The observed colour of water is the result of light backscattered upward from a water body after it has passed through the water to various depths and undergone selective absorption. The colour of light (i.e., wavelength) and the turbidity of water determine the depth to which light will penetrate in water systems. In pure water, light is highly absorbed in the infrared region of the light spectrum and poorly absorbed in the blue region. Thus, blue light is refracted, reflected, and/or re-emitted back, causing the visible colour of the water to be blue (Jerome et al. 1994a, 1994b).

The colour of water may be characterized as true or apparent. True colour depends on the dissolved fraction of water, which can include natural minerals such as ferric hydroxide and dissolved organic substances such as humic or fulvic acids (Hongve and Akesson 1996). Dyes (e.g., acid blue toilet flush), wood preservatives, antisapstains, and various other dissolved organic substances from anthropogenic sources can also contribute to water colouration (McCrum 1984; Brown 1987; Borgerding and Hites 1994). Organic compounds such as humic acids selectively absorb UV blue and green wavelengths and, to a lesser degree, the red and infrared region of the light spectrum. Colour also depends on factors that affect the solubility and stability of the dissolved and particulate fractions of water such as pH and temperature.

True colour can be measured by comparator and calorimetric methods. Comparator methods rely on visual comparison of a water sample to a standard colour solution, usually containing platinum (Pt) and cobalt (Co) chloride salts, or to a set of coloured filter disks. Calorimetric methods are based on the calibration of absorbance of the water sample at various single wavelengths, usually against the Pt-Co standard (Bennett and Drikas 1993; Hongve and Akesson 1996). Natural waters range from $<5\ mg{\cdot}L^{-1}$ Pt in very clear waters to $1200\ mg{\cdot}L^{-1}$ Pt in dark, peaty waters (Kullberg 1992).

Apparent colour of water is a function of dissolved and suspended material, such as organic plant debris, phyto- and zooplankton, and inorganic suspended sediments (Effler and Auer 1987; APHA 1992; Bennett and Drikas 1993). For example, a blue-green water colour may be due to blue-green algal blooms, a yellow-brown colour to diatoms or dinoflagellates, and red and purple colours to *Daphnia* sp. or copepods (Chapman 1992). As these organisms thrive on some anthropogenic releases or disturbances (e.g., fertilizers and forest activities), polluted waters may have a strong apparent colour. In addition, land use activities such as logging may affect apparent colour by increasing turbidty (Bilby and Bisson 1992). Apparent colour is commonly estimated by light transmittance through water, as measured by Secchi disk depth.

Water Quality Guideline Derivation

The Canadian water quality guideline for colour for the protection of livestock watering was adopted from the ambient water quality criteria for colour in British Columbia (Moore et al. 1997).

Livestock Water

The few toxicity studies on colouring agents such as humic and fulvic acids indicate that organic colouring agents are not toxic at the levels that could occur in human drinking water. For example, male rats supplied with soil fulvic acid for up to 90 d at levels of 10, 100, and $1000\ mg{\cdot}L^{-1}$ showed no significant changes in body weight, intake rates, organ/body weight ratios, or tissue histology (Health Canada 1996). Little information is available on the toxicities of metals and their humate complexes (Health Canada 1996).

Livestock, especially cattle, are not very sensitive to, or influenced by, the colour of the water they consume. If the water were to have a toxic effect on livestock, it would result from other physical, biological, and/or chemical parameters in the water. Existing guidelines for these parameters should protect livestock from being harmed. Livestock producers, however, will find coloured water suspect and may object to supplying it to their livestock. Most producers will have the same water colour standards for themselves as for their livestock. Therefore, the guideline value for livestock, $15\ mg{\cdot}L^{-1}$ Pt, is the same as that for drinking water. This value is based on human aesthetic considerations (Health Canada 1996).

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