



Asbestos-Cement (A/C) Drinking Water Pipes 29 November 2023

Discussion Document.

When we turn on a tap, we assume that the water is perfectly safe to drink, however as pipes age and deteriorate asbestos can scatter into the water. According to the United Utilities 15% of drinking water pipes in the north west contain asbestos which was used as a binding agent many years ago (10th. November 2023). These pipes are worn and near their end of useful life cycle, a concern around the world not just the UK, the worry is that asbestos fibres are being released into people's drinking water.

In Canada, Green Party Leader Elizabeth May has tabled a petition calling on the Federal Government to take urgent action on Canada's aging asbestos-cement pipes due to the potential dangers of drinking tap water containing the deadly fibre (9th. November 2023), the Government has 45 days to respond.

In South Africa District Speaker, Nomathemba Gabela has been asked for timelines and funding details for the replacement of asbestos cement pipes (7th. November 2023) describing the situation as *"a ticking time bomb as their life span is +/- 35 years, beyond this they become unreliable and can break with some micro residues making their way to the glasses of residents thus risking their health because of the carcinogenic nature of asbestos base materials"*.

Inhalation v ingestion – the Health & Safety Executive (HSE) acknowledge that the inhalation of asbestos fibres can kill [1] but many say the latter is not a problem such as the Drinking Water Inspectorate (DWI) [2] and Piperepair.co.uk [3]. However, to use the World Health Organisation's (WHO) advice and err on the side of caution, which WHO term as "the Precautionary Principle", we have considered that ingestion can cause peritoneal mesothelioma, in the abdominal cavity, and digestive cancers even if these are less common. A potential source for this ingestion could be from drinking water that has been contaminated by the water flowing through asbestos-cement (A/C) pipes. Further investigation on this is warranted but this would have to be taken by those with a clinician's background.

The WHO updated its information 2021 but the DWI are still quoting from a 2002 report that gathered information from multiple sources that could now be seen as dated, some go back to 1970's and societal concern over asbestos in the workplace or elsewhere has changed significantly in that near 50-year time span; consider societal approach to asbestos in 1940's to fifty years later in 1990's.

We would like to see the eradication of asbestos in the drinking water supply network throughout the UK alongside the campaign for the removal of asbestos from UK buildings.

Asbestos in water pipes.

Asbestos in cement, commonly under the umbrella classed as asbestos-cement (A/C) pipes are widely used internationally. Many of these pipes in the UK, and elsewhere, are coming to their end of life and deteriorating, thus the asbestos fibres within in the cement must be going somewhere along with the water that is being distributed by that A/C water pipe; it is quite rational to see that much of the end of the water cycle is by people drinking it and ingesting the asbestos fibre(s).

We start with the recognition that there is no need to discuss the historical wide use of asbestos or how asbestos exposure can cause serious health problems, such as lung cancer, mesothelioma, or asbestosis. Whilst we understand that asbestos can be found in many older buildings, we are considering water pipes that supply drinking water to millions of people, therefore think it important to assess the potential risks of asbestos contamination in those pipes.

During the 1950s to 1970s there were thousands of kilometres of A/C pipes installed in the UK's drinking water network, up to 20% of the network. These pipes are a serious concern now as many of these reach the end of their useful lifespan as they were expected to last fifty to seventy years. Failures in these lines are now becoming more common and the release of into drinking water becomes inevitable when breakages happen. As the UK's A/C pipes come to the end of their life in the next decade, it is fair to assume that higher levels of potentially dangerous sized asbestos will enter the water network as the frequency of leaks and bursts increases [3] but the WHO say this is not a problem, we will look at their comments later. The UK has no asbestos fibre level in water guidelines, and we do not routinely test drinking water for asbestos fibres.

A report to the Department of the Environment (DoE) informed them that many water pipes were reaching the end of their life for the most part and were beginning to cause big problems [4]. It questioned the suitability of A/C pipes for conveying potable water particularly with regard to its quality, raising concern over the possibility of asbestos fibres being released into the water supply by the deteriorating pipework. It went on to suggest that the aggressiveness of the water, the length and age of the pipes probably contribute to the concentration of fibres found. A/C pipes were known to deteriorate but their performance was not fully understood. Objective I (iii) was to “*determine the rate of deterioration of asbestos cement pipe occurring in the UK and potential for release of asbestos fibres into the water supply*”. The rationale was that DoE had concluded that A/C pipes may contribute to the numbers of fibres in the conveyed water in the distribution system.

The WHO updated its Guidelines for Drinking-water Quality in 2021 and included Chemical Fact Sheets for every element which they had found in drinking water [5]. It confirmed that asbestos was introduced into water by the dissolution of asbestos-containing minerals and ores, as well as from industrial effluents and atmospheric pollution. They highlighted that the greatest influence “*the main source of asbestos in drinking-water was asbestos–cement pipes in the distribution system*”). The fact sheet discusses the number of asbestos fibres from A/C pipes is related to the aggressiveness of the water supply and pipes being degraded. Despite this, the sheets repeat the reason for not establishing a guideline value being “*no consistent evidence that ingested asbestos is hazardous to health*”. However, at least the guidelines state “*Where existing asbestos–cement pipes are still in active use, suppliers should map and record their location, assess their condition (including related to water aggressiveness) and determine the most appropriate risk reduction strategies*”. Some water

companies seem slow to quote this advice, or that saying degradation of A/C pipes in drinking-water supplies should be minimised or that investigative monitoring of A/C pipes should be considered to provide additional information on the contribution of aging A/C pipes in the water distribution networks.

Piperepair.co.uk acknowledge the historical issue of A/C in drinking water supply network and do go in depth in their consideration, whilst quoting the current position of the WHO stating no further action required, they do state they are open to review any future evidence on the subject [6]. They put the figure on A/C pipes in England and Wales as up to twenty percent and whilst they point out that *“nobody can really say for sure”* about the dangers of ingestion and if fibres size has safe limit? The 37,000km of asbestos cement pipework installed across the UK was expected to last 50 to 70 years. Failures in these lines are now becoming more common, and the release of fibres into water occurs when breakages happen. As the UK’s A/C pipes come to the end of their life in the next decade, it is fair to assume that higher levels of potentially dangerous sized asbestos will enter the water network as the frequency of leaks and bursts increases. They highlight that concern to those in the UK comes from the WHO’s research being based upon the presence of chrysotile (white asbestos) in asbestos cement pipes. The majority of Britain’s network is made up of pipes with crocidolite, so-called blue asbestos. Of the two, blue asbestos is known to be more harmful than white because of its pointed fibres. These pose a bigger threat because they can more easily enter the tissue of organs such as the stomach or colon. They conclude saying *“we have also stated that should further evidence become available by way of peer reviewed science or advice from recognised health bodies or toxicologists and relates to ingestion of asbestos which contradicts this we will review this position.”*

As long ago as in 1980 the US Environmental Protection Agency (EPA) (responsible for the protection of human health and the environment) pointed out that that whilst asbestos was understood to be a known carcinogen when inhaled it was quite likely to be a human carcinogen when ingested *“given the ability of asbestos to induce malignant tumours in different animal tissue, the passage of ingested fibre through the gastrointestinal mucosa”*. Yet in Canada 2023, Health Canada say, *“there’s no consistent, convincing evidence that asbestos ingested through drinking water is harmful to your health”* [7]. We would suggest that means that there is no there’s no consistent, convincing evidence that asbestos ingested through drinking water is safe. As Dr Sears says even if the statement that you get rid of ingested fibres mostly through faeces – you get rid of most cigarette smoke by exhaling but smoking still causes cancer. There is zero evidence of ingested asbestos through drinking is safe. Whether inhaled or ingested asbestos fibre particles distribute throughout the body – in urine, organs such as kidney, heart, liver, spleen, adrenals, pancreas, brain, prostate & thyroid. Fibres are seen in various tumours. The International Agency for Research on Cancer say that all forms of asbestos are carcinogenic to humans, there is a possible health risk from asbestos in drinking water (2016), and we should apply the Precautionary Principle when dealing with ingestion of asbestos.

The Guardian reported concern taken up by Olivia Blake (Labour MP for Sheffield Hallam) over the water company responsible for maintaining a 50-year-old A/C pipe that burst and left thousands of people in Sheffield also without other utilities like gas, should upgrade its infrastructure, investing vastly more of its profits in replacing old pipes at the end of their lifespan, *“there are leaks popping up all over communities”* [8]. Blake, who was previously the shadow water minister added, *“there have been a series of failures over many years”*. The paper added that experts say the 23,000 miles (37,000km) of A/C pipes laid

in Britain was coming to the end of its 50 to 70 year lifespan and about £500,000 had been spent on mains pipes in the affected areas over the past two years.

In a more recent study [9] Zavašnik, Šestan & Škapin make some worthwhile observations that must be taken into consideration when listening to advice from any governmental organisation.

- There will be marked differences withing test results from different geographical areas due to such variables as higher water temperature resulting in calcite scaling isolating the asbestos from drinking water; lower water temperature cause dissolution of calcite scales and Ca leeching from cement; porous degraded layer of pipe being mechanically unstable resulting in spallation when subjected to vibrations and cement degradation by calcium leaching which is the main reason for asbestos fibres release in drinking water.
- The lifespan of A/C pipe is estimated at 70 years, but actual service life depends mostly on pipe manufacturing quality and working environments, A/C pipe undergoes gradual degradation that is influenced by several factors, the most important being the physical characteristic of the A/C pipes (*age, size, quality of manufacturing*), local environment (*conveyed water chemistry and aggressiveness of water supply*), and operational characteristics (*operation, maintenance and repairs*). Physical and chemical degradation of the A/C pipes, especially when conveying aggressive water, detrimentally affect the structural integrity of the A/C water mains and can act as a continuous source of asbestos fibres in the drinking water. The ageing of the pipes, leading to pipe softening and increased pipe failures, is also recognised as the important source of asbestos in drinking water.

In Ireland there is concern over asbestos piping in Limerick where, following a burst pipe, people were made aware that their supply was via an old A/C pipe. Their local councillor Sharon Benson saying that connecting to a pipe like this is “*taking us back to the last century*” and “*alarming to residents*” [10]. An Irish Water spokesperson said A/C pipes are widely used and, quoting the WHO position, that is no evidence of that asbestos in drinking water being a risk to health, adding that “*only 10% of Irish water mains are made from asbestos cement*”.

In 2019 the Financial Times (FT) reported on concerns raised by a UK village called Cranleigh where the drinking water supply was distributed via by A/C pipes and local residents had passed away because of asbestos-related diseases [11]. They questioned the safety of drinking water from such pipes which were deteriorating and releasing fibres into the water as well as the lack of guidelines and testing for asbestos levels in water in the UK, highlighting the fact that the miles of A/C pipes in the UK were now coming to the end of their expected 50 to 70 year lifespan. The FT confirmed that both the UK Government and the WHO concluded there was no need to take any remedial action to remove A/C pipes, even though they had found clear evidence asbestos fibres were entering the water supply through degraded pipes. This action was being disputed not only in the UK but also in Canada, the USA, Italy, Australia and New Zealand. Residents said they hoped there was not a problem but if there was a risk to public health the authorities “*should err on the side of caution*”. The FT went on to point out that Arthur Frank, professor of public health and professor of medicine at Drexel University in Philadelphia said that “*There is plenty of evidence that water rushing through asbestos cement water pipes leaches out asbestos fibres and there is no question in my mind that the ingestion of asbestos causes gastrointestinal tract and kidney cancers.*” The FT went on to report that most of the research into the issue had focussed on chrysotile (white) asbestos but the A/C pipes in the UK were mostly crocidolite (blue) asbestos from South Africa. Blue asbestos has pointed needle-like fibres that enter into the tissue of the oesophagus, stomach and colon.

In the EU a question was tabled to the Commission (E-005165/2021) on A/C pipes getting damaged and the likelihood of asbestos leaching into drinking water, the proliferation of asbestos fibres increasing the risk of ingestion [12]. Whilst acknowledging that there was little scientific evidence that ingested asbestos posed a health risk and there was no established limit for the concentration of asbestos in drinking water, it noted the US Environmental Protection Agency has set a limit of 7 million asbestos fibres per litre of water and the risk of contracting gastrointestinal cancers linked to the ingestion of asbestos could be underestimated. Mr Sinkevičius responded on behalf of the European Commission quoting the WHO and the 1998 Drinking Water Directive which obliges Member States to ensure that drinking water is “*wholesome and clean*” but it was not considered necessary for any maximum concentration limit for asbestos in drinking water in EU legislation. Regulation (EC) No 1907/2006 prohibits the manufacture and use of new articles containing asbestos in the EU, specifying that existing articles can still be used until the end of their service life or their disposal.

Italian research seems to be taking the ingestion of asbestos with more alarm, the finding of asbestos fibres in drinking water (up to 700.000 fibres/litres) in Tuscany led to concerns about health risks in exposed communities [13]. Exposure to asbestos has been linked with cancer at several levels of the gastrointestinal tract, and it has been documented, in an animal model, a direct cytotoxic effect of asbestos fibres on the ileum. Describing a possible link between asbestos and intrahepatic cholangiocarcinoma, with asbestos fibres being detected in humans in histological samples from colon cancer and in gallbladder bile. According to the International Agency for Research on Cancer (IARC), there is evidence pointing to a causal effect of ingested asbestos on gastric and colorectal cancer so the exposure to asbestos by ingestion could explain the epidemiological finding of mesothelioma in subjects certainly unexposed by inhalation. They concluded that several findings suggested that health risks from asbestos could not exclusively derive from inhalation of fibres and whilst there is no threshold level for health risks linked to the presence of asbestos in drinking water, the precautionary principle should impose all possible efforts in order to revise health policies concerning this topic, and a systematic monitoring of drinking water to quantify the presence of asbestos was needed.

In the USA Professor Giovanni Brandi and Doctor Simona Tavolari compared the prevalence of asbestos fibres in drinking water from around the world, a hidden source of asbestos exposure remaining almost ignored and represents a challenge in Western societies [14]. The source of fibres in water is frequently known, and drinking polluted or safe water is a matter of choice, as in A/C pipes. Gastrointestinal tract cancers can be varied, prostate, stomach, colon, rectus, oesophagus, small intestine, pancreas so a wide range. They highlighted that an accurate analysis from the Italian National Mesothelioma Register revealed that only 80% of mesotheliomas show a previous asbestos exposure; in the remaining cases, the source of exposure is unknown, suggesting hidden environmental sources. Brandi and Tavolari highlighted that whilst some US studies resulted in negative association, the largest cohort study in San Francisco Bay showed a significant increase in stomach, oesophageal and colon cancers that were directly correlated to the number of ingested fibres with water.

In a separate study Brandi and Tavorari looked at the link between asbestos exposure and cholangiocarcinoma malignancies [15]. The role of occupational and environmental risk factors in intrahepatic cholangiocarcinoma (iCCA) development has little been investigated to assess if there is a link between asbestos exposure and iCCA development but recent epidemiological studies have provided increasing evidence about a potential link, findings providing clear evidence that asbestos fibres may reach other target organs beyond the respiratory tract, like the liver and the biliary tract. Asbestos fibres are introduced into the body by inhalation (the most involved) and ingestion. They noted that in the ingestion pathway, ingested asbestos fibres can cross the intestinal mucosa and be finally delivered to the liver through the portal vein. In the liver, asbestos fibres could remain trapped in the smaller bile ducts and exert their carcinogenic effect inducing cell malignant transformation.

Not all experts have concluded that asbestos ingestion is of little consequence Mary Ellen Ellis, head writer for Metothelioma.net, considers peritoneal mesothelioma and digestive cancers are related, but whilst ingestion is less common than inhalation of asbestos fibres, ingestion may directly cause peritoneal mesothelioma and digestive cancers [16] a form of cancer that begins in the tissue lining of the abdominal cavity, it may be due to accidental ingestion of asbestos fibres. Peritoneal mesothelioma begins with tumour development in the peritoneum, the thin layer of tissue that surrounds organs in the abdominal cavity. From there, cancer may spread to the omentum, a layer of fat covering the abdomen, it may also affect the liver and intestines. A potential source of asbestos fibres is contaminated drinking water that has been supplied via asbestos-containing cement pipes becoming contaminated. She shares our concern that A/C pipes lifespan around seventy years, beginning to break down leading to contamination of the water with asbestos fibres. Ellis also looks at the study investigated over seven hundred lighthouse keepers in Norway (covered later), some of those workers consumed asbestos-contaminated water and had a significantly increased risk of developing digestive cancers. Ellis reiterates that experts say that there is no safe amount of asbestos exposure, the risk of developing asbestos cancer increases with the amount, frequency, and duration of exposure. Thus, those working in certain industries remain most at risk.

Five years ago, Agostino Di Ciaula suggested that asbestos fibres in drinking water could be linked with gastrointestinal cancers even though it is not regulated in several countries due to conflicting evidence [17]. Reports mainly associated fibre ingestion with gastric and colorectal cancer, showing ingestion induced toxic effects on the stomach, ileum and colon, may cross the placenta and enter foetal organs including the liver. Whilst few countries have asbestos in drinking water guidelines, regulations where adopted have weak scientific basis and may not be adequate. With further and more definitive studies, evidence might become sufficient to justify monitoring plans, persuade countries with no current limits to set a maximum level of asbestos fibres in drinking water and might induce a revision of the existing legislations, pointing to efficient primary prevention policies.

The international Labour Organization (ILO) looked at trends and priorities when it comes to protecting the health and safety of workers from occupational chemical exposures and the main finding was that top chemical exposure identified was asbestos. It acknowledged cancers (mesothelioma, cancer of the lung, larynx, and ovary) asbestosis and pleural disease and that exposure through inhalation was greater there is exposure through ingestion [18]. They also observed associations between exposure to all forms of asbestos and cancer of the pharynx, stomach, and colorectum. A study of over 5,000 cases of cholangiocarcinoma, or bile duct cancer, showed a positive association between occupational exposure to asbestos and the risk

of intrahepatic cholangiocarcinoma. They selected priority actions included replacing asbestos or products containing asbestos (e.g., A/C pipes) with materials evaluated as less harmful.

Marco Martuzzi and Joel Tickner discussed the WHO and the Precautionary Principle. Many governments, including the UK, say that there is no consistent convincing evidence that drinking asbestos is harmful, and point to the WHO, but the WHO says we should employ the precautionary principle [19]. Irreparable mistakes must be avoided, such as those related to tobacco, lead or asbestos, when people waited for definitive evidence far too long before springing to action. Further, irremediable chains of events leading to health damage must be prevented from being triggered. Precaution has been at the heart of public health protection for centuries, and the precautionary principle is indeed related to acting under uncertainty, an increasingly common circumstance in these days. The precautionary principle has been gaining prominence and profile and has become a guiding principle in modern thinking in environment and health. The concepts of precaution and prevention have always been at the heart of public health practice and public health is inherently about identifying and avoiding risks to the health of populations, as well as about identifying and implementing protective measures and there is no contradiction between pursuing scientific progress and taking precautionary action. These preventive precautionary actions ultimately aim at continuously reducing and if possible, removing exposures to potentially harmful substances, activities and other conditions. They noted that in 1898, Lucy Deane, a UK Factory Inspector, observed the “*The evil effects of asbestos dust....*” but it took the UK Government one hundred years later, in 1998, to ban “white” asbestos.

In one of the most objective studies on possible gastrointestinal cancer risk in population groups exposed to drinking water contaminated with asbestos from natural sources or asbestos-cement containing water pipes Norwegian lighthouse keepers were considered [20]. Specifically the effect of ingested asbestos fibres as the group had a proportion who had been exposed to asbestos in their drinking water, seven hundred and twenty six lighthouse keepers employed between 1917 and 1967 were followed up for cancer incidence with the risk of stomach cancer was elevated in the whole cohort. Their conclusion was that these results support the hypothesis of an association between ingested asbestos and gastrointestinal cancer risk in general and stomach cancer risk specifically.

Julian Branch, a former journalist from Canada and a current communications professional, has been highlighting concerns over asbestos in drinking water and supplied much of the source material that assisted in MAVSG in looking at the issue. He writes that it has been estimated that up to eighteen percent of the water distribution pipes in the United States and Canada are A/C, the pipes can contain up to 20 percent asbestos [21]. The United States Environmental Protection Agency (EPA) says asbestos fibres may be released from the use of A/C pipes in water supply systems consequently it regulates asbestos in water, maintaining that ingested asbestos can cause lung disease and cancers. In the USA enforceable regulation for asbestos became effective in 1992, with the maximum contaminant level (MCL) set at seven million fibres per litre (MFL). However, the USA did not merely leap into action but took decades of very detailed studies before the step was taken. In a 1979 report *Exposure to Asbestos from Drinking Water in the United States*, the EPA looked at asbestos concentrations in 365 cities in 43 States. “Of the 365 cities, 165 or 45.3 percent were reported to have significant concentrations of asbestos in the drinking water.” In 1980, the EPA conducted a detailed study entitled *Ambient Water Quality Criteria for Asbestos*. In part it reads: “*Asbestos is a known carcinogen when inhaled. The demonstrated ability of asbestos to induce malignant tumours in different animal tissues, the passage of ingested fibres through the human*

gastrointestinal mucosa, and the extensive human epidemiological evidence for excess peritoneal, gastrointestinal, and other extrapulmonary cancer as a result of asbestos exposure suggests that asbestos is likely to be a human carcinogen when ingested.” The National Research Council Canada (NRC) conclude from a 2010 study that *“severely deteriorated AC pipes also released asbestos fibre into the drinking water and could pose a hazard of tumours of the gastrointestinal tract, and other organs in consumers.”* Yet, like in the UK, Canada has no enforceable regulations for concentration of asbestos in drinking water.

In Australia, following a consultation exercise, there are guidelines providing water services to eliminate or minimise the risk of exposure to asbestos fibres being released from asbestos-cement pipes though they refer to airborne exposure when working on A/C pipes, there is only one paragraph that mentions asbestos in the drinking water [22]. There is no routine monitoring of Australian drinking water supplies for the presence of asbestos, but it is known that the deterioration of A/C pipes can result in asbestos fibres being released into water supplies. However, they do point out that like all A/C in a workplace, general asbestos workplace legislation applies, pipes must be inspected by a competent person to confirm if it contains asbestos, if now it must be assumed to be A/C. The term workplace is broadly defined in law, meaning that the requirement to prepare and maintain an asbestos register applies to the site of the A/C pipe, being a place where a worker goes, or is likely to be, while at work. In the UK the Government state a *temporary* workplace is somewhere the employee goes only to perform a task of limited duration or for a temporary purpose [23].

Legislation (*Managing and working with asbestos*) says that employers working with asbestos should comply with the requirements of the Regulations which help prevent and control exposure to asbestos, including carrying out a risk assessment and taking measures to prevent exposure and prevent the spread of asbestos [24]. It continues saying duties to others *“Employers must take into account people other than their own employees in the risk assessment required by regulation 6 and in the action taken to prevent or control exposure required by regulation 11”*. Dutyholders are required to ensure that reasonable steps are taken to find materials in premises (the workplace) likely to contain asbestos and to check their condition and materials are presumed to contain asbestos unless there is strong evidence that they do not.

The ACoP states that a written record of the location and condition of asbestos and/or presumed asbestos is made and that the record is kept up to date. It also requires a written plan to manage that risk is prepared and that the plan is put into effect to make sure that any material known or presumed to contain asbestos is kept in a good state of repair.

Linda Reinstein, the renowned American asbestos campaigner and founder of Asbestos Disease Awareness Organization (ADAO), completed a report published 30 September 2023 entitled *“The Analysis of Imports, Use, Impact on Human Health, and Current Regulations and Policy”*. We’d highlight a few pertinent points from pages 5 & 6; namely that the International Agency for Research on Cancer (IARC) determined that exposure to all forms of asbestos increases the risk of lung cancer and mesothelioma and that *“there is sufficient evidence that asbestos causes cancers of the larynx and ovary. The IARC Monograph also reported that positive associations have been observed between asbestos and cancers of the stomach, pharynx, and colorectum”*. Secondly, that asbestos fibres *“if swallowed, they can become embedded into the digestive tract as well”*. In the USA the Agency for Toxic Substances and Disease Registry (ATSDR) issued a Public Health Statement in 2021 via US Department of Health and Human Services [25]. To quote one paragraph from page three *“if you swallow asbestos fibers (either those present in water or those that are moved to your throat from your lungs), nearly all of the fibers pass along your intestines within a few days and are excreted in*

the feces. A small number of fibers may penetrate into cells that line your stomach or intestines, and a few penetrate all the way through and get into your blood. Some of these become trapped in other tissues, and some are removed in your urine". Clearly stating fibres can enter the body via ingestion and enter the bodies tissue(s), even if that is a small number.

There have been several of studies in Italy on asbestos in drinking water and asbestos cement pipes and the possible hazards to human health. One starts with the statement that according to the WHO and the International Agency for Research on Cancer (IARC), there exists at least sufficient evidence that all types of asbestos may cause cancer in humans [26]. The various scientific studies and epidemiological reports examined highlight that there is an ongoing debate on the possible carcinogenic risk associated with asbestos exposure through ingestion. Concluding that "*considering the latency with which diseases caused by asbestos may emerge, control measures should be adopted*".

A further Italian study of asbestos fibres and drinking water in Tuscany led to concerns about health risks in exposed communities where exposure had been linked with cancer at several levels of the gastrointestinal tract [27]. It described a possible link between asbestos and intrahepatic cholangiocarcinoma, and asbestos fibres have been detected in humans in histological samples from colon cancer and in gallbladder bile. In animal models, asbestos fibres ingested with drinking water acted as a co-carcinogen and, according to the IARC there was evidence pointing to a causal effect of ingested asbestos on gastric and colorectal cancer. Furthermore, the exposure to asbestos by ingestion could explain the epidemiological finding of mesothelioma in subjects certainly unexposed by inhalation. It concluded suggesting that health risks from asbestos could not exclusively derive from inhalation of fibres. Health hazards might also be present after ingestion, mainly after daily ingestion of drinking water for long periods. Despite the fact that the existence of a threshold level for health risks linked to the presence of asbestos in drinking water is still under debate, the precautionary principle should impose all possible efforts in order to revise health policies concerning this topic, and a systematic monitoring of drinking water to quantify the presence of asbestos is certainly needed in all regions.

The Drinking Water Inspectorate (DWI) was formed in 1990 to provided independent opinion on drinking water supplies to consumers in England and Wales with the strategic objective to protect public health and maintain public confidence in drinking water. In a very detailed and seventy two page comprehensive report in 2022 [28] it is noted that there are mains pipes totalling 321,363 km in England and Wales but no mention of how much of this contains asbestos. The data highlighted challenges such as pesticides, nitrates and other chemicals, various metals and horizon scanning for risks such as endocrine disruptors, pharmaceuticals, microplastics and post-industrial solvents. Whilst it mentions pressure on aging infrastructures which may not be able to cope and difficulties enabling asset inspections and replacement, it does not mention A/C pipes. It does mention that companies are legally required to carry out adequate risk assessments of each supply system and submit this data to the Inspectorate (regulation 27 and 28) so that hazards are identified, and actions are put in place.

When searching the DWI website for asbestos cement pipes the current relevant document is entitled "*Asbestos Cement Drinking Water Pipes and Possible Health Risks Review for DWI*" [29]. We have some concerns with the report, not least it is from 2002 and on pages 3 & 4 quotes a statement from WHO from 1993, repeating the often used line that "*there is no consistent evidence that ingested asbestos is hazardous to health.....*". We consider that there is now such evidence from international sources to put doubt on this. It further goes on to use epidemiological studies from as far back as 1974, 1976 and so on. Indeed, the report

uses data twenty five times from 1970s and 1980s. Furthermore, the WHO updated its earlier report and there were significant changes to both tone and content which we consider later.

Finally, to the asbestos in drinking-water document for development of WHO Guidelines for drinking-water quality, which was published in 2021, this reviews and evaluates the effects on human health of the substances or contaminants of potential health concern in drinking-water, including asbestos [30]. Asbestos, as well as other possible contaminants, was considered, the document evaluating the risks to human health from exposure to asbestos in drinking-water was prepared. The document was peer reviewed and a revised draft was submitted for final evaluation at expert consultations.

Whilst it is difficult not to be too selective, there are some recommendations in the report that may be getting overlooked or misinterpreted. Starting from the position that A/C pipes in contact with drinking-water are considered the main exposure source of asbestos in drinking-water but *“the data on adverse effects following ingestion are less clear, the overall weight of evidence from available epidemiology and animal studies does not suggest an increased risk of cancer following ingestion of asbestos in drinking-water”*. That is far from saying that there is not a problem, or that asbestos in drinking water is safe.

The report continues advising *“however, in view of the uncertainties and limitations of the data, it is appropriate to minimise the concentrations of asbestos fibres in drinking-water as far as practical”*.

Where there are A/C pipes considering degradation, the *“release of fibres into drinking-water should be minimised by controlling water corrosivity or coating A/C pipes with suitable structural linings”*.

As these materials fail or deteriorate significantly, the *“A/C materials should be replaced with non-asbestos-containing materials.....no new sources of asbestos fibres in drinking-water should be introduced”*.

Whilst recognising that there is limited data available on occurrence of asbestos in drinking-water, *“investigative monitoring should be considered”*, to provide additional information on the contribution of older A/C pipes to monitor fibres in the water.

It does consider that airborne asbestos could be released from tap water in the home, showers and humidifiers – but dismisses risk as *“the fibres detected in water are of a shape and size that are considered to be of low risk via inhalation”*. However, it then says the evaluation by the International Agency for Research on Cancer (IARC), it was concluded that *“exposure to all forms of asbestos causes mesothelioma, and cancer of the lung, larynx and ovary”* which seems contradictory.

In considering many other studies, including the lighthouse keepers, regularly using phrases like *“evidence was insufficient to evaluate cancer risk”* but, as previously mentioned, that is not saying that it is safe or a reassurance that there will be no harm. We have also considered the early days of asbestos use in the UK and the asbestos industries approach at the time compared to people’s current knowledge of the risks to health from asbestos.

Section seven of the report is Practical Considerations.

- In line with WHO’s position that all types of asbestos should no longer be used, to most efficiently eliminate asbestos-related disease, sources of asbestos fibres in drinking-water, such as A/C pipes and storage containers, should not be newly installed, particularly since suitable alternative materials are available.
- Where existing A/C pipes are still in active use, as part of water safety plans, suppliers should map and record their location, assess their condition (including related to water aggressiveness) and determine the most appropriate risk reduction strategies. As a precautionary measure, plans should be developed to replace A/C pipes when they fail

or deteriorate significantly. For water systems with existing A/C pipes, it is important to ensure that the water is not aggressive (i.e. dissolves the cement component) and provide pH and alkalinity or other adjustments to control corrosivity and prevent release of fibres. However, where pipes are already degraded, these actions will not prevent the release of asbestos fibres. It may also be of benefit to consider coating the interior of A/C pipes.

- Since the main cause of contamination of tap water with asbestos fibres is erosion and peeling of the inner wall of the A/C pipes, it is important to control erosion of the pipe.

Finally in conclusion reiterating they do not intend deriving a guideline value they do say – “...in view of the uncertainties and limitations of the data, it is appropriate to try to minimise the concentrations of asbestos fibres in drinking-water as far as practical”. Also, regarding the limited data available on occurrence of asbestos in drinking-water, “it would be useful to conduct investigative monitoring to obtain further information on the contribution of older A/C pipes to fibre numbers, types, size and shape in drinking-water”.

Conclusions:

Clean, fresh water is vital to people’s welfare, its provision is paramount and essential for well-being. The transportation of drinking water is crucial and investment in the UK distribution networks may need to increase to remove the threat of asbestos cement pipes that are used in parts of the network.

- There is a need for further in-depth clinical studies on ingested asbestos.
- There is a need for investigation of UK water pipes that would provide valuable information on the current status, sources, and impacts of asbestos in drinking water systems to end-users and consumers. Such an investigation would identify the best practices and technologies for detecting and the management of asbestos in water pipes and benefit public health, environmental protection, and water quality management.
- Although A/C pipes are not in premises they do become the workplace for some workers and as such should come under asbestos legislation. We would like to see an inventory of A/C pipes in the UK and an assessment of their condition, along with a planned inspection routine.
- The DWI should revisit the updated science on cancers risk from ingestion of asbestos, rather than, it may be suggested, a review of dated studies.
- The UK should be proactive and introduce similar standard measurement method of fibres in drinking water similar to guidelines in the USA.
- There should be regular measurements of asbestos levels in drinking water by all UK suppliers.
- There should be a high priority to replace A/C pipes before any collapse, don’t wait for the damage.
- The UK should establish an Asbestos Eradication Agency as has been done in Australia.

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