Turbidity – WHAT DO YOUR RESULTS MEAN?

A change in turbidity has an impact on the aquatic as well as human domestic use of water. In turbid water, light penetration is reduced, leading to a decrease in photosynthesis. This then reduces the amount of food available for water life. Turbid water may also have an effect on filtration – i.e unable to use ultra violet as a stand-alone system without proper dissolved sediment filtration, pre ultra violet. Turbid water also results in a decrease in temperature, which will affect those organisms that are sensitive to temperature changes. The South African water quality guidelines for domestic use are tabulated in table 5 below;

Table 5; South African water quality guidelines for domestic use according to TURBIDITY – Volume 1; Domestic use

TURBIDITY RANGE NTU	EFFECT ON AESTHETICS AND HUMAN HEALTH
0 - 1	No turbidity visible. No unfavourable aesthetic effects regarding appearance, taste or colour. No unfavourable health effects.
1 -5	No turbidity visible. A slight chance of negative aesthetic effects and infectious disease transmission exists.
5-10	Turbidity is visible and may be objectionable to users at levels above 5 NTU. Some chance of transmission of disease by microorganisms such as viruses and parasites.
➢ 10	Severe aesthetic effects, in terms of appearance, taste and odour occur. Water carries a risk of disease due to infectious microorganisms and chemicals attached to water silt. A chance of disease transmission at these levels, >10 NTU, exists at high turbidity.

Turbidity in water is caused by suspended particles, or colloidal matter that obstructs light transmission through the water. It may be caused by inorganic or organic matter or a combination of the two. Microorganisms (bacteria, viruses and protozoa) are typically attached to particulates, and removal of turbidity by filtration will significantly reduce microbial contamination in treated water. Turbidity in some groundwater sources is a consequence of inert clay or chalk particles or the precipitation of non-soluble reduced iron and other oxides when water is pumped from anaerobic waters, whereas turbidity in surface waters may be the result of particulate matter of many types and is more likely to include attached microorganisms that are a threat to health.

Turbidity in distribution systems can occur as a result of the disturbance of sediments and biofilms but is also from the ingress of dirty water from outside the system.
In addition, turbidity can seriously interfere with the efficiency of disinfection by providing protection for organisms, and much of water treatment is directed at removal of particulate matter before disinfection. This not only will increase the efficacy of disinfection by chemical disinfectants such as chlorine and ozone, but is an essential step in ensuring the effectiveness of physical disinfection processes such as ultraviolet irradiation, because light transmission through water is impaired by particulates.

Removal of particulate matter by coagulation and sedimentation and by filtration is an important barrier in achieving safe drinking-water. Achieving low turbidity by filtration (before disinfection) of water from surface sources and ground waters where raised turbidity occurs—for instance, where these are under the influence of surface waters—is strongly recommended to ensure microbially safe water.

Turbidity can also have a negative impact on consumer acceptability of water as a result of visible cloudiness. Although turbidity per se (e.g. from groundwater minerals or from post-precipitation of calcium carbonate from lime treatment) is not necessarily a threat to health, it is an important indicator of the possible presence of contaminants that would be of concern for health, especially from inadequately treated or unfiltered surface water. Data are emerging that show an increasing risk of gastro intestinal infections that correlates with high turbidity and turbidity events in distribution.
This may be because turbidity is acting as an indicator of possible sources of microbial contamination. Therefore, turbidity events should be investigated and the causes corrected, whereas turbidity

should be minimized as far as is possible within the constraints of the type of system and the resources available as one part of the management of distribution to achieve water safety. Turbidity is also an important consideration when investment decisions are made regarding sources and treatment for water supplies and should be identified in the water safety plan as a hazard that needs to be controlled.

Turbidity is measured by nephelometric turbidity units (NTU) and can be initially noticed by the naked eye above approximately 4.0 NTU. However, to ensure effectiveness of disinfection, turbidity should be no more than 1 NTU and preferably much lower. Large, well-run municipal supplies should be able to achieve less than 0.5 NTU before disinfection at all times and should be able to average 0.2 NTU or less.

Surface water (and groundwater under the influence of surface water) treatment systems that achieve less than 0.3 NTU prior to disinfection will have demonstrated that they have significant barriers against pathogens that adsorb to particulate matter. Of particular importance is the fact that this will be a good indicator that they are removing chlorine-resistant pathogens such as *Cryptosporidium*.

Small water supplies where resources are very limited and where there is limited or no treatment may not be able to achieve such low levels of turbidity. In these cases, the aim should be to produce water that has turbidity of at least less than 5 NTU and, if at all possible, below 1 NTU. For many of these small and usually rural supplies, measuring turbidity below 5 NTU may present a significant cost challenge, and thus providing low-cost measuring systems that can measure lower turbidities is an important requirement.

Occasionally, turbidity can be caused by minute air bubbles released when water has a high dissolved air content. Such turbidity clears rapidly upwards through the surface but can cause concern for consumers, and efforts should be made to manage distribution systems to ensure that this does not happen.