Private Water Supplies

Colour
Guidance for Local Authorities

Description and Background

Colour is the term used to describe water that is tinted. True colour is dissolved in the water – it is not associated with suspended material, so the sample should be filtered prior to analysis for colour. Most water from surface sources in Scotland is naturally coloured to some extent – water from true boreholes is usually not coloured (any colour would indicate a link to the surface and, probably, therefore a high risk of faecal contamination. Colour is derived from a wide range of compounds, mainly naturally occurring organic acids that originate from peaty soils. Humic and Fulvic acids are common components, but the proportion of the many colour causing compounds will vary from location.

Colour is measured in degrees Hazen, or (more properly) mg/l Pt/Co (meaning it is measured using a platinum cobalt electrode). Colour is relatively easy to measure using a hand-held probe, although remember that an accurate measurement of true colour requires the sample to be filtered; this is probably unnecessary for an on-site measurement for a PWS. The regulatory standard for colour is 20 mg/l Pt/Co – at the PCV a glass of water will have a slight tint; the colour will be more obvious when seen in volume in sanitary ware – for example it may appear noticeably straw coloured in bath tubs. The visual appearance may not bother PWS owners in the slightest!

Health Significance

The range of compounds that cause colour are of no direct health significance. Where colour does become an issue is where the primary disinfection process is via UV. Colour is indicative of organic compounds in the water that absorb UV radiation – the presence of colour can therefore indicate that UV treatment may not be providing an effective disinfection process and rendering the users at risk of illness. Note that UV adsorption is not directly related to the colour itself – waters can have quite low UV transmittance (UVT) and yet not be very coloured. An accurate measurement of how effective UV is likely to be in a particular water can only be obtained by measuring UVT (for which portable monitors are available). However, if the water is coloured this usually indicates UVT will be low.

Risk Assessment and Monitoring

Colour is likely to be present in most surface water sources from upland areas, therefore the risk of low transmissivity impacting upon UV disinfection processes should be considered as a possibility in all such supplies. Where chlorine disinfection takes place, the risk of trihalomethanes and other disinfection by-products should be considered. Colour is a regulatory parameter, and therefore part of testing schedule. The 2017 Regulations require colour to be tested as part of the annual sampling suite

for all regulated PWS. Having said this, UVT and total organic carbon (TOC) or dissolved organic carbon (DOC) are more useful measurements to determine the impact of organic matter on disinfection processes.

What if it fails?

A colour failure in itself is not cause for concern if it is not an aesthetic issue for the owner. However, if the water fails for colour and UV treatment is present, the UVT is likely to be too low for normally powered UV (30/40 mJ/cm^2) to be effective as a disinfectant. If this is the case you may require the owner / user to install treatment to remove the organic compounds in the water. Similarly, a colour failure on a chlorinated system may indicate that THM precursor compounds are likely to be present and trigger further monitoring for THMs.

Regulation 22 of the 2017 Regulations states that action in respect of a failure of the Table C parameters, (which includes colour), need only be taken if it is determined that the failure poses a risk to human health. This means that, provided the supply user is content, no action need be taken unless there is an adverse impact on disinfection.

Check the following:

- Remember that, even if a PWS passes for colour at the time it is sampled, this may not consistently be the case. After heavy rainfall in particular, the supply may well be highly coloured and therefore present an unacceptable challenge to UV. This potential needs to be explored in the risk assessment.

Options for resolving at source

- Examine the source(s) carefully – it may be that measures can be taken to block off or modify a specific source or tributary that is highly coloured;
- Scottish Water is using peatland restoration in order to reduce the amount of colour washing into sources – although this is on a larger scale. This could be tried on a smaller scale for PWS sources, for example by stabilising eroded peat through planting, rewetting or other means, but this is likely to be a longer term measure and not provide the certainty that is needed to ensure disinfection is consistently effective.
- Good intake design for river sources may have some limited effect to improve things, but this won't have much effect on true, dissolved, colour.

Treatment

Treatment processes for colour are available, but it is a difficult parameter to reliably remove and finding an effective process may take some trial and error. Treatment options include:

- **Carbon**
  Carbon is probably the simplest means of removing the organic compounds that cause colour. This is most commonly in the form of granular activated carbon (GAC) which is often used in filters as a loose, black granular medium. Other forms of carbon are also seen, such as impregnating other filter materials such as cloth, fibre and cellulose. Carbon works due to its large surface area and microscopic pores providing sites to which organic compounds can adsorb

and be removed from the water. As these sites become occupied, the carbon will become exhausted. Although carbon filters may be effective at first, their efficacy may deteriorate fairly quickly where organic compounds are present in large concentrations. Consequently, carbon filters need to be sized correctly and replaced regularly – the assessment of the correct sizing and frequency can prove very tricky where colour levels vary rapidly.

- **Ion Exchange**

  Ion exchange resins for removal of organic compounds are available and are sometimes known as organic scavengers. These remove the compounds from the water and in the process, replace them with an inert anion, such as chloride. Periodically the resin will become exhausted and require regeneration with a substance such as brine or caustic soda. Provided the regeneration chemical is kept topped up, the process is usually controlled automatically with minimal input from the user.

  A wide range of resins are available – different resins suit organics with different characteristics, hence some careful investigation is needed in order to optimise the process for a particular water. This is probably the origin of the perception that organic scavengers do not work or are unreliable – a resin that has not been matched to the particular organic fraction in a water is unlikely to be effective.