



"Speaking up for Cranleigh"

HEALTH AND SAFETY RISK ASSESSMENT

Nonpulmonary asbestos risk in Cranleigh, Surrey

Report prepared by Cranleigh Civic Society, January 2017

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Following contact with the Health and Safety Executive "Concerns and Advisory Team" in October 2016, this report is based on a desktop review of existing data in the public domain and it has been carried out to assess if there is any disease risk to Cranleigh residents being supplied drinking water from ageing asbestos cement pipes. The report has been compiled to send to the Government's [Drinking Water Inspectorate](#) and [Waverley Borough Council](#) for their action. The Drinking Water Inspectorate (DWI) was formed in 1990 to provide independent reassurance that water supplies in England and Wales are safe and drinking water quality is acceptable to consumers.

1. SUMMARY

1.1 Almost 30% of the drinking water supply pipes in Cranleigh are made from asbestos cement (AC), compared to a reported average of 2% throughout the rest of the Thames Water Region⁽¹⁾. The pipes are between 50 and 70 years old, and installed in the 50s and 60s following the 1944 Rural Water Act when Cranleigh was a small village. Due predominantly to ageing, the pipes frequently burst now, increasing the potential risk of free asbestos fibres entering the drinking water supply. Also, evidence shows that drinking water pipes over 20 years old degrade internally over time through water friction, and due to low pH and low soil alkalinity, releasing free asbestos fibres into the drinking water supply^{(1) (2) (16)}.

1.2 Reports in the 1980s, sponsored in part by the asbestos industry, claimed that there was little evidence to show disease risk from asbestos ingestion, though pulmonary risk was well accepted⁽³⁾. (Pulmonary means “of or relating to the lungs”, and in this case asbestos diseases are caused by breathing in asbestos fibres.) In 1996, the World Health Organisation (WHO) also reported that there was little evidence to show disease risk from ingestion⁽⁴⁾, and this was updated in a more comprehensive report in 2003.

1.3 Current UK Government advice to Water Companies in the UK, through the Drinking Water Inspectorate, is that there is no risk to public health through asbestos fibre ingestion⁽¹⁾. This advice was based on the 2003 WHO report⁽⁴⁾.

1.4 However, an updated wide-ranging report published in the USA in 2011⁽⁵⁾ found, from new independent research carried out since 2003, “*a strong association between asbestos exposure and peritoneal neoplasms*” (abnormal tissue growth around the uterus, rectum and bladder usually forming a tumour). The report states that “*The most likely route of exposure for gastrointestinal tract (GIT) disorders due to ingested asbestos is in contaminated drinking water. Exposure from pipelines containing crysotile asbestos is the most obvious source for exposure.*” This challenges the 2003 WHO guidelines on which current Drinking Water Inspectorate recommendations are based. The 2011 report stated “*Stomach cancer is the most consistently reported (nonpulmonary) outcome of GIT-related pathologies related to asbestos exposure*”. The report concluded that much of the previous data on nonpulmonary asbestos risk inconclusive, and that more fundamental research needs to be carried out.

1.5 The latest (2014) advice from the World Health Organisation has replaced their 2003 conclusion that there is no proven risk from nonpulmonary exposure, and WHO now states that “*there is no evidence for a threshold for the carcinogenic effect of asbestos*”⁽⁹⁾. Since 1987 when the USA Woodstock report was published⁽¹³⁾, there has been growing unease about the risk of ingesting asbestos from drinking water from AC pipes, and Cranleigh Civic Society’s view is that the Drinking Water Inspectorate’s advice to water utilities in the UK should be urgently reassessed and updated.

2. ASBESTOS

2.1 There are 6 types of asbestos used in construction and civil engineering. Five are in the amphibole group of inosilicates:- “brown” amosite, “blue” crocidolite, tremolite, actinolite and anthophyllite. The sixth is in the serpentine group of phyllosilicates. Called “white” chrysotile asbestos, it is a soft fibrous silicate material and it is the one used in AC pipe production as its fibres have good tensile strength (though up to 5% of the other types could typically be incorporated into AC pipes). All concrete products are strong in compression and weak in tension and so, like steel reinforcement in concrete, chrysotile fibres provide tensile strength to the asbestos cement pipes. The chemical formula for chrysotile asbestos is $Mg_3(Si_2O_5)(OH)_4$.

3. FIBRE SIZES

3.1 The size of asbestos fibres has a direct relationship with the risk of developing asbestos diseases, and it is generally accepted that a length $> 8\mu m$ and diameter $< 1.5\mu m$ are critical in asbestos based gastrointestinal track disorders⁽⁶⁾. A report produced for the Drinking Water Inspectorate in 2002 stated that “*asbestos fibres in AC pipes were thick and quite different to the shape and structure of fibres considered to be of high risk of inhalation*”.⁽⁶⁾ However, this desktop study has been unable to find any evidence for this, and one of the authors of this report has personal knowledge that fibre sizes were not screened in either of two of the main AC pipe manufacturing plants in the UK (Eternit and Cape). Furthermore, in Cranleigh Civic Society’s opinion, it is difficult to envisage how, in a large manufacturing plant, such microscopic fibres could be industrially sieved by size and diverted to alternative asbestos cement production, when even the fine media in domestic water filters (see section 10 cannot remove the fibres).

4. ASBESTOS CEMENT PIPES

4.1 AC pipes for supplying drinking water were developed in the 1920s as an alternative to cast iron pipes which were subject to metallic corrosion. The AC pipes in the Cranleigh area were installed in the 50s and 60s when the village was being expanded, as was the case in other UK rural areas at that time. Growing evidence of pulmonary risk in asbestos manufacturing plants and the introduction of durable plastics based pipes led to asbestos cement pipes being phased out and UK production finally ceased in 1987.

4.2 The design of AC pipes is simply a dense cement based mix reinforced with asbestos fibres, and typically the asbestos accounts for 11% by weight. Over time, the pipes deteriorate with age, making them vulnerable to bursting, and the inner surface is abraded away by water flow (friction), exposing free fibres which then migrate into the water supply. Attempts were made in the 1980s to line the pipes with a variety of materials, bitumen, thin plastic, epoxy resin and dense cementitious mortar are examples, but without much success and lining was abandoned.

4.3 AC pipes for UK installation were predominantly made by three companies Eternit, Cape and Turner and Newall. Growing public awareness of pulmonary risk and the introduction of uPVC pipes commercially forced all chrysotile asbestos production to cease in the UK in 1987, and the UK Government finally prohibited all UK asbestos production in 1999.

5. DETERIORATION IN AC PIPES

5.1 In 1984, the Government asked the then Water Research Centre to investigate and report on the deterioration of AC mains in the UK⁽¹⁾. At that time, the pipes in Cranleigh were 12 to 35 years old, and now they are up to 70 years old, but the authors published a formula in the report to attempt to predict burst failure rate:

$$F = 0.00697A + 0.122 \text{ for class B pipes}$$

$$F = 0.00217A + 0.00225 \text{ for class C pipe}$$

where F = failure rate failures/km yr

A = age years

Note that class B pipes had thinner walls and after a new code of practice was issued in 1957, the industry made the walls thicker and called them “class C pipes”. The proportions of class B and class C pipes in Cranleigh is unknown. Note also that much of the research work carried out in the UK was on bitumen lined pipes⁽²⁾, and it is known from Thames Water and from visual inspections that AC pipes in the Cranleigh area are not bitumen lined, and it is reasonable to expect that they would have much shorter design life spans.

5.2 This 1984 report concluded “AC pipes may contribute to the numbers of asbestos fibres in the distribution system, and the aggressiveness of the water and the length and age of the pipes are contributory factors” and “It is known that low pH (< 7.5) and low alkalinity (< 75mg/l CaCO₂) waters are aggressive to AC pipes”. The Cranleigh area is close to the “chemically aggressive” region on Table 1.7 of the report in terms of both soft groundwater and soft conveyed water. Thames Water stated to Cranleigh Civic Society that 2015 tests showed the Cranleigh supply to have a mean hardness (total) as CaCO₃ of 66⁽¹⁷⁾, and tests on 28-Jan-17 by Cranleigh Civic Society using a pH meter⁽¹⁸⁾ gave a mean pH of 7.4. This demonstrates that the results in the 1984 report⁽¹⁾ are still valid, i.e. that the soft ground water and the soft drinking water in Cranleigh is aggressive to AC pipes. As Cranleigh is in an area of heavy Weald clay, this places compressive and tensile stresses on AC pipes during ground heave and shrinkage in summer months, causing weakened pipes to burst.

5.3 The 1984 report stated that “corrosion” failures in AC pipes had been recorded at only 20 years old, and that 8mm internal “wearing away” of the inner skin had already been recorded in AC pipes 40 years old. WHO call this loss “exfoliation”⁽⁴⁾⁽⁸⁾. The loss of 8mm exposes free asbestos fibres and allows them to then be released into the drinking water supply. The report (33 years ago) stated “It is therefore

estimated that approximately 50% of AC mains laid (in the UK) may be deteriorating". High levels of asbestos fibres in drinking water from degraded AC pipes have been recorded by WHO in the USA in their 2003 report⁽⁴⁾.

5.4 The two modes of failure of AC pipes are:

(i) Corrosion failures, exacerbated by low water alkalinity, especially <75 mg/l CaCO₃. The mode of failure is by loss of free calcium leaching into the water, breaking down density and strength of the "concrete" encasing the asbestos fibres.

(ii) Structural failures (the pipes cracking or breaking when weakened).

The two modes are linked of course, and as the pipe becomes progressively degraded by corrosion, it becomes brittle and loses structural adequacy.

Degradation of pipe walls can be measured by evaluating the ratio of calcium to silicone. Pipes eventually fail by either longitudinal fractures or ring fractures.

5.5 Epoxy resin, bitumastic and dense cementitious linings in AC pipes have been shown to be effective in prolonging the durability of new AC pipes, but at a meeting between Cranleigh Civic Society and Thames Water on 16-Dec-16, Thames Water stated that AC pipes in Cranleigh had not been lined (and Cranleigh Civic Society has witnessed this by inspecting exposed broken AC pipes in Cranleigh). Research into similar materials for re-lining existing pipes has been carried out, but no effective way had been found to reline long pipe runs in small diameter pipes⁽²⁾.

5.6 The 1984 report found that surge pressures in AC pipes increases failure rates. This is important to note because several new housing estates being built in Cranleigh could require an increase in flow to feed them, and current "doorstep" pressure expectation for new housing is 1 bar. Should pressure and flow increase in line with growing demand, the old AC pipes in Cranleigh will be under greater stress and pipe failure rate would inevitably increase, along with a greater risk of asbestos fibres being released into the drinking water supply.

5.7 Here is a list of AC pipe failures over a recent six-week period in Cranleigh recorded by Cranleigh Civic Society. It is not known if this is a complete list of failures. However, it demonstrates a high incidence of local drinking water pipe failure:

Barhatch Road	16-Sep-16
The Ridgeway	16-Sep-16
Bloxham Road	16-Sep-16
Wyphurst Road	16-Sep-16
Wanborough Lane	19-Sep-16
Bridge Cottages, Elmbridge Road	20-Oct-16
Horsham Road	20-Oct-16
6 Elmbridge Road	20-Oct-16
Horsham Road (end of Overford Drive)	20-Oct-16
The Common	30-Oct-16
High Street	30-Oct-16

6. UK LEGISLATION

6.1 The Control of Asbestos Regulations 2012 seeks to minimise risk from asbestos by telling people to “*Prevent exposure to the fibre or, where not possible, make sure it is kept as low as reasonably practicable.*”

6.2 Under the Control of Substances Hazardous to Health 2002 (COSHH) regulations, employers have a legal duty to provide adequate control of employees’ exposure to harmful substances in the workplace.

6.3 Existing UK legislation is directed towards pulmonary risk. Nonpulmonary risk by ingestion of asbestos fibres through drinking water has only recently been studied.

7. EPIDEMIOLOGICAL EVIDENCE

7.1 The United Kingdom has one of the highest rates of mesothelioma in the world, largely because the UK government permitted the use of asbestos long after many other countries outlawed the mineral’s use. All types of asbestos are considered to be genotoxic carcinogens⁽⁸⁾.

7.2 Pulmonary carcinogenic risks from asbestos are well known, and since production ceased in the 1980s, very little new work has been done to research what was felt to be a well-documented subject. But much of the library of “research reports” produced in the 70s and 80s were sponsored by the asbestos industry, and must be studied in conjunction with data emanating from independent sources. Even as recently as in November 2011, the international Crysotile Institute (the trade association for asbestos producers and users) published a contentious statement in their newsletter, in response to the WHO Global Plan of Action on Worker’s Health 2008-2017, “*Many scientists indicate that when properly used under controlled conditions, chrysotile asbestos in its modern day high-density applications does not present risks of any significance to public and/or worker health.*”⁽⁷⁾

7.3 It is relatively recently that nonpulmonary risk has been studied⁽⁵⁾⁽⁸⁾⁽¹⁰⁾, because asbestos which has been in use for many years is starting to affect people in time-durability failing asbestos based products. Pre-1990 experiments (of which there are many) were carried out on laboratory rats and hamsters, by including asbestos as part of their diet and then analysing the animals to see if they had a higher incidence of disease compared to a control group not fed any asbestos. Recent studies⁽⁵⁾⁽⁸⁾⁽¹⁰⁾ have cast doubt on this old data, partly because test results on the digestion system in small rodents are difficult to extrapolate to humans, and partly because scientists accept that it can take 20 to 40 years to develop diseases from ingested asbestos and laboratory rodents only live for a maximum of 3 years.

7.4 A major study of animal testing research reports over 20 years (1967 to 1987) concluded that a further reason for ignoring data from tests on laboratory tests on rats and hamsters was that all the reports assumed that fibres would pass through the gastrointestinal wall by persorption of microparticles, yet there was no correlation

data available to link persorption rates between humans and laboratory rats and hamsters⁽⁴⁾.

8. IMPARTIALITY

8.1 Since asbestos disease risks started to emerge in the 1970s, the industry has been plagued with lobby groups⁽⁷⁾ trying to minimise publicity about health risks, and many of the 1970s and 1980s “research reports” need to be treated with a degree of caution where funded by the asbestos industry. Following a Yorkshire TV documentary “Alice, a fight for life” in 1982, the Government debated the role of the asbestos industry playing down the risks of asbestos exposure⁽¹⁵⁾. A BBC investigation in 2010 stated “*Banned or restricted in more than 50 countries, white asbestos continues to be widely used in China, India, Russia and Brazil, and many developing countries. The BBC’s Steve Bradshaw and Jim Morris from the ICIJ report on an industry supported by a **global network of lobby groups**. Critics say the groups’ strategy is one borrowed from the tobacco industry: create doubt, contest litigation, and delay regulation. Some industry-funded researchers have published hundreds of scientific papers saying that chrysotile can be used safely.*” (<http://www.bbc.co.uk/news/world-10623725>)

8.2 In response to growing concerns in WHO publications, the Crysotile Institute stated in 2011 “*When properly controlled and used, chrysotile asbestos in its modern day high density applications does not present risks of any significance to public or worker health*”⁽⁷⁾. In March 2016, the impartiality of some of the UK’s leading asbestos “experts” responsible for reports playing down asbestos risks in the UK was brought into question by Hazards Magazine (a leading independent UK health and safety publication).

8.3 Cranleigh Civic Society is of the opinion that nonpulmonary research reports from independent organisations like the World Health Organisation⁽¹²⁾ and the USA Journal of Toxicology and Environmental Health should be given primary consideration by the Drinking Water Inspectorate in assessing UK nonpulmonary disease risk from drinking water supplied through old asbestos cement pipes, and that the current DWI advice on the public safety of old AC pipes is outdated and flawed.

9. WORLD HEALTH ORGANISATION (WHO) ADVICE

9.1 Current Drinking Water Inspectorate (DWI) policy on the risk to the UK population from drinking water delivered through old AC pipes is that there is no proven risk from ingesting asbestos fibres (referred to in this report as nonpulmonary risk). This policy is quoted by the DWI as having been assessed from a WHO report issued in 1996 and updated in 2003⁽⁴⁾ which stated that there was no substantive evidence linking asbestos to nonpulmonary disease.

9.2 In their next major update of that report, in 2014⁽⁹⁾, for the first time WHO included AC drinking water pipes as a source of risk. This updated report has

removed the earlier comments on lack of evidence of ingestion risk and now states *“Bearing in mind that there is no evidence for a threshold for the carcinogenic effects of asbestos, including chrysotile, and that increased cancer risks have been observed in populations exposed to very low levels, the most efficient way to eliminate asbestos-related diseases is to stop using all types of asbestos”*. *“.....water pipes become damaged and release asbestos fibres into the environment.....concerns extend to the degradation of building materials”*.

9.3 WHO states *“This publication will be of interest to all government officials who need to make informed decisions about management of the health risks associated with exposure to chrysotile asbestos”*.

10. STATEMENT BY BRITA FILTERS

10.1 On 28-Apr-16, the water filtration company BRITA GmbH issued a statement⁽¹⁶⁾ to consumers as follows, *“In some drinking water distribution networks there are pipes that are coated with a mixture of asbestos and cement. This type of coating was used in the past. Today we know that the lining can loosen after several decades, especially if the water that flows through the pipes is corrosive. This means that asbestos fibres can enter the drinking water. As BRITA water filters are not determined to remove asbestos fibres reliably from water, we advise you to contact your waterworks and discuss possible solutions (e.g. replacing the water pipes or new inner linings), if you suspect that your distribution network uses asbestos pipes.”* BRITA Ltd (the UK subsidiary) confirmed to the Cranleigh Civic Society on 25-Jan-17 that this remains their company’s current advice.

10.2 This advice from BRITA may cause a high degree of concern to residents in the Cranleigh area who may assume that buying a home water filter system such as those sold by BRITA would remove dangerous asbestos fibres (> 8µm and diameter < 1.5µm) from their incoming drinking water supply.

11. CONCLUSIONS

11.1 Cranleigh Civic Society’s **RISK ASSESSMENT** conclusions are:

- There is sufficient recent independent evidence to indicate that there could be an increased risk of nonpulmonary disease from drinking water supplied through Cranleigh’s ageing (50 to 70 years old) asbestos cement pipes, and that the Drinking Water Inspectorate should immediately undertake independent research to assess the extent of this risk and update their policy guidelines accordingly to water authorities, as has been done in the USA where there are now specific limits set for asbestos fibres in drinking water supplies by the US Environmental Protection Agency in the Safe Water Drinking Act 1974 (as amended).
- A timely development plan should be put in place to remove and replace all AC drinking water supply pipework with plastic pipe, in order to reduce risk to residents.

- Any proposed increase in flow and pressure through the existing AC pipework infrastructure to facilitate new development in the Cranleigh area should be immediately assessed by the Waverley Borough Council to ensure that it will not contravene paragraphs 109 and 120 in the NPPF through increased release of free asbestos fibres into the drinking water supply infrastructure.

12. REFERENCES:

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17. 2015 Thames Water, Drinking Water Quality Report_Z0163_Cranleigh.pdf
18. pH tests in Cranleigh, 28-Jan-17.pdf

These reports have been sent in full to the Drinking Water Inspectorate, and they are available as PDF's from Cranleigh Civic Society upon request.

“Civic Societies can be provocative, stubborn, forceful, inspiring and outspoken on behalf of the places they care about. They are fiercely independent and grassroots organisations. They will celebrate and encourage positive action and be forthright in resisting damaging change.” Civic Voice, the UK national charity for the civic movement

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