

| Unit                                     | Range or boundary values for suitability as drinking water for animals | Comments and remarks (possible disturbances)                           | Limits for drinking water according to human regulations (Germany)                            |
|--|--|--|---|
| Physicochemical characteristics          |  |  |   |
| pH <sup>e</sup>                          | > 5 < 9  | Corrosion of water pipes   | 6.5–9.5   |
| Electrical conductivity                  | μS cm <sup>-1</sup>  | < 3000<br>Higher values may be associated with diarrhea, reduced taste | 2500  |
| Soluble salts; total                     | g L <sup>-1</sup>  | < 2.5  |   |
| Oxidable                                 | mg L <sup>-1</sup>   | < 15   | Measurement for oxidation potential in water  |
| Chemical substances                      |  |  |   |
| Ammonia (NH <sub>4</sub> <sup>+</sup> )  | mg L <sup>-1</sup>   | < 3  | Indication of impurities  |
| Arsenic (As)                             | mg L <sup>-1</sup>   | < 0.05   | Health disturbances, reduced yields   |
| Lead (Pb)                                | mg L <sup>-1</sup>   | < 0.1  | Avoidance of residues   |
| Cadmium (Cd)                             | mg L <sup>-1</sup>   | < 0.02   | Avoidance of residues   |
| Calcium (Ca) <sup>g</sup>                | mg L <sup>-1</sup>   | 500  | Lime scale in pipelines, technical malfunctions   |
| Chlorine (Cl <sup>-</sup> )              | mg L <sup>-1</sup>   | < 250 <sup>a</sup><br>< 500 <sup>b</sup>                               | Indication of contamination (e.g., faeces), wet excreta <sup>a</sup>                          |
| Iron (Fe) <sup>g</sup>                   | mg L <sup>-1</sup>   | < 3  | Palatability influenced, technical malfunctions, biofilms, antagonist to other trace elements |
| Fluorine (F)                             | mg L <sup>-1</sup>   | < 1.5  | Disturbances of teeth and bones   |
| Potassium (K)                            | mg L <sup>-1</sup>   | < 250 <sup>a</sup><br>< 500 <sup>b</sup>                               | see chlorine <sup>a</sup>   |
| Copper (Cu) <sup>h</sup>                 | mg L <sup>-1</sup>   | < 2  | Consider total intake of sheep and calves   |
| Manganese (Mn)                           | mg L <sup>-1</sup>   | < 4  | Precipitation in water distribution system, biofilms possible                                 |
| Sodium (Na)                              | mg L <sup>-1</sup>   | < 250 <sup>a</sup><br>< 500 <sup>b</sup>                               | see chlorine <sup>a</sup>   |
| Nitrate (NO <sub>3</sub> <sup>-</sup> )  | mg L <sup>-1</sup>   | < 300 <sup>c</sup><br>< 200 <sup>d</sup>                               | Methemoglobinemia possible, consider total NO <sub>2</sub> and NO <sub>3</sub> intake         |
| Nitrite (NO <sub>2</sub> <sup>-</sup> )  | mg L <sup>-1</sup>   | < 30   |   |
| Mercury (Hg)                             | mg L <sup>-1</sup>   | < 0.003  | General disturbances, intoxications   |
| Sulfate (SO <sub>4</sub> <sup>2-</sup> ) | mg L <sup>-1</sup>   | < 500  | Diarrhea  |
| Zinc (Zn) <sup>i</sup>                   | mg L <sup>-1</sup>   | < 5  | Mucous membrane alterations   |
|  |  |  | Presently no limit  |

<sup>a</sup> Poultry. <sup>b</sup> Further animal species. <sup>c</sup> Ruminants. <sup>d</sup> Calves and other animals. <sup>e</sup> pH < 5: acid and possible corrosive; addition of organic acids may decrease pH. <sup>f</sup> Parameter for organic substances in water (< 5 mg L<sup>-1</sup> for added water). <sup>g</sup> Deposits in pipelines and drinking bowls. <sup>h</sup> Recommendations difficult for sheep and milk replacers for calves (use milk replacers low in copper). <sup>i</sup> Recommendations for milk replacer for calves.