

UV Treatment of the Hascombe Spring

Does ultraviolet disinfection change the water? A summary of the scientific evidence

Prepared for Hascombe Parish Council · September 2026

1. Summary

Some members of the public are concerned that treating the Hascombe Spring with ultraviolet (UV) light would alter the molecular structure of the water and take away its special qualities. This report tests that claim against the established science of how UV disinfection works and how liquid water behaves.

Conclusion: the claim is not supported by evidence. UV disinfection is a physical process that inactivates bacteria, viruses and parasites by damaging their genetic material. It adds nothing to the water, removes nothing from it, and does not change its minerals, pH, taste or smell. The water molecules themselves are not altered, and the idea that water holds a lasting “structure” that UV could disturb is contradicted by decades of measurement.

If anything, UV is the treatment option that best preserves the natural character of spring water, because the main alternative, chlorination, adds a chemical and can affect taste.

2. Why treatment is being considered

Natural springs are shallow groundwater emerging at the surface, which makes them vulnerable to contamination from soil, rainwater run-off and animal or human faecal matter. Water can look clear and taste good while still carrying harmful organisms such as *E. coli*, *Cryptosporidium* and *Giardia*, and a single clean test only shows the water was safe on the day it was sampled.

The Parish Council has publicly advised visitors that the Hascombe water is not tested. Until the water was turned off in April, visitors had nonetheless continued to collect the water regularly, some weekly, for drinking. The Drinking Water Inspectorate (DWI) identifies contamination by sewage or animal faeces as the greatest danger in drinking water, and says disinfection is needed where untreated water contains such organisms.

3. How UV disinfection works

A UV unit passes the water through a chamber containing a lamp enclosed in a quartz sleeve. The lamp, usually a low-pressure mercury lamp similar to a fluorescent tube, emits UV-C light at a wavelength of about 254 nanometres. As micro-organisms pass the lamp, the light damages their DNA or RNA so they can no longer reproduce or cause infection. Exposure lasts only seconds.

- **Nothing is added.** Unlike chlorine, there is no chemical dose and no residual taste.

- **Nothing is removed.** Minerals and other dissolved substances pass through unchanged. Inactivated microbes remain in the water but are harmless.
- **Effective against parasites.** UV works against Cryptosporidium, which chlorine does not reliably kill. The DWI recommends UV where a source is at risk from Cryptosporidium or Giardia.
- **Recognised as safe.** The DWI describes UV as a common method for disinfecting private supplies and notes the absence of any known by-products of significance to health.

4. Examining the claims

4.1 Does UV change the water molecule?

No. A water molecule (H_2O) is one oxygen atom bonded to two hydrogen atoms. To alter it, light would have to break one of those O–H bonds. Each photon of 254 nm UV carries about 4.9 electron-volts of energy, slightly less than the roughly 5.1 electron-volts needed to break the first O–H bond in water. More importantly, pure water absorbs very little light at this wavelength; its strong absorption begins further into the ultraviolet, below about 190 nm. The UV passes through the water largely untouched, which is exactly why it can reach and inactivate the micro-organisms suspended in it.

The water leaving the unit is chemically identical to the water entering it: the same molecules, the same dissolved minerals, the same pH.

4.2 Does UV change the water’s “structure”?

When people speak of water’s “structure” they usually mean the way neighbouring molecules loosely attach to one another through hydrogen bonds. This network is real, but it is not fixed. Detailed simulations and laser experiments show that hydrogen bonds in liquid water form, break and swap partners on a timescale of around a trillionth of a second (a picosecond). One study calculated a typical hydrogen-bond lifetime of about 0.78 picoseconds.

This has a simple consequence: no particular arrangement of water molecules can last. Every time the water warms or cools, flows through a pipe, splashes into a trough or is poured into a bottle, the network has already reorganised itself billions of times over. Even if UV exposure did briefly disturb the arrangement, and there is no evidence that it does in any meaningful way, the water would have “forgotten” it long before reaching the outlet. At the molecular level, untreated and treated spring water are indistinguishable.

4.3 “Structured water” and “water memory”

Claims that particular waters have a special, lasting molecular structure, a “crystalline” arrangement or a “memory” of their origin circulate widely, often in connection with products sold at a premium. These ideas are not accepted in physics or chemistry. Scientists who study water point out that any unusual arrangement in bulk water dissipates within picoseconds, and that it is not possible to obtain water with a lasting structure different from ordinary water.

Earlier experiments claiming to show water memory have not been reproduced under controlled conditions.

4.4 Is the spring water “hexagonal”?

Some people describe the Hascombe water as “hexagonal”, meaning that its molecules are supposedly arranged in stable six-sided rings that make it healthier, more easily absorbed or more “alive” than ordinary water, and that treatment would destroy this. The idea was popularised in the 2000s through the book *The Water Puzzle and the Hexagonal Key* by the Korean scientist Mu Shik Jhon, and has since been widely used to market water filters, ionisers and “structuring” devices. It is often mixed with the “fourth phase” or “EZ water” ideas of Gerald Pollack, sometimes described with the formula H_3O_2 . The claim does not survive scientific scrutiny, for five reasons:

- **Hexagons belong to ice, not liquid water.** Ordinary ice (known as ice Ih) genuinely is a hexagonal crystal, which is why snowflakes have six-fold symmetry. When ice melts, that rigid lattice is lost; that is precisely what makes the water a liquid. Any water, from any source, freezes into the same hexagonal ice.
- **Rings in liquid water last less than a trillionth of a second.** Small ring-shaped groupings of molecules do form momentarily in liquid water, but hydrogen bonds break and reform within femtoseconds to picoseconds. A hexagonal arrangement cannot persist from the spring to the bottle, let alone into the body at 37°C.
- **Measurements find no difference.** Laboratory analysis, including nuclear magnetic resonance spectroscopy, has reportedly found no significant difference between water sold as “hexagonal” and ordinary purified water.
- **The chemistry does not add up.** Chemists point out that bulk “ H_3O_2 ” water would require hydrogen gas to be given off or oxygen to be absorbed from the air, neither of which happens, and that the H_3O_2 structure has not been proposed in a peer-reviewed publication. Effects observed in very thin layers of water next to certain surfaces are not properties of water in a bottle or a glass.
- **No evidence of health benefits.** There is no controlled clinical evidence that drinking “hexagonal” or “structured” water has any effect on health. Well-known photographs of “beautiful” ice crystals from particular waters come from experiments that were not blinded or controlled, and they show only that water freezes into hexagonal ice.

In short, the Hascombe water is no more or less “hexagonal” than tap water, bottled water or rainwater. Because no lasting hexagonal structure exists, UV treatment cannot remove one.

4.5 What gives the spring water its character?

What people notice and value in spring water, its taste and freshness, comes from its dissolved minerals (such as calcium, magnesium and bicarbonate), its temperature, and the absence of chlorine. UV affects none of these. Of the disinfection methods available, it is the one that leaves the natural chemistry of the water intact.

4.6 Summary of claims and evidence

Claim	What the evidence shows
UV breaks or alters the H ₂ O molecule	Germicidal UV (254 nm) carries slightly less energy per photon than is needed to break an O–H bond, and pure water absorbs very little of it. The light passes through the water to reach the microbes, which is why the method works.
UV changes the water’s “structure”	The hydrogen-bond network in liquid water rearranges itself in around a trillionth of a second. No arrangement, from UV or anything else, persists long enough to survive the pipe, let alone the bottle.
Water holds a “memory” or special structure from its source	No reproducible evidence supports this, and it conflicts with the measured behaviour of liquid water.
UV removes the minerals that give the water its taste	UV adds and removes nothing. Dissolved minerals, pH, taste and odour are unaffected.
UV creates harmful chemicals	The Drinking Water Inspectorate notes no known by-products of significance to health. Nitrite formation is negligible with standard low-pressure lamps at disinfection doses.

5. Genuine limitations of UV

For balance, UV does have limitations, but none of them relate to the “structure” of the water:

- **No lasting protection.** UV disinfects only at the point of treatment. Water collected in dirty containers can be re-contaminated, so clear advice to users about clean bottles remains important.
- **Needs clear water.** Cloudiness, colour, iron or manganese can shield microbes from the light. The DWI advises pre-filtration to below 1 NTU turbidity where *Cryptosporidium* may be present, and manufacturers typically require UV transmittance above 90–95%.
- **Needs maintenance.** Lamp output falls to about 70% after 10–12 months even though the lamp still looks lit. Sleeves must be cleaned and lamps replaced on schedule.
- **Power or lamp failure.** If the lamp fails and flow is not stopped automatically, untreated water will pass through.

6. The legal requirement for wholesome water

Drinking water from supplies not provided by a water company is governed in England by the Private Water Supplies (England) Regulations 2016 (SI 2016/618). These define a “private supply” as any supply not provided directly by a water undertaker or licensee, covering everything from the point of abstraction to the point of use. The “relevant persons” responsible

for a supply include the owner and occupier of the land on which any part of it sits, and anyone who exercises management or control over it.

Regulation 4 (Wholesomeness) provides that water from a private supply is regarded as wholesome if:

- it does not contain any micro-organism, parasite or substance, alone or in combination, at a concentration or value that would constitute a potential danger to human health;
- it meets the concentrations or values set for each parameter in Part 1 of Schedule 1 (these include zero E. coli and zero enterococci per 100 ml); and
- its nitrate and nitrite levels satisfy the formula $[\text{nitrate}]/50 + [\text{nitrite}]/3 \leq 1$ (in mg/l).

Regulation 9 applies additional risk assessment and monitoring requirements to private supplies that provide 10 m³ or more per day on average, or that supply water “as part of a commercial or public activity”. Hascombe fountain is freely accessible to the public and falls within this category.

Section 77 of the Water Industry Act 1991 places a duty on local authorities, in this case Waverley Borough Council, to keep themselves informed about the wholesomeness and sufficiency of water supplies in their area, including private supplies.

The relevance for the Council is that wholesomeness is judged by the absence of harmful micro-organisms and the chemical standards in Schedule 1. UV treatment directly addresses the microbiological part of the legal test and does not affect the chemical parameters.

7. Conclusion

The concern that UV treatment would alter the molecular structure of the Hascombe Spring water and remove its special qualities is not supported by science. UV light at germicidal wavelengths passes through water without changing its molecules, dissolved minerals, taste or smell, and water does not retain any lasting structure that could be disturbed. What UV does change is the one thing that matters for safety: it inactivates the micro-organisms that can cause serious illness. Properly installed and maintained, it would let the spring remain the water people value, with the risk of infection greatly reduced.

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