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Best Practice Guide on the Control of Arsenic in Drinking Water

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Arsenic (As) in drinking water derived from groundwater is arguably the biggest environmental chemical human health risk known at the present time, with well over 100,000,000 people around the world being exposed. Whatever the level of contamination, suitable remediation measures should be taken once As is detected in drinking water sources, to ensure the provision of safe drinking water. Source substitution and treatment are two approaches for As remediation of drinking water. In this presentation we will first be providing an overview of these methods and then zoom into a couple of them with supporting case studies with a special focus on centralized, municipal scale drinking water production facilities.

One of the case study will based on a technique that has recently been investigated at lab-, pilot- and demonstration-scale, called as is Advanced Oxidation-Coprecipitation-Filtration (AOCF. It is a 3 step process, including (i) pre-oxidation of As(III) to As(V), (ii) adsorbing As(V) to Fe(OH)3(s) and finally (iii) filtering Fe(OH)3-As(V)(s) complex by granular media filtration. In deep groundwater, As(III) is generally the dominant form of As. We have observed that the oxidation of As(III) by conventional aeration is ineffective. Therefore, we dose permanganate to oxidize As(III). Dosing of permanganate not only increases the oxidation rate of As(III) to As(V), but also of Fe(II) to Fe(III). The iron hydroxide flocs [Fe(OH)3(s)] sorb As(V). When As is present in relatively high concentration, addition of extra Fe becomes necessary and in our lab-scale experiments we have observed that adding Fe as Fe(III) is more effective compared to adding Fe(II). AOCF can be easily implemented at the conventional groundwater treatment plants. No evidence of disturbance has been noticed for the pre-existing removal processes of common groundwater undesirable constituents.

Every year approximately 80,000 tonne of iron rich drinking water treatment sludge is generated by the Dutch drinking water companies. By lab- and pilot scale tests we have investigated the As adsorption potential of dried and subsequently pelletized iron rich sludge. The As(V) adsorption capacity of the sludge based media was comparable to various other iron based adsorptive media that are available in the market today and/or in experimental stage. It must be noted that producing an adsorbent of commercial value out of the residuals contributes to circular economy and is an excellent way to achieve sustainability in the drinking water industry.