INFORMATION SHEET 4.1

4.1: Chemicals leaching from plumbing products

(Public consultation draft July 2024)

Background

Section 9.6 outlined that some plumbing products used within premises such as residential buildings, hospitals and schools have the potential to leach chemicals (such as metals and metalloids) into drinking water under certain conditions. This is likely to occur past the point of water supply (i.e. the water meter) as leaching most likely occurs within the in-premise plumbing system. For example, metals can potentially dissolve into drinking water from copper alloy plumbing products when water has been in stagnant contact with the fittings for long periods. Additionally, there may be higher concentrations of dissolved metals resulting from hot water systems compared with cold water systems.

Other factors that can contribute to leaching of chemicals include temperature, water quality (pH, alkalinity and hardness), plumbing fittings and fixtures (material type and galvanic corrosion) and hydraulics (flow rates, stagnation times and water turnover) (Taylor et al. 2018). Rainwater may also dissolve more metals from plumbing products due to the slight acidity of the rainwater (enHealth 2021a, 2021b).

Leaching of chemicals into drinking water increases the likelihood of exposure to these chemicals and as a result can increase the risks to public health. The leaching of lead containing copper alloys in plumbing has historically received the most attention given the known health effects of lead exposure (see the Lead Fact Sheet and NHMRC 2015). In light of concerns about the health effects of lead, there have been efforts to reduce exposure by reducing the allowable limit of lead in plumbing materials (ABCB 2023). As a result, there is an increasing availability of alternative plumbing products (such as Lead Free plumbing products) on the Australian market.

The National Construction Code (NCC), administered by the Australian Building Controls Board (ABCB), requires from 1 May 2026 that copper alloy plumbing products used for conveying drinking water must limit the allowable lead content to a weighted average of not more than 0.25%. Products that meet this requirement will be known as Lead Free copper alloys. Products are still required

to be assessed against *AS4020:2018 Testing of products for use in contact with drinking water* and comply with the Lead Free requirements of the Plumbing Code of Australia (ABCB 2022) to ensure that metals do not leach into the water during use at concentrations higher than the health-based guideline values. Compliant products will be marked as "Lead Free WaterMark" under the certification scheme. All copper alloy products that are in contact with drinking water will be required to comply with these requirements, and include: fittings, valves, backflow prevention devices, taps, mixers, water heaters, water dispensers (boiling and cooling units) and water meters.

There are many other metals of concern that may be present in plumbing products such as antimony, cadmium, chromium, copper and nickel (enHealth 2021b). Further information on the health effects of these metals is provided in the relevant Fact Sheets in Part V of these Guidelines. Various other materials have been studied worldwide as a replacement for lead in copper alloys. These materials include bismuth, selenium, silicon, graphite, indium, gallium and manganese/zinc. At this stage, limited information is available on the composition of substitute plumbing products and what is available on the Australian market. In the United States of America, the most common substitutes for lead in copper alloys are bismuth and silicon (ABCB 2021).

Risks from exposure to chemicals leaching from plumbing products

There is reduced risk to health from exposure to chemicals leaching from plumbing products that have undergone testing under Australian regulations and requirements for plumbing.

While the introduction of low-lead or Lead Free plumbing products will reduce the risk of exposure to lead leaching into drinking water, it is important to confirm that any chemicals used to replace lead in plumbing products do not leach into water at unsafe levels. In the absence of information on specific copper alloys, the available information on the relevant chemicals that may reasonably be expected to leach into drinking water should be considered when setting acceptable limits in lead replacement plumbing products. Further information on the health effects of specific chemicals, including calculations for health-based guideline values or levels that health effects are expected to occur, are provided in the relevant Fact Sheets in Part V of these Guidelines.

As new information and data on the types and composition of products becomes available, guidance around the potential risks to health from chemicals leaching from plumbing products can be refined and updated.

Review of bismuth, selenium and silicon copper alloys

A review of the existing scientific evidence was undertaken for several copper alloy formulations that had been identified as potential lead replacements in plumbing products, specifically bismuth, selenium, and silicon (SLR 2023a, 2023b, and 2023c). The review found little to no data to quantify the nature or levels of chemicals that may leach into drinking water from these copper alloys, whether in distribution systems or in-premises. No data were found about methods to remove or measure the leachates from bismuth, selenium or silicon used in copper alloy plumbing products.

The available toxicological information for individual chemicals that may reasonably be expected to leach from the relevant copper alloys were instead used to derive health-based guideline values for bismuth and silicon, and to revise the health-based guideline value for selenium. The derivation of these values, including uncertainty factors and assumptions, are provided in the relevant Fact Sheets for bismuth, selenium and silicon (See Part V Physical and chemical characteristics).

Reducing exposure to chemicals leaching from plumbing products

There are a number of regulatory measures already in place in Australia to preventatively manage health risks from plumbing and to ensure water at the tap is safe. For example, health risks can be reduced before a product is available on the market by ensuring that plumbing products used for drinking water are safe for use. All new repairs or new installations of plumbing products in contact with drinking water are required to use components that are certified compliant to relevant Australian standards, such as the WaterMark Certification Scheme, *AS/NZS 4020:2018 Testing of products for use in contact with drinking water*. These testing standards use the health-based guideline values described in these Guidelines to determine whether leaching from the plumbing products is significant.

Section 9.6 of these Guidelines provides further information on:

- roles and responsibilities in managing water quality in-premises
- ways that water suppliers can help to reduce risks.

The introduction of Lead Free regulations for plumbing materials that come into contact with drinking water aims to reduce the potential health risks from lead leaching from plumbing products. In most circumstances, it will also reduce the need for additional measures to reduce exposure to lead within a building, such as preventative flushing regimes.

In instances where there is uncertainty about the water quality within a building (e.g. after drinking water has been sitting stagnant in a school plumbing system during a holiday break), additional measures can be taken to reduce potential risks to health.

Flushing

In the absence of in-premises water treatment options, reducing potential exposure to chemicals that may leach from plumbing products in households can be achieved at the tap by (enHealth 2021b):

- only using water from cold taps for drinking and food preparation
- flushing cold water taps for at least 10 seconds first thing in the morning to draw fresh water through the tap
- flushing cold water taps used for drinking and food preparation for at least 2 minutes after periods of non-use of more than 48 hours (such as when returning from holidays).

Flushed water can be collected and used for washing, bathing, general hygiene and garden irrigation.

As young children are the most at risk from adverse health effects associated with exposure to metals, it is recommended that facilities take a proactive approach to risk reduction. Reducing potential exposure to chemicals that may leach from plumbing products in schools, preschools and childcare centres can be achieved at the tap (enHealth 2021b) by:

- using water from cold taps only for drinking and food preparation
- flushing all outlets and water fountains / bubblers that are used for drinking and food preparation for at least 10 seconds to clear any water that has been sitting in the individual plumbing fittings.
- flushing a drinking water outlet furthest away from the incoming supply (i.e. the water meter) for at least 2 minutes after periods of non-use of more than 7 days. Flushing for a longer period (up to 5 minutes) or selecting outlets at a number of locations may be required in facilities with larger water distribution systems in order to draw fresh water from the incoming supply.

In other buildings with vulnerable occupants, such as pregnant women, the elderly and immunocompromised, flushing frequency and duration will depend on the likelihood of stagnation, and the length and complexity of the plumbing system. Taps that are unused for several days or more should be flushed for at least 2 minutes. In facilities that do not provide overnight services, taps used as a source of drinking water and drinking water fountains should be flushed for at least 10 seconds each morning. As good practice, building and asset managers should

identify all drinking water outlets to be flushed, documenting the frequency of when flushing is to occur and recording when flushing has occurred.

Extensive flushing is also advisable towards the end of commissioning of newly constructed or renovated plumbing systems. This is required because plumbing works can leave significant amounts of "swarf" or metal filings within the drinking water pipes. Flushing to remove these needs to be done after aerators or flow restrictors are removed to ensure they are not entrapped within drinking water outlets.

Treatment

Some in-premises water treatment units, such as filtration or reverse osmosis units, may be effective at removing chemicals from drinking water from in-premises plumbing systems. However, this can vary depending on the type and form of the chemical (dissolved or particulate) and where the unit is connected into the plumbing system. Advice from a water professional, relevant health authority and/or drinking water regulator should be sought to determine if water treatment units are appropriate for the given context. As water treatment units require regular maintenance and replacement, they should not be viewed as a permanent solution to manage elevated levels of metals or metalloids. Filters may also trap particles, causing metals to dissolve from the particles into the drinking water. Buyers of point-of-use filtration devices should look for filters that have been validated to demonstrate metal removal. Manufacturers' instructions regarding installation, operation and maintenance should be followed to ensure the filtration units remain effective.

In-premise sampling

Methods for monitoring for metals of concern in-premises have been reviewed by the Environmental Health Standing Committee and guidance developed for the Australian context (enHealth 2021b). The Environmental Health Standing Committee (enHealth) of the Australian Health Protection Principal Committee has published *Reducing exposure to metals in drinking water from plumbing products, 2021* that details all considerations and recommended methodologies for taking samples.

The water sampling methods described below will help to identify metals of concern in a plumbing system. They can also help to find the sources of those metals. Proactive testing of drinking water for metals is not generally required unless there are specific concerns (see below). Similarly, other than at building commissioning, building and asset managers do not need to test drinking water from their plumbing system without good reason.

A sampling program to test for metals should be initiated for any of the following reasons:

- during commissioning of new or renovated buildings, excluding sole occupancy dwellings, to ensure the system can supply safe water (e.g. new hospitals or large multi-occupancy commercial buildings)
- if there is evidence of elevated metals in the water supply (e.g. metallic taste, discoloured water, brown or blue/green copper staining of plumbing products such as basins or toilet bowls) or suspected elevated metals from the use of non-compliant plumbing products.

A sampling program to test for metals could be useful in certain circumstances such as:

- verifying/validating the success of a flushing program
- assessing whether a flushing regime is required
- identifying outlets that may require inclusion in a flushing program.

There is no single water sampling method for metals in drinking water that is suitable for all circumstances. The sampling method chosen is dependent on the objective. AS/NZS 5667.513 is well designed for collecting drinking water samples from treatment plants and distribution systems but has limitations when collecting drinking water samples within buildings (Health Canada 2019) and specifically when the intent of a sample is to determine metal influences from plumbing products. The scope of enHealth (2021b) guidance covers the water sampling methodologies for four separate objectives:

- Incoming water supply sampling – to determine the concentration of metals from the incoming water supply. A flushed sample is the most appropriate methodology.
- Building commissioning – to determine the presence of metals in a building as part of the commissioning process. The 6-hour stagnation is the most appropriate methodology.
- Screening sampling – to determine the presence of metals in drinking water within the plumbing system. The random daytime sample is the most appropriate methodology.
- Investigative sampling – to identify the potential source of metals in drinking water within a plumbing system after non-compliant results are generated from the 6HS or RDT sampling methodology. The 30-minute stagnation is the most appropriate methodology.

Further technical details are provided in enHealth (2021b).

Plumbing systems are site-specific and advice should be sought from water professionals, local water suppliers, the relevant health authority and/or drinking

water regulator before implementing a sampling program. The design and implementation of a water sampling program is complex and careful planning should be undertaken to ensure that meaningful results are generated.

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