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TOX/2026/12

Committee on the Toxicity of Chemicals in Food, Consumer Products and the Environment

Potential health risks from fluoride at UK exposure levels – Introductory paper

Introduction

1. The COT is requested by a number of Government Departments and Agencies to review toxicity information with respect to fluoride in relation to neurotoxicity, effects on bone and effects on the thyroid, and to consider the potential risks in the context of UK exposure levels through dental products, drinking water, and other exposure sources.
2. There has been renewed scientific discourse on effects of fluoride in particular relating to neurotoxicity. While this has not suggested concerns below current regulatory limits, there is an opportunity to revisit and consolidate the evidence, including on total exposure.

Background

3. Fluoride is present in:
 - Dental products, commercially and on prescription, to support dental health,
 - In drinking water, naturally and where it is added as part of fluoridation schemes to support dental health,

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- And in food as a contaminant and via its naturally occurring presence in water.

4. In 2003, COT considered the results of the 1997 Total Diet Study (TDS) with respect to fluoride following publication of the report of the Expert Group on Vitamins and Minerals (EVM). The overall conclusion at that time was that “based on the current information available and the dietary intakes estimated from the 1997 TDS, no adverse effects other than mild to moderate dental fluorosis would be expected to be associated with fluoride intake from food, either in adults or in children, at the intake levels in the UK.” ([COT, 2003](#)).

UK Regulatory frameworks

5. In the UK there are a number of different regulatory frameworks under which human exposure to fluoride is covered. These are:

6. Section 90A of the Water Industry Act 1991, as amended, requires a “relevant authority”, that has entered into fluoridation arrangements to monitor the effects of the arrangements on the health of persons living in the area specified in the arrangements. It also requires that such an authority publishes reports containing an analysis of those effects, making available any information, or summaries of information, collected by it for these purposes. Health monitoring reports are required at intervals of no greater than four years, beginning with the date on which the last report was published, unless the schemes in question are terminated. As of 1 April 2013, the Secretary of State for Health and Social Care is the "relevant authority" in England for the purposes of the fluoridation provisions. The Secretary of State's functions in relation to fluoridation health monitoring and reporting are exercised by the Water Fluoridation Health Monitoring Working Group.

7. The Drinking Water Inspectorate (DWI) is the regulator for the Water Supply (Water Quality) Regulations 2016 (2018 Wales) and Local Authorities are the regulators for the Private Water Supply Regulations. The maximum concentration for fluoride in both regulations is 1.5 mg F/l, measured at the consumers tap. This is

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the same as the WHO guideline value for drinking water. The statutory role of the DWI is to ensure compliance with these regulations. Companies submit their monitoring data monthly and DWI Inspectors assess any compliance breaches and take enforcement action to bring the supply back into regulatory compliance. The enforcement policy is a risk-based system with increasing sanctions and is published on the DWI website. The Inspectorate also publishes the Secretary of State's list of approved products for use in drinking water (Regulation 31). Only approved fluoride dosing chemicals (hexafluorosilicic acid, also known as fluorosilicic acid, and disodium hexafluorosilicate, also known as sodium hexafluorosilicate or sodium fluorosilicate) are permitted to be used to ensure there is no contamination of the water supply for example from impurities in the formulation.

8. The DWI has a further role in administering the reporting of operational compliance where artificial fluoridation is practiced, on behalf of the Department for Health and Social Care (DHSC) Office for Health Improvement and Disparities (OHID). Companies report results outside the operational limits to the Inspectorate, along with their regulatory compliance data, and the Inspectorate reports to OHID. The Inspectorate holds the technical guidance on artificial fluoridation on the DWI website. There are regular meetings with OHID, and under performance is also discussed with companies as part of the regular liaison role. Site audits may be carried out. However, the Inspectorate has no powers to enforce the practice of artificial fluoridation, either the application of the correct dose (within the regulatory standard) or the health and operation of the fluoridation dosing plant.

9. Under the UK Cosmetics Regulation No. 1223/2009, fluorine compounds as listed in Annex III of the regulation are permitted for use in oral care products at a maximum concentration of 0.15% (1500 ppm) calculated as fluorine. When two or more fluorine compounds are mixed together in a preparation, the total fluorine concentration must not exceed 0.15%. The fluorine compound must be labelled on the product as "Contains [fluoride compound]". Toothpastes containing fluorine concentrations between 0.1% and 0.15% must be labelled with the following "Children of 6 years and younger: use a pea-sized amount for supervised brushing to minimise swallowing. In case of intake of fluoride from other sources consult a

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dentist or doctor". Toothpastes which are indicated for adult use only are exempt from this labelling requirement.

10. The Medicines and Healthcare products Regulatory Agency (MHRA), an executive agency, sponsored by the Department of Health and Social Care (DHSC), regulates dental healthcare products (toothpastes and dental varnishes), containing high concentrations of fluoride ion ranging from 2,800ppm to 22,600ppm, that are authorised for the treatment and prevention of dental caries and hypersensitivity. These products are regulated under two regulatory frameworks:

- Medicines: High-strength toothpastes containing either 2,800ppm or 5,000ppm fluoride, and one dental varnish (Duraphat 50 mg/ml Dental Suspension, 22,600ppm fluoride) are licensed for use as medicinal products in accordance with 'The Human Medicines Regulations 2012 (S.I. 2012/1916)'. Due to the high fluoride concentrations, these products are only available under prescription (POM) where their use can be kept under medical supervision by the dentist or other authorised healthcare practitioners. They are prescribed following an assessment of a patient's total exposure to fluoride (e.g. fluoridated water, fluoride mouth washes etc.) and guidance is provided to minimise the risk of increased exposure to fluoride ion. In 2024 'The Human Medicines Regulations 2012' were amended through 'The Human Medicines (Amendments relating to Registered Dental Hygienists, Registered Dental Therapists and Registered Pharmacy Technicians) Regulations 2024', to allow registered dental hygienists and therapists to supply and administer certain medicines, including high-strength fluoride toothpaste (2,800ppm and 5,000ppm) under specific exemptions without a dentist's prescription
- Medical Devices: Dental Varnishes, indicated for treatment of hypersensitivity and caries prevention, are regulated as medical devices under 'The Medical Device Regulations 2002' (as amended).

11. There are no specific provisions for fluoride levels in food. Where a food safety concern is identified, action could be taken under general food law (Assimilated Regulation 178/2002) principles, which sets out the responsibility of

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food businesses to ensure all products placed on the market are safe for consumption.

12. Fluoride levels in bottled water are not in the remit of the Food Standards Agency (FSA) and are the responsibility of Department for Environment, Food and Rural Affairs (Defra).

Dental health and use of fluoride

13. Tooth decay is a significant, yet largely preventable, public health problem in England. It can be almost entirely prevented by reducing the amount and frequency of the consumption of sugar in food and drink and by adequate exposure to fluoride, which can be applied directly to teeth via toothpaste, through professional application of fluoride varnish or by addition to the drinking water supply. It affects people at all stages of life and is the most common oral disease in children. Tooth decay is a progressive disease which, if left untreated, can cause pain and infection. In severe cases it can lead to hospitalisation.

14. Poor oral health can have a negative impact throughout life. Poor oral health impacts on children and families. It affects children's ability to eat, smile and socialise and causes pain and infection with days missed at school, and parents' work to attend a dental service to receive care. Children who have high levels of disease in primary teeth have an increased risk of disease in their permanent teeth. Once treated, these teeth will require long term maintenance throughout life.

15. Amongst adults, it can result in time off work due to pain or treatment. Good oral health is essential for general health and wellbeing. For example, good oral health can support older people to stay independent for longer, or to recover from episodes of crisis or frailty.

16. Evidence shows that poor oral health in older people can lead to:

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- Pain and discomfort, which can lead to mood and behaviour changes, particularly in people who cannot communicate their experience, have speech problems and reduced ability to smile and communicate freely.
- Problems chewing and swallowing which limit food choices and can lead to impaired nutritional status.
- Poor quality of life.
- Reduced self-confidence and increased social isolation.
- Impaired well-being and mood.
- Poor general health and premature mortality.

17. The Global Burden of Disease (GBD) study for 2010 found that most disability amongst children aged five to nine in the UK was caused by poor oral health. An average of 2.24 hours of children's healthy lives was lost for every child aged five to nine years because of poor oral health. This exceeded the level of disability associated with vision loss (1.64 hours), hearing loss (1.77 hours) and type 2 diabetes (1.54 hours) (GBD, 2013).

18. Oral health is seen as a marker of wider health and social care issues including poor nutrition and obesity. The relationship between obesity, deprivation and dental caries is unclear. Despite this, it is likely that interventions that reduce sugar intake have the potential to impact both conditions at the population level because deprivation and high intakes of free sugars are known risk factors for both dental caries and for obesity (Public Health England (PHE), 2017).

19. Like many common chronic lifestyle associated diseases, the prevalence of dental caries is linked to deprivation. This has been shown by results of oral health surveys.

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Oral health in England

20. In England, as part of the annual National Dental Epidemiology Programme, DHSC co-ordinates dental surveys which assess local oral health needs of specific population cohorts.

Oral health survey of children in year six, 2023 (OHID, 2024)

21. The survey found that 16% of Year Six schoolchildren who participated in this survey had experienced tooth decay. Of these children each child had on average two affected teeth. Year six school children living in the most deprived areas of the country were more than twice as likely to have experience of tooth decay (23%) as those living in the least deprived areas (10%).

Oral health survey of five year old children 2024 (OHID, 2025a)

22. This survey found that more than a fifth (22.4%) of five year old children in England had experience of tooth decay, having on average 3.5 affected teeth (at the age of five years children normally have 20 primary teeth).

23. There are significant oral health inequalities in England. Children living in the most deprived areas of the country were more than twice as likely to have experienced tooth decay (32.2%) as those living in the least deprived areas (13.6%). There were also disparities in the percentage of those who had experienced tooth decay by ethnic group, which was significantly higher in the Other ethnic group (45.4%) and the Asian or Asian British ethnic group (37.7%). Inequalities in prevalence of experience of tooth decay in five year old schoolchildren significantly reduced from 2008 to 2015 but there has been little change in inequalities since then.

Oral health survey of three year old children 2020 (PHE, 2021)

24. This survey found that, 10.7% of children participating in the survey had experience of tooth decay despite having had their back teeth for just one or two

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years. Among the children with experience of tooth decay, each had on average three affected teeth (at age three, children normally have all 20 primary teeth).

25. Children living in the most deprived areas of the country were almost three times as likely to have experience of dental decay (16.6%) as those living in the least deprived areas (5.9%).

26. This is the second national survey undertaken for this age group in England. The first was completed in 2013, The findings indicate that the oral health of three year olds has changed little since 2013 when 11.7% had experience of dental decay.

Hospital tooth extractions in 0 to 19 year olds 2025 (OHID, 2026)

27. In the financial year ending 2025 there were 56,143 episodes of tooth extractions in NHS hospitals in England for 0 to 19 year olds. Of these, 33,976 episodes (60.5%) of tooth extractions were for a primary diagnosis of tooth decay.

28. Tooth decay is still the most common reason for hospital admission in children aged between five and nine years. The decay related tooth extraction episode rate for children and young people living in the most deprived communities was just over 3 times that of those living in the most affluent communities. Dental treatment under general anaesthesia has a small but real risk of life-threatening complications for children and carries significant morbidity for children undergoing this procedure.

29. The costs to the NHS of hospital admissions for tooth extractions in children aged 0 to 19 years have been estimated and are based on the latest [NHS national cost collection data](#). The costs were £87.7 million for all tooth extractions and £51.2 million for decay-related tooth extractions in the financial year ending 2025.

Adult dental health survey 2023 (OHID, 2025b)

30. Among dentate adults (those with at least 1 natural tooth), over two-fifths (41%) showed evidence of obvious decay.

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31. The severity of tooth decay varied by household income with rates of severity lower in higher income households. A similar pattern was seen with area deprivation, with rates of severity lower for adults living in the least deprived areas.

Evidence for effectiveness of various fluoride vehicles

32. Toothbrushing with fluoride toothpaste is the most commonly used vehicle for prevention of tooth decay in the world and is thought to be the main reason for improvements in the number of people affected by tooth decay over the last forty years (Ten Cate, 2013). For best effects, toothbrushing with fluoride toothpaste needs to be undertaken twice daily, once at bedtime and on at least one other occasion (OHID, 2025c). In the most recent survey of national Adult Oral Health Survey (OHID, 2025d), 71% of adults with teeth reported brushing twice a day. Of those that brushed their teeth, 87% used a fluoride toothpaste. Six per cent of adults who cleaned their teeth reported using a high fluoride toothpaste that had been prescribed to them by a dentist.

33. Application of fluoride varnish is another option for increasing the availability of fluoride on teeth. Fluoride varnish has to be applied by a trained member of the dental team. A Cochrane review concluded that fluoride varnish had a substantial caries-inhibiting effect in both permanent and primary teeth (Marinho et al, 2013).

34. Fluoride mouth rinses are another way of increasing fluoride availability in the mouth. These are used for children aged eight years and above. Effectiveness evidence shows that regular use of fluoride mouthrinse under supervision results in a reduction in tooth decay in children's permanent teeth (Marinho et al, 2016).

35. Fluoride tablets and drops (supplements) can be prescribed for the prevention of dental caries in children. It is recognised that the use of fluoride tablets and drops requires ongoing compliance by families and can result in under and over-use. The evidence shows that the uses of fluoride supplements are associated with a reduction in caries increment when compared with no fluoride supplement in permanent teeth, but the effect on primary teeth is less clear as is whether there is

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benefit over and above use of topical fluorides (Tubert-Jeannin et al, 2011). In England, in our current guidance, we do not advise use of fluoride tablets and drops.

36. There are school milk schemes in England in which parents can opt for their child to have fluoridated milk. They are provided in areas which water is not fluoridated and where levels of caries are high. There is low quality evidence to suggest fluoridated milk may be beneficial in reducing tooth decay (Yeung et al, 2015). Additional high-quality research is needed before definitive conclusions about the benefits of milk fluoridation can be made.

37. Some countries use fluoridated salt. However, in England this method of oral health improvement has not been utilised as a community intervention. Although salt fluoridation has the potential to reach populations, the lack of availability or actual use of fluoridated salt may mean that the intervention does not obtain full coverage. In addition, fluoridated salt would be contradictory to public health messages that encourage the reduction of consumption of salt to decrease the risk of hypertension.

Rationale for water fluoridation intervention

38. Water fluoridation is a fluoride vehicle that does not require behaviour change/compliance by the individual.

39. All water contains small amounts of naturally occurring fluoride. At the optimal concentration (one part per million or 1mg fluoride per litre of water [1mg/L]) it can reduce the prevalence and severity of tooth decay. Where the naturally occurring fluoride level is too low to provide these benefits, a water fluoridation scheme raises fluoride to the optimal level.

40. Water fluoridation schemes have been used for over 75 years internationally. Schemes in England have been in place since the 1960s. At levels recommended in the UK, it is a safe and effective public health measure to reduce dental caries and inequalities in dental health.

41. Following public consultation in 2024, we will expand community water fluoridation in the north east of England so that it reaches 1.6 million more people by

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April 2030. We will assess further rollout in areas where oral health outcomes are worst.

42. The water fluoridation provisions of the Health and Care Act 2022 came into force on 1st November 2022 and transferred statutory powers from local authorities to the Secretary of State to introduce, vary and terminate community water fluoridation schemes as well as to pay water companies for reasonable operating costs. Water fluoridation continues to be a ministerial priority and contributes to the Health Mission priority of “a shift from sickness to prevention” reducing preventable illness and tackling persistent health inequalities. It will contribute to the government’s ambition to “raise the healthiest generation of children ever” reducing tooth decay, one of the most common diseases affecting children and the leading cause of hospital admission for five to nine year olds.

43. The four UK Chief Medical Officers have made a [statement on water fluoridation](#). This concludes that “On balance, there is strong scientific evidence that water fluoridation is an effective public health intervention for reducing the prevalence of tooth decay and improving dental health equality across the UK”.

44. Water fluoridation is a complementary strategy, not a substitute for other effective methods of increasing fluoride such as fluoride toothpaste. Good practices such as regular dental check-ups and limiting sugar are important, but water fluoridation does have a positive effect even when those practices are absent.

45. With the evidence on cost benefit and the statement on water fluoridation from the UK Chief Medical Officers, community water fluoridation should be seen as a complementary strategy, not a substitute for other effective methods of increasing access to fluoride. It provides an important population level intervention as part of the overall strategy to improve oral health that will bring benefits to the most disadvantaged communities.

46. There have been many individual studies of the effects of water fluoridation over decades, using a wide variety of research methods, across different countries and investigating a range of health outcomes. There have been multiple systematic reviews of water fluoridation schemes from around the world. The common finding of

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these reviews is that water fluoridation is a safe and effective public health intervention for reducing the prevalence of tooth decay. Other relevant references that may be of interest are:

- Australian National Health and Medical Research Council (NHMRC) 2017.
- Royal Society of New Zealand (RSNZ) 2021.
- (Ireland) Health Research Board (HRB) 2022.
- Community Water Fluoridation Exposure: A Review of Neurological and Cognitive Effects - A 2020 Update.

47. The Secretary of State continues to have a duty to monitor the effects of water fluoridation schemes on health and to publish reports at no greater than four yearly intervals.

48. The most recent Health Monitoring Report (2022), which considers dental and other health outcomes, found that:

Five year olds in areas with higher fluoride concentrations were less likely to experience dental caries, and less likely to experience severe dental caries, than in areas with low fluoride concentrations.

- Five year olds in areas with a fluoridation scheme in place were less likely to experience dental caries than in areas without a scheme.
- Children and young people in areas with higher fluoride concentrations were less likely to be admitted to hospital to have teeth removed (due to decay) than in areas with low fluoride concentrations.
- Children and young people in areas with a fluoridation scheme in place were less likely to be admitted to hospital to have teeth removed (due to decay) than in areas without a scheme.
- These effects were seen at all levels of deprivation, but children and young people in the most deprived areas benefitted the most.

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49. These findings are consistent with the view that water fluoridation at levels within the UK regulatory limit (<1.5mg/l) is an effective, safe, and equitable public health intervention to reduce the prevalence, severity, and consequences of dental caries. It supports previous findings that these benefits are greatest in the most deprived areas, thereby contributing to reducing dental health inequalities. Although most studies focus on children, there are also substantial benefits for adults. Studies suggest adults living in fluoridated areas may retain more teeth when compared to adults living in non-fluoridated areas and suffer less decay (Griffin et al, 2007). The next Health Monitoring Report will be published in March 2026.

Health outcomes raised in recent authoritative review

50. A number of authoritative reviews have been conducted in recent years, with the US National Toxicology Program (NTP) and European Food Safety Authority (EFSA) publishing their evaluations in 2024 and 2025 respectively.

51. The US NTP undertook a systematic review of fluoride exposure and neurodevelopment and cognition. This concluded that with moderate confidence that fluoride exposures above the World Health Organization drinking water quality guideline of 1.5 mg/L, which is the same as the UK regulatory limit, were associated with lower IQ in children. Further studies were needed to understand potential for IQ effects at lower levels of exposure (NTP, 2024).

52. EFSA evaluated the evidence for potential adverse health effects from oral sources of fluoride. Its review concluded that drinking water concentrations of fluoride above 1.5 mg/L were associated with adverse effects on the developing brain. Evidence of effects below 1.5 mg/L were not sufficiently consistent. The EFSA review also identified that drinking water concentrations above 1.5 mg/L were associated with possible adverse effects on thyroid function and bone mineralisation. For adults and children over 8 years old, the drinking water concentration of 1.5 mg/L was used as a basis for the Upper Level for these age groups (EFSA, 2025).

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53. For younger children (less than 8 years old), EFSA considered that dental fluorosis was the most sensitive effect (EFSA, 2025). The next section provides more information on dental fluorosis.

Dental fluorosis

54. Dental fluorosis is a cosmetic condition caused by excessive fluoride exposure during tooth development. It appears as white flecks, lines, or patches on the teeth. The impact of milder forms of fluorosis on measured quality of life (using the Oral Health Related Quality of Life scale) is certainly less than that of tooth decay and may be non-existent or even positive (Do and Spencer, 2007; Chankanka et al, 2010).

55. Severe cases (with brown staining or pitting) are rare and more often found in countries with high naturally occurring fluoride levels.

56. The time of potential risk for aesthetic concern is during calcification of crowns of maxillary incisors. This is complete by age of 36 months. Excess fluoride will not cause fluorosis once teeth have developed.

57. Dental fluorosis can also occur in the absence of water fluoridation, through ingestion of other sources of fluoride during tooth formation, particularly toothpaste and other fluoride supplements.

58. A study reporting on fluorosis prevalence and severity in England was commissioned to inform the 2018 health monitoring report. It found that 10.3% of children in fluoridated areas (Newcastle, Birmingham) had prevalence of fluorosis that may be of aesthetic concern, compared to 2.2% in areas not fluoridated (Liverpool, Manchester) (Pretty et al, 2016). However, there was no difference between children and young people surveyed in fluoridated and non-fluoridated cities when asked about their opinion on the appearance of their teeth, taking into account concerns which have resulted from any cause e.g., poor alignment, decay, trauma or fluorosis. Further research in adults in England has suggested that the aesthetic impact of fluorosis diminishes with age (Macey et al, 2018).

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Planned process for COT's review

59. Following this paper, the Secretariat proposes presenting a series of papers:

- Toxicity reviews of the key sensitive endpoints identified in recent authoritative reviews:
 - Neurotoxicity,
 - Effects on bone,
 - Effects on thyroid.
- UK Exposure data across dental products, drinking water exposure and food exposure.

Search strategy for toxicity review papers

60. Preliminary searches have been undertaken to identify relevant recent authoritative review and consider the searching strategies used in these to determine whether the search approaches from a single review or combination of reviews can be used as a basis to identify new literature, or if these will only be used to inform a search approach for primary literature.

Preliminary searches

61. A preliminary search was conducted in the chemical inventory of the bibra TRACE database in order to identify potentially relevant terms for subsequent searching. The following chemicals (and associated CAS RNs) were identified:

- Fluoride (CAS RN 16984-48-8),
- Sodium fluoride (CAS RN 7681-49-4),
- Potassium fluoride (CAS RN 7789-23-3),
- Calcium fluoride (CAS RN 7789-75-5),
- Ammonium fluoride (CAS RN 12125-01-8),
- Magnesium fluoride (CAS RN 7783-40-6),
- Fluorosilicic acid (CAS RN 16961-83-4) also known as hexafluorosilicic acid,

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- Ammonium monofluorophosphate (CAS RN 20859-38-5),
- Sodium monofluorophosphate (CAS RNs 7631-97-2 and 10163-15-2),
- Potassium monofluorophosphate (CAS RN 14104-28-0),
- Calcium monofluorophosphate (CAS RN 7789-74-4),
- Sodium fluorosilicate (16893-85-9) also known as disodium hexafluorosilicate or sodium hexafluorosilicate,
- Potassium fluorosilicate (CAS RN 16871-90-2),
- Ammonium fluorosilicate (CAS RN 16919-19-0),
- Magnesium fluorosilicate (CAS RN 16949-65-8),
- Calcium fluorosilicate (CAS RN 16925-39-6),
- Magnesium monofluorophosphate (no CAS RN identified) was not chemically indexed but has been suggested for further consideration for completeness.

62. A search was conducted in the bibra TRACE chemical toxicity database using the above CAS RNs, limiting the results to comprehensive or authoritative reviews published in the past 10 years (between 2015 and 2025 inclusive).

63. The list of potentially relevant reviews returned in the TRACE search was screened to identify those publications that covered one or more of the key endpoints under consideration, and which included documentation of the specific search strategy employed.

64. The following relevant publications were identified, ordered by date:

- ANSES (2025),
- EFSA (2025),
- NTP (2024),
- HRB (2022),
- CADTH (2019),
- Jack et al (2016): a report to the Australian NHMRC. This expert group is not considered further in the current proposal, since CADTH (2019) included an update to this review,

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- RSNZ (2014): Although this report falls outside the selected publication window, it was referenced in a report from the New Zealand government (OPMSCA, 2021). The latter considered new research on fluoridation and comprehensive reviews published subsequently but did not give further details on specific search strategies. This expert group is not considered further in the current proposal.

65. Details of the search strategies utilised in each review are provided in Annex A document for awareness in case Members wish to have more information.

Summary

Key endpoints covered

66. EFSA, HRB and CADTH address the three key endpoints under consideration, with ANSES focusing on neurodevelopmental and thyroid effects and NTP confined to neurodevelopment and cognition.

Databases

67. PubMed/Medline would seem a good starting point for an updated literature search as this features in all of the key expert group reviews.

68. Other databases used by multiple expert groups: Embase (NTP, HRB and CADTH), Web of Science (WoS; EFSA and NTP), and the Cochrane library (HRB and CADTH), while NTP was the only expert group to address Chinese database searching.

Literature search date

69. ANSES and EFSA searches covered the period up to early 2024 (or late 2023 in the case of the targeted EFSA searches), while NTP searches were generally up to 2020 (children's IQ searches were updated to October 2023), and HRB and CADTH covered up to 2021 and 2017 (or 2018), respectively.

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Chemical search terms

70. The EFSA list of chemical search terms seems to be the most comprehensive, though other expert groups (e.g. NTP) include unique terms.

71. The TRACE list specifies relevant fluoride chemicals (e.g. simple salts) for potential inclusion in the search strategy. It is likely that these would be covered by the generic fluoride search terms in the key expert group reviews.

Toxicity search terms

72. The EFSA list appears to be the most comprehensive, with both general searches and targeted searches for the three key endpoints under consideration. However, the NTP search contains a more extensive set of neurotoxicity search terms.

Species search terms

73. EFSA and NTP use specific search terms to capture both human and experimental animal data (ANSES covers both sets of data without using specific search terms), while HRB and CADTH focus only on human data. NTP noted that updated searches for experimental data did not strengthen the confidence assessment based on the human evidence available and removed the animal evidence stream from later drafts of the publication.

74. The various EFSA searches incorporate slightly different terms to cover/exclude experimental animal data. The set of terms to be used in subsequent searches will need careful consideration.

Preliminary overview

75. Table 1 below provides an overview of the search details for the key reviews, focusing on PubMed/Medline.

76. The EFSA review would appear to be a good starting point for development of a search strategy, as it is recent and relatively comprehensive in terms of the endpoints covered and the chemical, toxicity and species search terms included.

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Table 1: Overview of search strategies from existing reviews

Expert group	Key endpoints covered	Databases	Search date	Chemical search terms	Toxicity search terms	Species search terms
ANSES	Neurodevelopment and thyroid	PubMed	March 2024	“sodium fluoride” OR Fluoride OR NaF.	Brief list of targeted terms.	No specific search terms (review covers human and experimental animal data).
EFSA	Neurotoxicity, bone and thyroid	PubMed; WoS	January 2024 (or October 2023 for targeted search on bone outcomes).	Shortlist of general fluoridation terms, and specific fluorides.	Extensive lists of general and targeted terms.	Human and experimental animal terms.
NTP	Neurodevelopment and cognition	Biosis; Embase; PsycINFO; PubMed; Scopus; WoS; CNKI; Wanfang	May 2020 (or October 2023 for searches on childrens IQ).	Shortlist of general fluoridation terms.	Extensive lists of targeted terms.	Human and experimental animal terms.

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Expert group	Key endpoints covered	Databases	Search date	Chemical search terms	Toxicity search terms	Species search terms
HRB	Neuropsychological, bone, and endocrine (thyroid)	Medline; Embase; Cochrane (Library Cental); LILACS; Epistemonikos; Prospero	September 2021.	Shortlist of general fluoridation terms.	None included.	Human terms only.
CADTH	Neurodevelopment, bone (skeletal fluorosis, bone development and bone fracture), and thyroid	Medline; Embase; Cochrane (Central Register of Controlled Trials; Database of Systematic Reviews; Methodology Register, Database of Abstracts of Reviews of Effects); Health Technology Assessment; CINAHL; PubMed; Scopus	October 2017 (possibly December 2018).	Shortlist of general fluoridation terms (including subtopics).	None included.	Human terms only.

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Updated searches

77. Preliminary searches were conducted in February 2026 in PubMed, using the EFSA search strings (conducted in October 2023 and January 2024) as a basis (key searches 1A, 2A, 3A, 4A and 5A), but with various modifications to account for potential areas of improvement in the search strategy: key searches 1B, 2B and 3B incorporated the more extensive set of neurotoxicity search terms utilised by the NTP; searches 1C, 2C and 3C incorporated the unique chemical search terms included by the NTP; searches 1D, 2D and 3D incorporated the unique chemical search terms included from TRACE (these were found not to impact the number of hits, hence retrospective searching was deemed unnecessary in PubMed/Medline); searches 1E, 2E and 3E are retrospective searches to cover the intervening period between the NTP and EFSA search dates, incorporating the more extensive set of neurotoxicity search terms utilised by the NTP; searches 1F, 2F and 3F are retrospective searches to cover the intervening period between the NTP and EFSA search dates, incorporating the unique chemical search terms utilised by the NTP. Table 2 - Table 5 below provide an overview of the number of hits for each of the updated key searches.

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Table 2: Preliminary PubMed/Medline search results – key search 1 (human)

Sub-search	Description	PubMed hits	WoS hits	De-duplicated
1A	Based on EFSA search.	2827	TBC	TBC
1B	As for 1A but with NTP neurotoxicity terms.	2996	TBC	TBC
1C	As for 1A but with NTP chemical terms.	4764 (3014 removing fluorin*[tiab] due to a particularly high number of hits, presumably on fluorine itself).	TBC	TBC
1D	As for 1A but with TRACE chemical terms.	2827	TBC	TBC
1E	Retrospective version of 1A (with NTP neurotoxicity terms).	208	TBC	TBC
1F	Retrospective version of 1A (with NTP chemical terms).	2508 (301 removing fluorin*[tiab] as for 1C).	TBC	TBC

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Table 3: Preliminary search results – key search 2 (animal)

Sub-search	Description	PubMed hits	WoS hits	De-duplicated
2A	Based on EFSA search.	309	TBC	TBC
2B	As for 2A but with NTP neurotoxicity terms.	312	TBC	TBC
2C	As for 2A but with NTP chemical terms.	317 (without fluorin*[tiab] as for 1C).	TBC	TBC
2D	As for 2A but with TRACE chemical terms.	309	TBC	TBC
2E	Retrospective version of 2A (with NTP neurotoxicity terms).	3	TBC	TBC
2F	Retrospective version of 2A (with NTP chemical terms).	14 (without fluorin*[tiab] as for 1F).	TBC	TBC

Table 4: Preliminary search results – key search 3 (targeted neurotoxicity)

Sub-search	Description	PubMed hits	WoS hits	De-duplicated
3A	Based on EFSA search.	509	TBC	TBC
3B	As for 3A but with NTP neurotoxicity terms.	556	TBC	TBC
3C	As for 3A but with NTP chemical terms.	566 (without fluorin*[tiab] as for 1C).	TBC	TBC

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Sub-search	Description	PubMed hits	WoS hits	De-duplicated
3D	As for 3A but with TRACE chemical terms.	509	TBC	TBC
3E	Retrospective version of 3A (with NTP neurotoxicity terms).	56	TBC	TBC
3F	Retrospective version of 3A (with NTP chemical terms).	97 (without fluorin*[tiab] as for 1C).	TBC	TBC

Table 5: Preliminary search results – key searches 4 (targeted bone) and 5 (targeted thyroid)

Sub-search	Description	PubMed hits	WoS hits	De-duplicated
4A	Based on EFSA search.	286	TBC	TBC
5A	Based on EFSA search.	39	TBC	TBC

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Questions on which the views of the Committee are sought

78. The Committee is invited to consider this paper and in particular:
- i. Are Members content with the proposed approach (outlined in paragraph 59) for this consideration?
 - ii. With respect to the search strategy:
 - a. Does the Committee agree that the 2025 EFSA review is an appropriate starting point for the development of a search strategy?
 - b. Does the Committee agree with the proposed modifications of the EFSA search strategy (see Table 2), namely the inclusion of additional search terms utilised by the NTP (covering: (a) neurotoxicity and (b) chemicals)?
 - c. Does the Committee agree with the proposal to conduct retrospective searches, based on the additional search terms utilised by the NTP, to check for potential omissions from the EFSA search?
 - iii. Is there any other information the Committee would wish to see?

**Secretariat and Bibra under contract supporting the UKHSA COT Secretariat
March 2026**

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List of Abbreviations and Technical terms

ANSES	French National Agency for Food, Environmental and Occupational Health & Safety
CADTH	Canadian Agency for Drugs and Technologies in Health.
COT	Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment
Defra	Department for Environment, Food and Rural Affairs
DHSC	Department for Health and Social Care
DWI	Drinking Water Inspectorate
EFSA	European Food Safety Authority
EVM	Expert Group on Vitamins and Minerals
FSA	Food Standards Agency
GBD	Global Burden of Disease
HRB	Irish Health Research Board
HSA	Health Security Agency
MeSH	Medical Subject Headings
MHRA	Medicines and Healthcare products Regulatory Agency
NHMRC	Australian National Health and Medical Research Council
NTP	US National Toxicology Program.
OHID	Office for Health Improvement and Disparities, DHSC
OPMSCA	Office of the Prime Minister's Chief Science Advisor of New Zealand
PHE	Public Health England
RSNZ	Royal Society of New Zealand
TDS	Total Diet Study
WoS	Web of Science

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TOX/2026/12 Annex A

Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment

Potential health risks from fluoride at UK exposure levels – Introductory paper

**Fluoridation literature search proposal development, more detailed
information, for interest only**

This has been sent to Members as a separate document for ease.

**Bibra under contract supporting the UKHSA COT Secretariat
March 2026**