Stadt Zürich
Wasserversorgung

Analytical Chemistry
Analytical strategies
WS 2016/2017

Strategic exercise: Drinking Water
Exercise of WS 2016/17

Drinking Water

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Is it safe?

Introduction:

Water Works Zurich supplies drinking water to nearly 1 million people in the greater Zurich area. The Hardhof groundwater plant is one of the three large drinking water plants of the city of Zurich.

One of the important hazards for drinking water quality in the Hardhof groundwater plant is the nearby old waste disposal site of the city of Zurich. Waste disposal sites are also a major risk for many other groundwater plants in Switzerland and in other countries.

Figure 1. Groundwater plant Hardhof located at about 4 km from the city center with 4 groundwater wells A, B, C and D. 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 arrow indicates 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, 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 into the groundwater wells is avoided by means of an artificial groundwater recharge and a groundwater management system. Last but not least, a groundwater monitoring program ensures the absence of contaminants originating from the waste disposal site. About 50 groundwater sampling sites are regularly sampled in the groundwater plant area.

Supporting Information:
As in many other countries, drinking water is a highly regulated foodstuff in Switzerland, too. Chemical parameters and limits for drinking water are specified in the *Fremd- und Inhaltsstoffverordnung (FIV)*. This ordinance defines *Toleranzwerte* and *Grenzwerte* for drinking water and other foodstuffs. When a *Toleranzwert* is exceeded, immediate measures have to be taken to comply with the requirements; if a *Grenzwert* is violated, drinking water supply has to be stopped. A useful summary of parameters and limits for drinking water is published by Kantonales Labor Zurich. Groundwater used for drinking water is regulated in Annex 2, chapter 22 of the Waters Protection Ordinance (*Gewässerschutzverordnung)*. With regard to health risks, toxic elements and compounds 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 the responsible chemist at Water Supply Zurich. Please propose a chemical groundwater quality monitoring program for the 50 groundwater sampling sites to detect contaminants from the waste disposal site on time.

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

(b) Which organic compounds from the waste disposal site could contaminate 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
- Fremd- und Inhaltsstoffverordnung (FIV), https://www.admin.ch/opc/de/classified-compilation/19950193/201510010000/817.021.23.pdf.
- Kantonales Labor Zurich (KLZH):Anforderungen an die Trinkwasserqualität (Toleranz- Grenz- und Erfahrungswerte).

http://www.kl.zh.ch/internet/gesundheitsdirektion/klz/de/wasser/trinkwasser/chemische_qualitaet/_jcr_content/contentPar/downloadlist/downloaditems/anforderungen_an_die.spooler.download.1464763765070.pdf/anforderungen_trinkwasserqualitaet.pdf.

- SR 814.201 Gewässerschutzverordnung vom 28. Oktober 1998 (GSchV).
- Deutsche Einheitsverfahren zur Wasser-, Abwasser- und Schlammuntersuchung. Herausgeber: Wasserchemische Gesellschaft in der GDCh, DIN.
- World health organization (WHO): Guidelines for drinking-water quality - 4th ed.