been observed. One case of selenium toxicity directly attributable to a water source (well water containing selenium at a concentration of 9 mg/l) has been reported. The average dietary intake that is associated with selenosis has been found to be in excess of 900 µg/day.

As selenium is an essential element, various national and international organizations have established recommended daily intakes of selenium. A joint FAO/WHO consultation recommended intakes of 6–21 µg of selenium per day for infants and children, according to age, 26 and 30 µg of selenium per day for adolescent females and males, respectively, and 26 and 35 µg of selenium per day for adult females and males, respectively.

Because of concern about the adverse effects resulting from exposure to excessive levels of selenium, various national and international organizations have established upper limits of exposure for selenium. FAO/WHO established an upper tolerable limit for selenium of 400 µg/day.

Silver

Silver occurs naturally, mainly in the form of its very insoluble and immobile sulfide, oxides and some salts. Silver ions are primarily found in the +1 oxidation state, and the ionic compounds silver nitrate (soluble) and silver chloride (relatively insoluble) are the most important forms of silver for drinking-water. Silver can also occur as nanoparticles, which can be present in water bodies as a result of release into the environment from wastewater or industrial discharges. When silver is used in point-of-use water treatment devices, drinking-water is expected to be the major source of exposure to silver.

Reason for not establishing a guideline value	Available data inadequate to permit derivation of health-based guideline value, and silver usually occurs in drinking-water at concentrations well below those of health concern
Provisional reference value*	0.1 mg/l
Occurrence	In surface water and groundwater, silver concentrations are usually below 5 µg/l; however, detections >100 µg/l, although rare, have been reported
TDI	A formal TDI could not be derived because of database limitations. However, 0.6 mg/kg bw of colloidal silver per day was considered a LOAEL based on a case report of argyria in a woman who ingested this dose of silver for 16 months. An uncertainty factor of 100 (10 for intraspecies variability and 10 for database limitations) was applied. The database limitations include the short duration of the study, uncertainty associated with a dose level derived from human recall and use of a LOAEL instead of a NOAEL.
Limit of detection	2 ng/ by neutron activation analysis; 5 ng/l by ICP-MS; 2 µg/l by graphite furnace AAS; 10 µg/l by a spectrographic and colorimetric method with dithizone for a 20 ml sample. In addition, asymmetric flow field-flow fractionation in combination with single particle ICP-MS can differentiate between silver nanoparticles and dissolved silver, although this method has not yet been standardized. Since ionic silver can be released from silver nanoparticles, it may be difficult to determine whether silver dispersed in water has originated from the ionic or the particulate fraction.

Treatment performance	Conventional treatment (coagulation, sedimentation, filtration) and lime softening are effective for removing ionic silver; conventional treatment is also expected to be effective for removing coated silver nanoparticles
Guideline value derivation	
• allocation to water	80%
• allocation to water	60 kg adult
• consumption	2 litres/day
Additional comments	The provisional reference value is applicable particularly where silver is used in point-of-use water treatment devices. However, silver is not recommended for disinfection of drinking-water including in point-of-use water treatment devices (see Part III of the supporting document *Alternative drinking-water disinfectants: Bromine, iodine and silver*; Annex 1). It is also noted that silver with copper may be necessary to control *Legionella* in the distribution systems of buildings, and the risks of legionellosis outweigh the risks from low levels of silver ions (usually in the low µg/l range) that may be detected in drinking-water as a result of such use. See *Silver in drinking-water*, Annex 2, for further information, including on *Legionella* control measures.
Assessment date	2021
Principal reference	WHO (2021) *Silver in drinking-water*

* Although a formal guideline value cannot be established, the provisional reference value was derived based on limited available studies, recognizing that a "bounding value" may be useful, to provide guidance to Member States in the event of need. Reference values are too uncertain to be used for developing regulations or standards.

The only obvious sign of silver overload is argyria, a condition in which skin and hair are heavily discoloured by silver in the tissues. In argyria, silver is deposited in various organs (e.g. skin, kidney, liver) after oral ingestion of silver in its ionic form or as silver nanoparticles, oxidizing to insoluble silver sulfide, which is responsible for the discolouring effects. It is difficult to determine the lowest dose that may lead to development of argyria, and the toxicological database on silver is not adequate to support derivation of a formal guideline value. Furthermore, a formal guideline value is considered unnecessary since silver usually occurs naturally in drinking-water at concentrations well below those of health concern. Nevertheless, a bounding value (provisional reference value) may provide a useful benchmark where elevated concentrations of silver in drinking-water may be expected. The provisional reference value of 0.1 mg/l is supported by the prior assessments that concluded that 10 g of ingested silver can be considered a human NOAEL (WHO, 1984a, b, 1993; US EPA 1992). Over a 70-year period, assuming a drinking-water intake of 2 litres/day, 0.1 mg/l is a concentration in drinking-water that would give a total dose of half this NOAEL.

Simazine

Simazine (CAS No. 122-34-9) is a pre-emergence herbicide used on a number of crops as well as in non-crop areas. It is fairly resistant to physical and chemical dissipation processes in the soil. It is persistent and mobile in the environment.