options for improvement: either to renew and intensify treatment of local water or to connect with adjacent water supply with unpolluted groundwater. However, local groundwater has magnesium level about 30 mg/l, but adjacent water supply only 5-8 mg/l. If the town switches to adjacent source with much lower Mg content for consumers, it would represent about 20-30% higher risk of death from cardiovascular diseases. If we take into account high incidence of cardiovascular diseases, the change of water source may lead to several cases of death per year – in comparison with “benefit” lowering 1 case of cancer per 25 years. The operator decided not to switch the source, but continue to treat local water and not increase health risk for consumers.

3. Scientific background

Acute health effects, which may appear within weeks to months after starting regular consumption of distilled or demineralized water, comprise signs of profound deficiency of calcium, magnesium or sodium: extreme fatigue, malaise, nausea, headache, brittleness of nails and hairs, leg and abdominal cramps, preeclampsia, twitch, metabolic acidosis, cardiovascular disorders (arrhythmia), higher diuresis, etc. [4]. These symptoms occur mostly independently on nutritional status of ill person.

³ Information is based on survey done in 2006 by the National Institute of Public Health in Prague and the Istituto Superiore di Sanità in Rome.

Chronic health effects of naturally occurring low mineral water or artificially softened water – or specifically water low in magnesium, calcium or bicarbonates – have been consistently proved by hundreds of epidemiologic studies completed in different countries by different teams of researchers since 1960. The most comprehensive review of about 2 thousand papers, including more than 100 studies with primary data, had been ordered by the Drinking Water Inspectorate (England and Wales) and completed by the University of East Anglia in Norwich in 2005 [5].

Subsequent systematic review and meta-analysis of 14 analytical observational studies (i.e. the most valid epidemiological studies) investigating the association between cardiovascular disease and drinking water hardness brought convincing epidemiological evidence about the protective role of Mg in drinking water, as a pooled odds ratio and showed a statistically significant inverse association between Mg and cardiovascular mortality (OR 0.75 (95%CI 0.68, 0.82), $p = 0.001$). It means that the highest exposure category (people consuming drinking water with magnesium 8.3 – 19.4 mg/l) was significantly associated with a decreased likelihood of cardiovascular mortality (by 25%), compared with the baseline, i.e. people drinking water with Mg content of 2.5 – 8.2 mg/l [6]. Two recent and independent meta-analyses confirmed these findings and found also significant protective effect of water calcium on cardiovascular diseases [7, 8].

A number of other papers [partially summarized in 9] suggest a beneficial or protective effect of water Ca and Mg on other diseases: neurological disturbances, amyotrophic lateral sclerosis, preeclampsia in pregnant women, high blood pressure, metabolic syndrome, bone mass density, higher incidence of fractures and disturbed bone development in children, etc. Studies done at least in two different countries suggested protective effect of water calcium and magnesium against several kinds of cancer [9, 10]; the theoretical explanation of the mechanisms of this protective effect is also available [11].

Existing scientific evidence for negative health effects of low mineral water is comparable with evidence for disinfection by-products, arsenic and lead and much stronger than for parameters like NO₃, F, Ni, Cu, Mn, Na, Fe. For all other chemical parameters in Annex I, the health risk – in concentrations occurring in drinking water – is only hypothetical and not proved and regulation is based only on precautionary principle. There is no reason not to use precautionary principle for other known and much higher risk like presented by low mineral water.

4. References

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