Water Quality

Is it safe to drink water from the tap in Zurich?

Introduction
The Zurich Water Works supply drinking water to nearly 1 million people in the greater Zurich area. Most of the drinking water is taken from Lake Zurich. In addition, ground and spring water is used to enhance the resilience of the water supply. Typically, drinking water quality from groundwater plants is ensured by the natural treatment process of water passage through the soil. In the city of Zurich, however, the situation is a bit more complex with respect to groundwater management. The natural groundwater flow towards the Hardhof area runs through several old waste disposal sites. The challenge for a safe drinking water production at Hardhof is to avoid inflow of contaminated groundwater. The most important site with respect to drinking water production is the old disposal site “Herdern”.

![Diagram of the Hardhof groundwater plant](image)

Figure 1. The Hardhof groundwater plant is located at about 4 km west of the city center. The dark blue circles indicate the four groundwater wells. The old waste disposal site Herdern is located in the railway area and has a length of 1.4 km, a width of 600m and a depth of about 4 m. The blue arrows indicate the undesired inflow of ground water from the disposal site.

Until the early 1950s, the waste disposal site Herdern was mainly filled with domestic waste, slag and unverified construction waste. It should be noted that all types of waste were disposed at that time.

The inflow of possibly contaminated groundwater from the waste disposal area to the groundwater wells is avoided by means of an artificial groundwater recharge and a groundwater management system. A brief technical overview of the drinking water production at Hardhof can be found in the supporting documents listed below.
Zurich Water works run a groundwater monitoring program to control the absence of contaminants originating from the waste disposal site. Approximately 50 groundwater sampling sites (groundwater wells and piezometers), which are spread over the whole production site (cf Fig.1), are sampled regularly.

**Supporting Information**
As in many other countries, drinking water is a highly regulated foodstuff in Switzerland. Parameters and limits for drinking water are specified in the "Verordnung des EDI über Trinkwasser sowie Wasser in öffentlich zugänglichen Bädern und Duschanlagen". This ordinance defines legal limits ("Höchstwerte") for drinking water contaminants. Groundwater used for drinking water is protected accorded to Annex 2, chapter 22 of the Waters Protection Ordinance (Gewässerschutzverordnung). With regard to health risks, toxic elements and harmful substances are of course of major interest. The WHO Guidelines provide some information in this respect. The relevant documents can be found among the Supporting documents listed below.

**Questions**
You are a chemist at Zurich Water Supply. Your responsibility is to ensure the chemical water quality. Please propose a chemical groundwater quality monitoring program for the 50 groundwater sampling sites to ensure that the drinking water from the Hardhof plant is safe at any time.

(a) Which inorganic elements/compounds from the waste disposal site could contaminate the drinking water?

(b) Which organic compounds from the waste disposal site could contaminate the drinking water?

(c) Indicate very briefly the major health or consumer related risks for the elements/compounds named.

(d) Please propose an appropriate analytical test method for each of the parameters. Please note that the detection limit of the proposed test method should be about 10 times lower than the legal requirements.

(e) What time interval is appropriate for sampling?

**Supporting documents**
- booklet with information about the Hardhof groundwater plant (in German)
- Verordnung des EDI über Trinkwasser sowie Wasser in öffentlich zugänglichen Bädern und Duschanlagen (in German)
- Gewässerschutzverordnung (GSchV) (in German)
- Deutsche Einheitsverfahren zur Wasser-, Abwasser- und Schlammuntersuchung. Herausgeber: Wasserchemische Gesellschaft in der GDCh, DIN.