

Health  
Protection  
Scotland



# Public Health Action in Response to Detecting High Levels of Lead in Drinking-Water

## Good Practice Guidance for Health Protection Teams in Scotland

CPHM (Health Protection) Group

Health Protection Scotland is a division of NHS National Services Scotland.

Health Protection Scotland website: <http://www.hps.scot.nhs.uk>

Published by Health Protection Scotland, NHS National Services Scotland, Meridian Court,  
5 Cadogan Street, Glasgow G2 6QE.

First published February 2012

Version 1.1 published March 2012

Version 2.0 published March 2016

Version 2.1 published April 2016

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**Reference this report as:**

CPHM (Health Protection) Group. Public Health Action in Response to Detecting High Levels of Lead in Drinking-Water. Good Practice Guidance for Health Protection Teams in Scotland. Health Protection Scotland, 2016.

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# Abbreviations

<b>CPHM</b>	Consultant in Public Health Medicine
<b>DPH</b>	Director of Public Health
<b>DWQR</b>	Drinking Water Quality Regulator for Scotland
<b>EH</b>	Environmental Health
<b>EHO</b>	Environmental Health Officer
<b>FAO</b>	Food and Agriculture Organization (of the UN)
<b>FAQ</b>	Frequently Asked Questions
<b>FBC</b>	Full Blood Count
<b>GP</b>	General Practitioner
<b>GV</b>	Guideline Value
<b>HP</b>	Health Protection
<b>HPN</b>	Health Protection Network
<b>HPTs</b>	Health Protection Teams
<b>HPS</b>	Health Protection Scotland
<b>HSE</b>	Health and Safety Executive
<b>ICT</b>	Incident Control Team
<b>JECFA</b>	Joint (FAO/WHO) Expert Committee on Food Additives
<b>LFT</b>	Liver Function Tests
<b>mcg</b>	Micrograms
<b>mcg/L</b>	Micrograms per Litre
<b>ml</b>	Millilitres
<b>NHS</b>	National Health Service
<b>NPIS</b>	National Poisons Information Service
<b>PAG</b>	Problem Assessment Group
<b>PCV</b>	Prescribed Concentration or Value
<b>PHE</b>	Public Health England (formally HPA)
<b>PTWI</b>	Provisional Tolerable Weekly Intake
<b>SEISS</b>	Scottish Environmental Incident Surveillance System
<b>SGHSCD</b>	Scottish Government Health and Social Care Directorate
<b>SW</b>	Scottish Water
<b>U&amp;E</b>	Urea and Electrolytes Test
<b>US EPA</b>	United States Environmental Protection Agency
<b>WHO</b>	World Health Organisation

# Foreword (and 2016 Revision Update)

The updated version of the CPHM (Health Protection) Group Good Practice ‘Guidance Note’ is a revised version of the original Interim Guidance issued in 2012. It has been reviewed by the CPHM (HP) Group to update weblinks and other factual material. The CPHM (HP) Group agreed that the professional advice provided in this ‘Guidance Note’ is still fit-for-purpose and therefore a complete review of the content was not considered necessary.

The ‘Guidance Note’ represents a consensus view on good practice agreed by the CPHM (HP) Group for use as a guide to the investigation of incidents involving elevated lead concentrations in drinking-water supplies, especially in domestic (household) and non-domestic settings (schools etc.). The ‘Guidance Note’ was produced following recognition of the need for guidance resulting from a number of incidents involving lead contamination of water supplies in public use buildings.

The ‘Guidance Note’ is intended primarily for use by NHS board Health Protection Teams (HPTs) but will be of interest to public health professionals in local authorities and Scottish Water (SW). The ‘Guidance Note’ is intended specifically to assist NHS board HPTs in managing the health protection aspects of such incidents. The ‘Guidance Note’ therefore refers to other relevant agencies (e.g. local authorities, SW or the Drinking Water Quality Regulator for Scotland (DWQR)) but does not address the roles and responsibilities of other agencies in detail. Drinking Water Quality Regulator for Scotland have produced general guidance on the wider roles and responsibilities of public agencies and others in relation to the investigation of drinking-water quality issues in public use buildings (<http://dwqr.scot/media/15535/investigation-and-reporting-of-a-failure-in-a-public-building-served-by-a-public-water-supply.pdf>).

The ‘Guidance Note’ was produced by a sub-group of the CPHM (HP) Group. The original recommendations are based on published evidence and expert opinion on best practice. The ‘Guidance Note’ follows the (CPHM) process for producing Good Practice documents produced by the CPHM (HP) Group (‘Scottish CPHM (Health Protection) Group Framework for the Development & Production of Good Practice Statements’ accessed via SHPIR: <http://www.shpir.hps.scot.nhs.uk/ResourceDisplay.aspx?resourceid=1174>).

Evidence was reviewed following identification via searches of on-line published medical literature databases for material on exposure to lead in drinking-water (especially involving children, pregnant women and incidents involving schools) supplemented by supporting literature to cover evidence gaps. A secondary search was carried out for evidence on methods for estimating drinking-water consumption. The search involved MEDLINE (OVID) Embase, Web of Science and Google scholar, as well as other public health databases, using internet searches for material published from October 1992 to 2010. Additional expert advice was sought via the DWQR in relation to public use buildings.

The ‘Guidance Note’ does not imply any authority beyond a professional agreed consensus on best practice. Implementation of the guidance is at the discretion of individual health professionals.

The ‘Guidance Note’ will be reviewed and revised as necessary, and no later than two years after each publication date. The next review will be due in 2018.

## Members of the CPHM (HP) Group, Guidance Sub-group (2012)

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# Acknowledgements

Given the limited evidence base for and purpose of the 'Guidance Note', a full scale multi-professional consultation was not undertaken. However, early drafts (of the original (2012) Interim Guidance) were shared informally with colleagues in local authority Environmental Health departments and the DWQR who provided comments which are also gratefully acknowledged. The contributions and comments from members of the CPHM (HP) Group, particularly Jane Cooper and Stan Murray, are gratefully acknowledged.

# 1. Introduction

The 'Guidance Note' primarily outlines the role of the NHS board Health Protection Teams (HPTs) in responding to a report of elevated lead levels in drinking-water. However, it is recognised that such incidents require a multi-agency response involving the NHS board HPT, local authority EHOs, SW (for public supplies) and possibly others (e.g. DWQR). [Appendix 4](#) of the 'Guidance Note' summarises the roles of the relevant agencies. However, the guidance does not set out to be prescriptive about the specific roles of the individual agencies, given that these may vary locally. However, the 'Guidance Note' provides an opportunity to ensure that all relevant actions are coordinated by relevant local agencies.

A systematic approach to the investigation and management of excess lead levels detected in drinking-water supplies is described. The advice is applicable to incidents involving lead in drinking-water ranging from small scale scenarios, involving a single residential property to large scale situations involving a commercial or public use building (e.g. a school). The approach should be tailored to the specific scenario.

Objectives of an investigation will include:

- Action to prevent further excess lead exposure:
  - Rapid intervention to prevent continued exposure to excess levels of lead in drinking-water, especially in vulnerable groups (i.e. young children, pregnant women etc.).
- Provision of access to a Prescribed Concentration or Value (PCV) compliant source of drinking-water.
- Risk Assessment and Management of those exposed:
  - Characterisation of the level of risk associated with past consumption and appropriate investigation of individuals assessed as having been exposed to potentially harmful amounts of lead.
- Lead source identification:
  - Action to identify and eliminate the source of excess lead and restore a PCV compliant drinking-water supply.

## 2. Background

Exposure to lead can occur from a variety of environmental and occupational sources. The main non-occupational exposures are by ingestion and inhalation, from sources including drinking-water, lead-based paint, contaminated air, soil, dust and food.

Domestic exposures sufficient to cause harm have been largely mitigated by existing source reduction policies (e.g. removal of lead from paints, petrol, drinking-water, food and drink cans). However, exposures to excess lead via drinking-water may still occur in Scotland due to lead pipe work in older housing (pre 1970s), and older public use buildings and workplaces. Excess lead in drinking-water has also been identified in association with the (illegal) use of lead solder in domestic drinking water plumbing.

Significantly elevated drinking-water lead exposures may result in lead toxicity with the development of classical signs and symptoms. However, florid signs of classical lead poisoning are very rarely seen outside occupational settings in Scotland. The initial symptoms of low level toxicity are more likely to be non-specific (e.g. general malaise in adults, failure to thrive in very young children).

In situations where there are no obvious symptoms of toxicity, excess lead exposure is still a concern; even relatively low levels of body lead burden can result in biochemical effects and can adversely affect brain and intellectual development in children; in utero or when still very young (less than two years old).

Until 2011, the WHO specified a Guideline Value (GV) of 10 micrograms (mcg) of lead per litre as an acceptable lifetime exposure threshold for drinking-water, based on a provisional tolerable weekly intake (PTWI) that would be protective against adverse health effects.<sup>1</sup> In 2011, JECFA (Joint (FAO/WHO) Expert Committee on Food Additives) re-assessed evidence of health effects associated with very low level lead exposure and withdrew their PTWI on the basis that they no longer consider that there is a safe level of lead exposure (no tolerable threshold dose). WHO noted this development but recognised that in practical terms, achieving lead levels of less than 10 mcg/L may be technically very difficult. WHO have not therefore withdrawn their GV but designated it as 'provisional'.

Lead levels in drinking-water should not exceed the Prescribed Concentration or Value (PCV). In practice, lead levels are unlikely to be reported to HPTs unless the PCV is exceeded. In Scotland, the regulatory limit (PCV) fell from 25 mcg/L to 10 mcg/L on 25 December 2013.

Detection of a single water sample result that exceeds the PCV need not automatically result in precipitate action. A measured and systematic approach is essential to the assessment of the risks in each situation. Minor or short duration exceedances of a PCV are unlikely to present a serious threat to health even in the more susceptible groups. A balanced approach to dealing with each situation is therefore required.

Drinking-water consumption patterns will vary between households and between domestic and institutional/workplace settings. Careful enquiry may reveal minimal consumption from the affected tap or pipe-work, meaning that exposure to excess lead intake is likely to be minimal. Variability in water sample results may also complicate a retrospective exposure assessment.

The main health protection priorities of an investigation are therefore to:

- Stop significant ongoing exposure;
- Identify and eliminate any continuing sources of excess lead;
- Assess the likelihood of adverse effects in those exposed and decide what further clinical assessment might be needed to enable decisions about treatment, if appropriate.

### 3. Problem Identification

A problem may come to attention either from identification of a suspected case of lead toxicity (rarely) or from detection of a high lead level in a water sample.

NHS boards may be alerted to a case who has been found to have an elevated blood lead level, by a clinician (GP or paediatrician). This protocol does not address such scenarios. Such cases require full investigation to assess all possible sources of lead exposure including a case's drinking-water supply.

The more likely scenario is the reporting of a drinking-water sample with a lead level above the PCV.

## 4. Actions

### 4.1. Immediate actions following a report

- a. Immediate information requirements;
- b. Record method, date and time of notification to public health;
- c. Record who carried out the sampling and why (routine random sample or due to a specific complaint or problem with the water quality);
- d. Record age and type of property: e.g. domestic property (individual house, flat etc), a communal building (school, workplace etc) or a building to which the public have access (library, sports facilities, health centre);
- e. Identify if it is a public or private water supply;
- f. Identify the context of the problem (is this the first high lead level detected or is there a history of past PCV failures for the property, or supply zone).

#### 4.1.1. Hazard and Exposure Assessment - Further Information Required

- a. Hazard Assessment: water sample details:
  1. Date, time and type of sample (this will affect the lead level), e.g.:
    - **random sample** - the most likely sample type (no prior preparation by flushing of the tap):
    - **first draw sample** (taken after non-use overnight);
    - **flushed sample** (taken after flushing the tap for a period);
    - **stagnation sample** (taken after supply has been unused for a defined period).
  2. Place of sample: e.g. kitchen, bathroom, mains supply.
  3. Whether the water supply was in normal everyday use prior to sampling.
  4. Whether the tap was used for drinking-water (including use for cooking), for bathing or for brushing teeth etc.
- b. Exposure Assessment: Persons at Risk:
  1. Numbers of individuals potentially exposed to the excess lead levels, especially any in vulnerable groups (pregnant women, very young children). Where practical, obtain details of name, age and gender. ([Appendix 1a](#) provides an information template);
  2. Details of individual's water consumption ([Appendix 1b](#) provides an example water consumption questionnaire).
- c. Context of the situation:

Whether there are any specific concerns about this particular situation: e.g. potential media, political, parental interest.

## 4.1.2. Initial Health Risk Assessment and Immediate Risk Management

- a. Assess level of exceedance of PCV (25 mcg/L until 2013 or 10 mcg/L after 25/12/2013):
  1. If the result is only marginally above the PCV then immediate action may reasonably be limited to advice on flushing taps pending the results of further sampling ([Appendix 2](#), SW Factsheet 7<sup>2</sup>).
  2. For pregnant women or children under two years, exceedance of the WHO (provisional) GV of 10 mcg/L is a guide to when immediate action could be justified to prevent further exposure and provision of an alternative supply (e.g. bottled water).
  3. For other adults, for an exceedance above a level of 50 mcg/L, immediate action (as per 2 above) could be justified, pending the results of further investigation.
- b. Assess if anyone who is regularly exposed to the supply has symptoms consistent with significant lead exposure (e.g. GI disturbance (anorexia, nausea, vomiting, abdominal cramps, constipation, weight loss), cognitive impairment, irritability, lethargy, headache, fatigue, dizziness, weakness, paresthesia). See also PHE Compendium of Chemical Hazards – Lead.<sup>3</sup>
  1. If yes: refer for more detailed clinical assessment including blood lead estimation by their clinician (GP or a paediatrician if a young child).
  2. If no: consider whether further clinical assessment including blood lead estimation might still be of benefit for reassurance purposes.
- c. Consider, and if appropriate assess, any other potential significant exposures (e.g. occupational exposure to lead, use in recreational activities, exposure to lead paintwork) that might result in an increased risk of cumulatively increased lead exposure.

## 4.2. Follow on Action

### 4.2.1. Further Investigation

#### a. Detailed Hazard and Exposure Assessment:

A single random water sample is not an adequate basis for exposure assessment. Further samples should be taken to allow an assessment as to whether the initial raised lead level was a transitory incident or indicative of a more sustained chronic exposure.

Depending on the situation, further random samples (preferably more than one) may be helpful in deciding if a more detailed sampling suite is required.

If the initial assessment indicates that a full sampling suite is necessary to inform exposure assessment or if re-sampling (random samples) indicates persistently elevated lead levels, then a sampling framework (see [4.1.2b](#)) should be agreed (e.g. with the local Environmental Health department (EH) and SW).

Ideally, sampling of drinking-water would be carried out by a local EHO in support of a HPT public health intervention. However, each situation will differ and responsibility for taking (and paying for) samples may have to be negotiated. In general terms for public mains water supplies, SW is responsible for the water quality only up to the property boundary. Beyond the property boundary, responsibility for the water quality (and the system) lies with the property owner.

#### b. Drinking-Water Sample Suite:

If practical, all taps used for personal consumption should be sampled. Where impractical, then sufficient samples should be taken to provide a representative assessment of potential exposures from taps used for drinking-water purposes. In communal or public access buildings, access to a plan of the building pipe-work would assist in agreeing a sampling strategy.

For comparison, a sample should also be taken as close as possible to the entry point of the supply to the building (to assess lead levels in the incoming supply).

Samples should be analysed by an appropriately accredited laboratory.

To characterise the personal exposure risk and to determine the most likely source of the excess lead, a comprehensive sample set is required. However, if this is too problematic, variations may be used ([Appendix 3](#)). A full sample set (as recommended by HPS<sup>4</sup>) would consist of the following:

1. **Random sample** – 250ml taken at any point in the day, irrespective of when the water was last used.
2. **Overnight sample** – 250ml collected first thing in the morning after leaving the water system undisturbed overnight.
3. **Flushed sample** – allow the water to run for a period of minutes until consistently cold to the touch and then take a 250ml sample (this represents water from the mains supply). The length of time the water has to run will depend on the internal 'pipe-to-tap' length and will be at the discretion of the individual collecting the samples (e.g. EHO).

4. **Stagnation sample** – immediately after collection of a flushed sample, allow a standard period of contact between water and the internal pipe-work; the water system should be left undisturbed for at least 30 minutes then collect a further 250ml sample.

**N.B. Remedial work should not commence until all required samples have been taken.**

## 4.3. Incident Management

### 4.3.1. Organisational Aspects

Consider whether a Problem Assessment Group (PAG) meeting is required to review the situation especially to identify roles and responsibilities (in line with the Scottish Government guidance on Public Health Incidents<sup>5</sup>), to agree an initial joint investigation strategy and to determine if an Incident Control Team (ICT) is required to manage the situation. ([Appendix 4](#) outlines the roles and responsibilities with regards to public-use buildings.)

### 4.3.2. Communications

**Maintain liaison with all relevant parties (e.g. EH, SW, householder, owner, manager and clinician) as appropriate. Consider merits of formal arrangements as above.**

- a. Keep those involved informed by letter/telephone or face to face meeting ([Appendix 5](#)). Address immediate health concerns and advise discussion with their own clinician if there are symptoms of concern. Consider use of the PHE FAQ on lead<sup>3</sup>;
- b. Advise relevant clinicians (GP or a paediatrician) of the situation; of the signs and symptoms of lead toxicity and the investigations to be performed in case of clinical concern: (blood lead levels if less than 100 days since last exposure and potentially also FBC and film (to exclude anaemia), U&E, LFT and blood pressure assessment). Additional clinical toxicology advice is available from the Scottish Poisons Information Bureau (NPIS) via TOXBASE (<http://www.toxbase.org/>) or telephone direct on 0844 892 0111.
- c. If the incident is of sufficient scale or likely to be high profile, consider the need to:
  - Alert DPH and Communications department if appropriate;
  - Set up a helpline if large numbers of individuals are affected;
  - Prepare a media statement(s);
  - Depending on situation inform:
    - Health Protection Scotland (HPS), Scottish Government Health and Social Care Directorate (SGHSCD) and others (e.g. Education department) as required.
  - If considered a significant incident, inform DWQR who may also be able to provide advice.
- d. Ensure consistent advice is given to all affected individuals. The PHE Compendium of Chemical Hazards - Lead<sup>3</sup> includes an FAQ which could be amended/added to. SW has a standard leaflet for householders ([Appendix 2](#)). The Health and Safety Executive (HSE) regulate and advise on occupational settings and provide advice leaflets relevant to DIY lead exposures.

### 4.3.3. Follow up actions (depending on the situation):

a. Detailed Individual Risk Assessment:

Decide if individual risk assessments are justified or whether calculation of a 'worst case exposure' scenario may be appropriate for the exposed group ([Appendix 6](#)).

1. Collate sampling results and estimate lead concentrations in water over an average day and week;
2. Assess quantity of water consumed from this source and pattern of consumption ([Appendix 1a](#) and [Appendix 1b](#));
3. Assess potential exposures from other sources;
4. Calculate approximate weekly intakes;
5. Decide if exposure level has been high enough to warrant further investigation including blood lead levels ([Appendix 6](#));
6. Seek expert advice from HPS and NPIS as required (<http://www.spib.scot.nhs.uk/spibdir.htm>);
7. Arrange or recommend appropriate medical follow up in case of significant exposure (via GP or paediatrician especially for young children).

b. Individual Risk Communication:

1. If there is no evidence of exposure to harmful lead levels, reassure and provide written information (consider merits of discussion with relevant clinician);
2. If there has been exposure to significant levels and/or there are symptoms that could be consistent with lead toxicity, advise discussion with a clinician (GP/paediatrician) to consider appropriate clinical assessment. (If appropriate, check and communicate time of availability of blood lead levels and how results will be communicated.)

c. Remediation & Risk Reduction:

Discuss measures to eliminate source and/or reduce exposure ([Appendix 2](#), SW factsheet 7 describes responsibilities for pipe-work supplying premises). Ensure building owner has access to advice on potential funding. Agree post remediation sampling.

Consider whether other properties/locations share characteristics suggesting that proactive sampling to exclude significant exposures, might be appropriate.

- d. When the incident is over, write report/summary and disseminate as appropriate including a report to the Scottish Environmental Incident Surveillance System (SEISS), coordinated by HPS.

## 5. References

1. WHO. Lead in Drinking-Water (WHO/SDE/WSH/03.04./09/REV/1). Background Document for Development of WHO Guidelines for Drinking-Water Quality. Available from: [http://www.who.int/water\\_sanitation\\_health/dwq/chemicals/lead.pdf](http://www.who.int/water_sanitation_health/dwq/chemicals/lead.pdf) (last accessed: 8 February 2016).
2. Scottish Water. Factsheet 7: Lead Explained. 2015. Available from: <http://www.scottishwater.co.uk/you-and-your-home/your-home/customer-factsheets/7-lead-explained> (last accessed: 8 February 2016).
3. Health Protection Agency. HPA Compendium of Chemical Hazards - Lead. HPA. 2011. <https://www.gov.uk/government/publications/lead-properties-incident-management-and-toxicology> (last accessed: 8 February 2016).
4. Scottish Centre for Infection and Environmental Health. Scottish New Homes Lead Survey Stage 2. Glasgow: SCIEH. 2003. <http://www.documents.hps.scot.nhs.uk/environmental/scottish-new-homes-lead-survey/scottish-new-homes-stage-2.pdf> (last accessed: 8 February 2016).
5. Scottish Government. Management of Public Health Incidents - Guidance on the Roles and Responsibilities of NHS led Incident Management Teams. Scottish Government. 2011. <http://www.scotland.gov.uk/Publications/2011/11/09091844/24> (last accessed: 8 February 2016).

# Appendix 1a

## Forms for Information Gathering

### A. Occupants of the Building(s).



# Appendix 1b

## B. Water Consumed

A sample questionnaire/form from the Scottish New Homes Lead Survey Stage 2<sup>i</sup> may be useful to quantify the amount of water consumed.

**N.B.** Discuss the capacity of the respondent's drinking water vessels. Consider also the use of drinking-water to make drinks, soups and ice, or use in medication or other ingested preparations.

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i Scottish Centre for Infection and Environmental Health. Scottish New Homes Lead Survey Stage 2. Glasgow: SCIEH. 2003. <http://www.documents.hps.scot.nhs.uk/environmental/scottish-new-homes-lead-survey/scottish-new-homes-stage-2.pdf> (last accessed: 8 February 2016)

# SCOTTISH NEW HOMES LEAD SURVEY

## TAP WATER CONSUMPTION

### QUESTIONNAIRE (B)

#### Instructions

Each individual in the household of 16 years or over should complete a separate Questionnaire (B) for themselves.

For each child under 16 years (including babies) an adult should complete a separate form on each child's behalf.

Please base your responses on an **average day** even if your actual water consumption varies from one day to the next.

This survey only concerned about the use of **tap water** in the home. Please give details only on drinks involving tap water in your own home. Do not include water drunk outside the home, at work, or elsewhere (unless the water was taken from the tap at home e.g. in a thermos flask). Do not include any bottled water, bottled juice, etc (unless you have used tap water to dilute it).

#### Please Note:

If you have changed your tap water drinking habits very recently as a result of receiving specific advice to do so, then please base your answers on what you used to drink **before** you changed your behaviour.

**Please ensure that there is one single Questionnaire (A) completed for the whole Household and all Questionnaires (A) and (B) are returned in the reply paid envelope provided.**

# SCOTTISH NEW HOMES LEAD SURVEY

## QUESTIONNAIRE (B)

For each individual member of the household, a separate Questionnaire (B) should be completed.  
**Remember; only include drinks consumed in the home using tap water.**

1. a. Your Name:
- b. (or – if completing on behalf of a child)  
The Childs Name:
- c. Age:
- d. Sex: Male  Female
2. If you are using the kitchen cold tap to take water (or if you are completing this on behalf of a child) would you run the tap before taking water for a drink?
- a. Never
- b. Sometimes
- c. Usually
- d. Always
3. Do you (or does the child) drink coffee? Yes  No
- If yes, how is it made up?
- a. All water
- b. Half water, half milk
- c. Other, give details
4. Do you (or does the child) take water from a hot tap to drink or use to make up a drink with?
- a. Never
- b. Sometimes
- c. Usually
- d. Always

## SCOTTISH NEW HOMES LEAD SURVEY

5. If you (or the child) were making up a food item such as a packet soup or pot noodle dish, using boiled water from the kettle, would you fill the kettle from a hot tap first?

- a. Never
- b. Sometimes
- c. Usually
- d. Always

6. Which tap do you (or does the child) **normally** use for brushing teeth?  
(Tick one choice only)

- a. Kitchen cold
- b. Kitchen hot
- c. Main bathroom cold
- d. Main bathroom hot
- e. En-suite cold
- f. En-suite hot
- g. Other

7. Do you (or does the child) swallow water from the same tap while brushing teeth?

- a. Never
- b. Sometimes
- c. Usually
- d. Always

8. Do you (or does the child) drink water from the shower, while having a shower?  
(This question applies particularly to children)

- a. Never
- b. Sometimes
- c. Usually
- d. Always

## SCOTTISH NEW HOMES LEAD SURVEY

9. Do you (or does the child) drink water from the bath or the bath taps while having a bath?  
(This question applies particularly to children)

- a. Never
- b. Sometimes
- c. Usually
- d. Always

10. If the form is being completed on behalf of a child, is the child fully weaned off milk feeds yet? Yes  No

If No, is the child:

- a. Only bottle fed with milk formula made up with tap water Yes  No
- b. Only breast fed Yes  No
- c. Fed on a mixture of milk formula made up with tap water and breast milk Yes  No
- d. Some other type of feed or combination (if yes, please give details below) Yes  No

# SCOTTISH NEW HOMES LEAD SURVEY

In Question (11) (over the page), you are asked to describe the drinks you have in an average day (weekday), describe the water drunk as follows:

- a) The number of drinks taken starting when you get up for the day
- b) When the drink was taken – time period
- c) Whether it was cold or hot drink
- d) The amount drunk using size of glass or cup
- e) The kind of drink e.g. plain water, coffee, hot chocolate, Bovril, soup, hot Ribena etc.
- f) The tap normally used for the water used for that drink

An example of how to fill in Question (11) is given with the table.

## **Children not yet fully weaned from milk feeds**

If the questionnaire is being completed on behalf of a child who is not yet fully weaned off milk feeds, use the boxes in Question (11) to describe only drinks or feeds made up with tap water in the home. Feeds and drinks made up with tap water should be described as follows:

- a) The number of the feeds from the start of the day
- b) The time period
- c) Either as a cold drink or hot drink
- d) The quantity in terms of a standard milk feed bottle:
  - quarter full bottle ( $\frac{1}{4}$ B)
  - half full bottle ( $\frac{1}{2}$ B)
  - three quarters full bottle ( $\frac{3}{4}$ B)
  - full bottle (FB)
- e) The type of drink e.g. milk feed, diluted juice, etc.
- f) The tap used – describe (as for adult drinks) which tap was used for the water





# Appendix 2

## Scottish Water Factsheet 7: Lead

# Lead explained

## Lead in drinking water

In Scotland, lead does not occur in significant concentrations in mains water, and is only a problem for our customers when the water comes into contact with lead service pipes, lead joints or lead tanks.

**This factsheet will provide you with information on:**

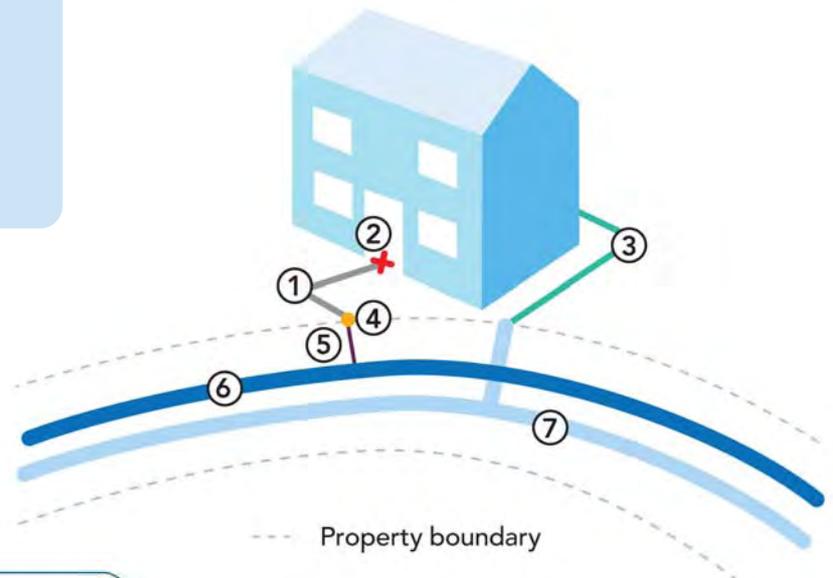
- Where lead comes from
- Where we sample
- Lead service pipes
- Lead soldered joints
- Lead tanks
- Why lead can be a problem
- How to check if you have lead pipes
- What to do if you have lead pipes
- grants
- Practical steps to reduce lead in drinking water
- Contacting a plumber
- How to contact us

## Where lead comes from

The use of lead service pipes was phased out during the 1960's and officially became illegal in 1969. Modern service pipes are made of blue plastic.

## Where we sample

Water is sampled regularly at our treatment works, service reservoirs and at our customers' taps to monitor the quality of the drinking water. In addition to this, some water quality parameters are continuously monitored at major treatment works. Across Scotland laboratory tests are carried out on water samples each year for regulatory purposes. Many more samples are taken by staff for operational reasons (e.g. bursts, new mains, complaints). The percentage of all regulatory samples complying with the relevant standards in Scotland is over 99%.



Water and waste pipes		Water and waste pipes	
①	— The water supply pipe	Homeowner	
②	✘ Stop valve	Homeowner	
③	— Private drain	Homeowner	
④	— Stopcock/meter	Scottish Water	
⑤	— The communication pipe	Scottish Water	
⑥	— The water main	Scottish Water	
⑦	— Sewer	Scottish Water	



## Lead service pipes (supply + communication pipes)

If there is a higher than background level of lead in your drinking water this is likely to be caused by the service pipe to your property. This is the pipe that carries water from the water main in your street direct to your property. The service pipe is made up of two parts – the communication pipe and the supply pipe (please see the diagram opposite).

Scottish Water is responsible for the water main in your street and the communication pipe up to, and including, the stopcock at the boundary of your property. The property owner is then responsible for the supply pipe from the stopcock into the property and all of the indoor plumbing.

## Lead soldered joints

Lead may also enter your water supply through soldered joints in household copper pipework. Although lead solder for these types of joints was prohibited in 1987, there is evidence that lead solder is still sometimes used illegally. Scottish Water recommends that you always use a plumber registered with SNIPEF (Scottish & Northern Ireland Plumbing Employers Federation). Full contact details are provided at the end of this factsheet.

## Lead tanks

Some older properties, including tenements, may still have a lead-lined water storage tank.

Where the drinking water tap in the kitchen is supplied from a household storage tank Scottish Water advises that the kitchen plumbing is changed to connect this tap direct from the supply pipe. This is particularly important if there is a lead-lined tank, because lead may enter the water from this tank.

For further guidance please contact our **Customer Helpline** on **0800 0778778**, or seek advice from your licensed plumber.

## Why lead can be a problem

When water lies in contact with lead service pipes, lead-lined tanks, or lead solder, particularly for longer periods (e.g. overnight) it can absorb lead. The longer time that water lies in contact with lead, the more lead will enter the water.

Exposure to significant quantities of lead can be harmful to health especially for unborn babies and young children. For this reason it is important that lead levels in drinking water are kept down to the lowest levels, particularly for those at special risk.

## Lead in drinking water and the law

We must meet a strict standard on the level of lead in drinking water. The maximum limit (PCV – Prescribed Concentration or Value) for lead in drinking water is 10 microgrammes per litre.

## How to check if you have lead pipes

If you live in an older property you may still have some lead plumbing present. You may already know if you have a lead service pipe or a lead-lined storage tank within your property.

Even if you have already replaced your internal plumbing, it is important to check if any underground water pipes in your garden or driveway are made of lead.

If you are not sure whether you have any lead pipework please contact our **Customer Helpline** on **0800 0778778** (we may organise a water sample from your property) or alternatively, phone your local council's Environmental Services Department and ask for advice. You will find contact details for your local council in your phone book.

## What to do if you have lead pipes

If the analysis of your water sample shows that the lead level is higher than the current PCV, we would advise you to consider replacing your lead pipes as soon as possible. We will replace our communication pipe, if it is found to be lead, when the PCV is exceeded.

## Grants

You may be able to obtain a grant for part of this lead replacement work from your local council. For specific information on your local council and up to date details of funds available, please contact your local council's Environmental Health Department.

If you find that you have lead solder fittings and your house is less than 10 years old you should contact the house builder. Alternatively, contact a SNIPEF registered plumber for further advice and information.

## Practical steps to reduce lead in drinking water

If you think you have lead pipe, you should follow these simple steps until you are able to replace them:

- Always take your drinking and cooking water directly from a mains-fed tap. This is normally the cold water tap at the kitchen sink.
- Never use water for drinking or cooking from any hot tap. Warm water increases the amount of lead that is absorbed from plumbing.
- Run the mains tap first thing in the morning to flush out any water that has been lying overnight before using any water for drinking or cooking. You should also do this if the water has not been used all day (e.g. when you're out at work) and always before making up bottle feeds for infants.
- Two minutes is usually enough to flush out this water. However, if your service pipe is longer than average, you'll need to allow a bit longer for the water to flush through.

If you need any more information, please contact our **Customer Helpline** on **0800 0778778**.

## Contacting a plumber

To find a licensed plumber in your area visit **[www.watersafe.org.uk](http://www.watersafe.org.uk)** or call SNIPEF on **0845 224 0391** who will be able to recommend a plumber. Office opening hours are Monday – Thursday 8.30am to 5pm and Friday 8.30am to 4.30pm. For out of hours, please visit the website or refer to your telephone directory.

Scottish Water supports and promotes the WaterSafe scheme. WaterSafe is a dedicated online search facility to help customers to find the nearest qualified plumbing and heating professionals in their area. Scottish and Northern Ireland Plumbing Employers' Federation (SNIPEF) runs the Plumbing Industry Licensing Scheme and this is part of WaterSafe.

## We want to make it easy to **contact us** – here's how:

We always have someone here to take your call, you can write to us or alternatively you can contact us through our website.

Alternative formats of this leaflet can be made available free of charge. For information on Braille, large print, audio and a variety of languages, please call our Customer Helpline.

If you have a disability, medical condition or other reason where you will need additional assistance from Scottish Water then please contact us and we can add your name, address and requirements to our confidential Additional Support Register.

We record all calls for quality and training purposes.

-  Customer Helpline 0800 0778778
-  [www.scottishwater.co.uk](http://www.scottishwater.co.uk)  
[customer.services@scottishwater.co.uk](mailto:customer.services@scottishwater.co.uk)
-  Scottish Water, PO Box 8855,  
Edinburgh, EH10 6YQ
-  [www.facebook.com/scottishwater](https://www.facebook.com/scottishwater)
-  [twitter.com/scottish\\_water](https://twitter.com/scottish_water)

Please quote this reference code when contacting us: **SWFact LE5 03/15**

# Appendix 3

## Investigating Lead Levels in Drinking-water

### Guidance on Sampling Water Supply Systems and Human Exposure Estimation

#### Introduction

The HPS guidance on water system sampling defines four types of sample that may be used in assessing the probability that there is a source of lead contamination affecting a drinking-water supply. Ideally a full suite of all four samples would be taken for two purposes:

- a. To fully characterise the extent of lead contamination in a supply and help identify whether the source of lead is external to the property, internal or both;
- b. To allow estimation of the average likely exposure of the drinking-water consumers.

However, it might not be possible to conduct comprehensive sampling and to collect complete data in all situations. The following guide is intended to help decision making where only partial sampling is possible.

Domestic properties are likely to be easier to investigate than public use buildings (e.g. schools). Some adaption of the sample recommendations may be needed where there are multiple drinking-water taps. A full set of samples on every tap in a non-domestic setting is unlikely to be practical; however sufficient samples of the most useful sample types should be taken to ensure a representative picture of potential lead exposure to occupants.

A range of exposure estimates between worst case and best case would be useful. Understanding of the internal pipe-work layout may be essential to help devise an appropriate sampling framework. Also, sampling of internal water appliances (e.g. water boilers used for hot drinks) may be helpful in characterising personal exposures.

#### Sample Types

The types of sample that are appropriate are:

- **a random sample** - the initial screening sample used to check if a water supply system is PCV compliant; this is normally taken 'at random' with no preparation, no standardised tap run or flushing.
- **a flushed sample** – one taken after the supply has been run for a period long enough to ensure that mains water is being sampled, this normally takes a few minutes but may take longer in larger buildings with long pipe runs; this will give a measure of the lead content in the mains water and should help to define where a source of lead contamination lies (outside and/or inside the property).
- **a stagnation sample** – one taken following a **flushed sample** after a defined period (e.g. 30 minutes); used to assess the rate of leaching of lead into the supply in a given period and to give a sample result that is more representative of average exposure of the water consumers than a random sample.

- **an overnight sample (also referred to as a ‘first draw’ sample)** – one taken first thing in the morning after the mains supply water and water system have been left undisturbed overnight; used to assess the maximum lead concentration to which consumers might be exposed.

A random sample gives an indication of what a consumer is likely to be exposed to ‘at random’. However, it is often just a starting point for an investigation and may not be representative of what individuals are actually exposed to over a whole day. A single random sample is not sufficient to identify if there is a significant source of lead in the pipe-work (internal or external) or to characterise the exposure profile of the occupants/consumers.

Where a random sample indicates a lead level that is not PCV compliant, a flushed sample is needed as a baseline to tell if the water delivered from the mains tap is itself PCV compliant or not, and therefore to eliminate the possibility that external pipe-work is responsible for the elevated lead levels. A **flushed** (mains) sample should be taken by Scottish Water to prove that they are delivering potable (PCV compliant) water to the property, and so need not be a cost to the local authority or local NHS board. A flushed sample will however only indicate the quality of the water from the mains tap. It does not provide any additional information on lead sources within the property itself. A flushed sample result below the PCV does not exclude the possibility that there may still be a problem within the property that needs to be investigated further.

To check if the original **random** sample was a one off and decide if further sampling is justified, in addition to taking a baseline flushed sample, a repeat random sample is one option. However, any random sample is highly dependent on how much the tap has been used immediately beforehand and hence may be a poor reflection of the average lead concentration to which consumers are being exposed.

A stagnation sample is therefore also useful to determine the leach rate of lead into the water over a fixed period. If forced to make a choice between taking a repeat **random** sample (which could be taken immediately after a variable length of tap use) and a **stagnation** sample (i.e. no water is drawn for any purpose in the property for 30 minutes), a **stagnation** sample is more likely to provide a result that is representative of ‘average’ exposure, than a second **random** sample is.

An overnight sample (first draw sample) taken first thing in the morning (after a period of stagnation overnight, and assuming no one uses the water system overnight for any purpose including flushing toilets) is the most sensitive indicator of a source of contamination inside the property pipe-work. This sample should yield the maximum likely lead exposure level encountered by a consumer drawing water first thing in the morning. If sampling options are extremely limited an overnight sample taken together with the first **random** sample could give an approximate range of extremes between which the average lead exposure is likely to lie but would not be ideal.

## Recommendations

Where a single **random** sample lead result above the PCV is only marginally above the PCV, it might be reasonable to collect a repeat **random** sample to check before deciding if a more comprehensive sampling set is necessary.

However, for any **random** result that is more than marginally above the PCV (e.g. more than 25% higher), it would be advisable to carry out a complete set of samples as soon as practicable (flushed, 30 minute stagnation and overnight). Where this is not possible, at the very least a **flushed** sample should be taken to exclude involvement of the mains water supply, followed by a 30 minute **stagnation** sample.

If the flushed sample result is then above the PCV, it suggests that there is an external problem; conversely if the result is below the PCV, then external sources of lead contamination are unlikely.

If after flushing the tap a 30 minute stagnation sample result is also above the PCV, then it would be advisable to proceed to an overnight (first draw) sample as well, in order to establish what the extremes of lead exposure values are and to allow an adequate human exposure and risk assessment.

An estimate of drinking-water exposure for consumers should then be made with a calculation for average daily exposure. The US EPA suggest a method for apportioning lead exposures based on a formula which allocates 25% to 'standing' water, which would equate to a 30 minute stagnation sample (or an overnight sample whichever was higher) and 75% to a 'running' water sample, which would equate to a flushed sample (or if no flushed sample result is available, to a **random** sample).

The average volume of water consumed would also need to be estimated.

**HPS EPH Team**

December 2011

# Appendix 4

## Roles and Responsibilities in a Building to which the Public have Access to Drinking-water

### **NHS Public Health:**

- Carry out appropriate health risk assessment (hazard, exposure and health impact);
- Arrange appropriate clinical follow up (if any is required);
- Coordinate action to minimise the risk of continued exposure.

### **Local Authority (Environmental Health department):**

- Carry out water sampling to assist the health risk assessment;
- Ensure any remedial action is completed to an appropriate standard.

### **Building Owner/Operator:**

- Facilitate the investigation and risk assessment of building occupants/users;
- Ensure consumers are aware of the risks associated with detected levels;
- Provide an alternative to the tap-water supply where necessary;
- Carry out or cooperate in the completion of any remedial action required to eliminate source of lead and ensure that supply is PCV compliant.

### **Scottish Water (SW):**

- Ensure a mains water supply conforms to the PCV or if not take appropriate remedial action;
- Provide technical expertise and support for risk assessment.

### **Health Protection Scotland (HPS):**

- Provide expert advice and support as required.

# Appendix 5

## Example Communications

### A. Letter to occupant where SW have notified failure in Public supply

Dear Sir / Madam

#### **Water Supply (Water Quality) (Scotland) Regulations 2001 Lead in Water**

I have been advised by Scottish Water that a sample of water taken from your house at the above address had a lead level of **(insert result in ug/l)** which exceeds the maximum level permitted under the above Regulations.<sup>i</sup>

Scottish Water may have already notified you of this in writing and may advise you in due course whether they propose to undertake replacement of lead pipes, if any, in their ownership which may affect lead levels in your water supply. In addition, they may also advise you to replace any lead pipes within your property, which are the responsibility of the owner.

#### **Short Term Precautionary Measures**

I recommend that you take the following precautionary measures in the short term until such time as remedial action is taken to reduce lead levels to a more acceptable level.

Always take water for drinking or cooking direct from a mains cold water tap. This is usually the tap in the kitchen.

Never take water for drinking or cooking from any hot water tap. Warm water increases the amount of lead which is absorbed from plumbing and the water may have been stored in a lead lined tank in your loft.

Run the mains tap first thing in the morning to flush out any water which has been lying overnight - one to two minutes is usually enough. But if you live in a rural area, your part of the service pipe may be very long and you will need to allow a longer period for the water to flush clear. If you have any doubt about the level of flushing required please phone the Scottish Water Helpline 0345 437 437 for help.

#### **Repair Grant**

I wish to advise you that a Repairs Grant may be available for the replacement of certain lead plumbing in your property subject to you satisfying the Council's eligibility criteria for grant aid. Please contact **(Insert name of Grant Officer)** at **(Insert Area Office address)** should you wish to obtain further advice about the availability of grant.

If you are not an owner-occupier or crofter, I should be pleased if you could advise me, by return, of the name and address of your landlord so that a copy of this letter may be sent to him/her.

Please do not hesitate to contact me should you wish any further advice.

Yours sincerely,

EHO, LA

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<sup>i</sup> The permitted level (PCV) for lead is 25 micrograms/Litre (mcg/L) until 2013, then 10 mcg/L.

## B. Fax Message regarding Lead in Water Supply

**Date:**

**Time:**

**TO:**

<HPT>

<NHS Board>

I refer to the notification of a lead level above exceedance of the PCV (25 mcg/L until 2013 or 10 mcg/L after 2013) in the water supply serving the undernoted property and herewith advise you of the status of the occupants in terms of the Lead in Water Protocol.

<b>Property:</b>	<b>Property:</b>
<b>Address:</b>	
<b>Postcode:</b>	
<b>Tel No:</b>	<b>Supply: SW / PRIVATE SUPPLY</b> (circle as appropriate)

**NB** \* Status – pregnant woman (PW); Bottle-fed baby (BF)

<b>Occupant's name</b>	<b>Age</b>	<b>Status*</b>	<b>General Practitioner's name and address</b>

**FROM:** <EHO, COUNCIL>

**Tel No:**

**Fax No:**

**Principal Contact:**

## C. Letter to GP

Dear Doctor

### **Re: Possible Exposure to Lead in Drinking Water**

I am writing to advise that your patient attends XXX/lives at XXX address where a survey of water quality found elevated levels of lead in the drinking water supply and to ask you to bear this information in mind should your patient present with any symptoms suggestive of lead toxicity.

As you will be aware, the symptoms of lead poisoning are varied and can occur in other medical conditions.

The signs and symptoms of lead poisoning in children may include irritability, loss of appetite, weight loss, sluggishness and fatigue, abdominal pain, sickness, constipation, anaemia and learning difficulties.

In adults the signs and symptoms include abdominal pain, sickness, loss of appetite, high blood pressure, anaemia, headaches, irritability, tiredness, muscle weakness, paralysis, kidney and liver damage. Lead exposure may cause miscarriages or still births and also fertility problems in males.

Given the level of possible exposure, our assessment is that children/adults will/will not require blood tests to check blood lead levels. If your patient presents with symptoms suggestive of lead poisoning, a blood test can be offered to check blood lead levels (EDTA sample, purple top container) and if clinical concerns, FBC and film, U&E and LFT.

Should you have any queries or require further information please contact the Health Protection Team on XXXXX. I enclose a copy of the letter provided to your patient for your information.

I hope this information is of assistance to you.

Yours sincerely

CPHM, NHS Board

## D. Example of a Q&A for a school situation

### Why are there elevated lead levels in this water supply?

**Brief description of known details** e.g. Part of the school building dates back to XXX. Although some pipes have been renewed, the existing pipes were lead. This could account for any lead in water samples taken.

### What has been done to improve the situation?

**Details** e.g. As an interim measure, bottled water has been in use in the school since XXX. Work to rectify the situation includes...

### What was the lead level identified?

Details as appropriate.

## Assessing the risk

### How do we know what a safe level of exposure is?

Although there is no defined threshold at which lead exposure has no effects, we are able to assess whether the level of exposure is high enough to be able to increase blood lead concentrations to levels requiring treatment.

The levels in the school water supply are such that our recommendation is that blood lead levels are/are not required for pupils/staff.

Even when the lead concentration in the water supply is high enough for us to recommend tests, many individuals will not have blood lead levels that require any form of treatment.

### Are there any possible health risks?

Consider using the HPA FAQ from the HPA Compendium of Chemical Hazards – Lead.<sup>3</sup>

### What would be the symptoms?

The symptoms and signs of lead toxicity can also occur for many other reasons. This is why we recommend discussion with your own doctor before tests are carried out.

Symptoms and signs of lead toxicity are varied and include abdominal pain, sickness, loss of appetite, high blood pressure, anaemia, headaches, irritability, tiredness, muscle weakness, liver and kidney damage. It can sometimes cause miscarriages or still births, or fertility problems in males.

### What tests can be done?

If there are concerns about an individual's exposure or concerns about symptoms that could potentially be related to lead exposure, blood levels can be checked. Blood levels are useful with 100 days of the last exposure. Symptoms seen with high blood lead levels are also seen in many other circumstances and thus should be discussed with your own doctor prior to testing.

## **Will my doctor be aware of this issue?**

**Details as appropriate** e.g. GPs have been sent copies of the letters sent out within the school and also a letter from the public health department explaining the situation, listing the possible signs and symptoms and inviting them to contact the public health department if they wish to discuss further.

## **I am pregnant/have recently been pregnant. Could this affect my baby?**

Lead crosses the placenta to the fetus from around the twelfth week of pregnancy and can be present in breast milk.

Anyone with concerns that they have been exposed to lead should discuss with their own doctor as before. Consideration should be given to the likely exposure of each individual as before.

## **Is treatment available?**

No treatment is required for low blood levels of lead where there are no symptoms. If symptoms and/or raised blood levels of lead are present these would be assessed to consider if treatment is necessary. If you have concerns, please contact your GP in the usual manner.

## **Other factors to consider**

Lead can be found in various mediums and measuring environmental levels can be difficult. The largest controllable source is in water and due to recent legislation; water sampling is now carried out more regularly. The age of a property and its plumbing are a factor. Lead pipes are more common in older properties (built before 1970). You may wish to consider your own situation in terms of property and plumbing to avoid future exposure.

**Consider enclosing Scottish Water Factsheet 7: Lead ([Appendix 2](#)).**

# Appendix 6

## Assessment of Individual Exposure to Lead

The WHO (2011) (provisional) guideline value (GV) for lead in drinking water is 10 mcg/L. This was based on a previous Joint FAO/WHO Expert Committee on Food Additives (JECFA) provisional tolerable weekly intake (PTWI) of 25 mcg/kg body weight/week.<sup>i</sup> JECFA have since withdrawn the PTWI on the basis that consumption of lead even at this level has been associated with population level changes in children's IQ and a rise in adult systolic blood pressure. As such the PTWI is no longer thought to be protective; consequently there is now no accepted threshold for the health effect of lead.

Despite the lack of an accepted 'safe' threshold for lead in drinking water, intensive clinical investigation is not automatically justified in all situations. It is still necessary to decide whether an individual's exposure is such that investigation of blood lead levels is likely to be appropriate. It is unlikely that blood lead levels will be significantly elevated (above 10 mcg/l) at exposure levels below the previous (JECFA) PTWI (25 mcg/kg body weight/week) or the WHO GV for lead.

A US study used the EPA Integrated Exposure Uptake Biokinetic Model for Lead in Children to predict blood levels after exposure to lead in school drinking water. This study calculated worst case scenario blood lead levels for 5-6 year old school children, based on the 90th percentile lead levels in school drinking water samples. Assumptions were that children consumed 50% of their water supply from school and that 25% of this was from standing samples and 75% from running samples. The study reports that, assuming exposure to lead levels in school drinking-water of up to 49 ppb (standing water) and 7 ppb (running water), then no children (aged 5-6 years) are likely to have resultant blood lead levels that would exceed the CDC guideline of 10 micrograms per deciliter for blood lead<sup>ii</sup> (1 ppb Pb = 1 mcg Pb /l.).

(Note: Local biochemistry laboratory values may vary e.g. NHS Lanarkshire laboratory report that a blood lead level <0.5 micromol/l should be considered 'normal' (10 mcg Pb /dl = 0.483 micromol Pb /l).

### Calculation of Provisional Tolerable Weekly Intake (PTWI) of Lead<sup>i</sup>

The calculated tolerable limits for individuals are based on weight in Kg and take into account the cumulative nature of lead exposure.

Young children are the most sensitive to lead toxicity. They absorb around four times more of any lead that they ingest than adults do (approximately 40% compared to 5-15% in adults).

JECFA formerly suggested a provisional tolerable weekly intake (PTWI) of 25 mcg/kg body weight/week as outlined above. This remains a reasonable pragmatic level against which to compare individual exposure when deciding if blood lead levels are necessary. Up to half this intake is allowed from drinking-water exposure.<sup>i</sup>

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i WHO. Lead in Drinking-Water (WHO/SDE/WSH/03.04./09/REV/1). Background Document for Development of WHO Guidelines for Drinking-Water Quality. Available from: [http://www.who.int/water\\_sanitation\\_health/dwq/chemicals/lead.pdf](http://www.who.int/water_sanitation_health/dwq/chemicals/lead.pdf) (last accessed: 8 February 2016).

ii Sathyanarayana S, Beaudet N, Omri K, Karr C. Predicting Children's Blood Lead Levels from Exposure to School Drinking Water. *Ambulatory Pediatrics* 2006;6:288–292.

A 60 kg adult ingesting 1500 mcg/week of lead would not exceed the level of 25 mcg/kg/week. Assuming all water intake is consumed from the affected water source and (given that 50% of lead exposure is allowed from water) this equates to consuming a two litres of water per day at a lead concentration of 53.5 mcg per litre.

(Calculation:  $(0.5 \times 1500 \text{ mcg}) / 14 \text{ litres} = 750 \text{ mcg} / 14 \text{ litres} = 53.5 \text{ mcg/litre}$ )

For a 5 kg infant, this equates to consuming 0.75 litres of water per day at lead concentration 11.9 mcg per litre all from the affected source.

The PTWI is based on studies in children and adherence to the 50% of lead exposure from drinking-water is necessary for this group. Sources such as dust and soil ingestion are more of an issue for children.

In practice, it is unlikely that all water consumption would be from the same source. It is also less likely that adults would be exposed to lead from non-water sources and this should be taken into account in the risk assessment process (in other words more than 50% of lead intake could be allowed for drinking-water, so increasing the upper tolerable exposure limit).

Exposure above 25 mcg/kg/week is still unlikely to result in blood lead levels that would justify treatment but this is considered a reasonable threshold at which to consider offering blood tests.

Some individuals may request blood lead levels despite calculation of a level of exposure below this threshold. Access to this could be discussed further with the relevant clinician (GP or paediatrician).