Reuse of Treated ETP Water:

There are a range of known requirements in terms of water quality for various industry end uses and requirements are specific to each industrial process and different end uses will require different levels of treatment for recycled water. For example, where end uses have the potential for human contact (washing operations) or generation of aerosols (cooling towers) control of pathogenic micro-organisms is particularly important. Alternatively, control measures to reduce human exposure and contact may be a more cost-effective option.

The quality of recycled water is dependent on wastewater sources and level of treatment. The present of organic constituents and suspended impurities remains in treated effluent, Suez and water from Multiple evaporator is culprit and gives critically negative impact on utility operation such as cooling tower and boiler. No doubt in organic impurities in treated impurities are somehow controllable and manageable through water treatment equipments and chemicals but the presence of organic constitutes and suspended impurities are dangerous for any heat transfer machineries.

Its observed that to meet environment controlling para metres industries are dumping their poorly treated waste water in to the utilities such as cooling tower and boilers. This short cut or time being solution is dangerous and industries losses huge energy and equipment failures.

Right amount of particular treatment is over sited or ignore or not practical in terms of costing of costly chemicals treatment. Industries should avoid poorly treated effluent/ Suez water in to the utilities unless proper command and control is establish.

Below are the factors / problems accused or multiples because of usage of poorly treated effluent or Suez water.

Microbiological

The microbiological content of recycled water used in industry can impact on human health, or on the industrial process through bio corrosion and biofouling mechanisms. The concentration of pathogenic microorganisms in secondary treated wastewater is rarely monitored and the indicator organisms, Faecal coliforms, thermo tolerant coliforms, E. coli and F. entercocci are usually used. Tertiary and other advanced treatment measures are used to monitoring recycled wastewater for micro organisms that cause bio corrosion and

biofouling is rarely carried out and none of the case studies investigated measured any specific micro-organism species which contribute to bio corrosion and biofouling.

Bacteria and viruses in recycled water may be resistant to disinfection processes due to shielding from larger particles and so other quality parameters, such as suspended solids, are important in assessing microbiological quality.

The colour of recycled wastewater can be in issue for use in industrial applications, specifically when used as process water as the colour can impact the quality of the product i.e. paper production. If the colour is organic in origin this may promote microbiological growth and biocorrosion. Colour may also affect the user perception of recycled water. This is likely to be more of an issue in residential and higher contact end uses.

Odour can be caused by sulphate compounds which are subject to anaerobic conditions, forming H2S. This may be an issue in industrial processes where water is stored for a long period of time, allowing anaerobic conditions to occur. The development of anaerobic conditions will be related to the microbiological activity, the concentration of biological organic matter (usually measured by BOD) and the dissolved oxygen (DO) content of the water. Microbiological activity due to high BOD will lead to low DO and anaerobic conditions.

Recycled water turbidity gives an indication of the clarity of the treated water and
is also correlated in most circumstances to suspended solids concentration. Turbidity alone is not necessarily a good indicator of impact on industrial processes and operations as information on the cause of turbidity is required. For example, if turbidity is related to high inorganic content then issues of fouling and scaling are important. However, if related to organic content then the issues of biofouling and biocorrosion are more relevant.

Suspended solids are those greater than 0.45 µm and can be inert inorganic material, organic material or a combination of both. Suspended solids in recycled water can be deposited on surfaces in the process or foul filtration media, the former also providing a ‘seed’ for microbiological growth. As with turbidity the nature of the suspended solids, organic or inorganic, is important in assessing the potential impact on industrial processes.

Residual organics in wastewater can have a number of impacts on industrial processes. As organic compounds contain a carbon source they are a precursor to microbial growth and slime formation. They can also cause scale formation and in certain applications i.e. boilers, and can cause foaming.

Silica, SiO_2, is rarely monitored in recycled water but is an important parameter when assessing the impact on industrial processes. Silica forms scale, with the propensity for scale formation being dependent on both temperature and pH. Sulphates can impact industrial processes by causing scaling and through corrosion of concrete structures. The presence of sulphates can lead to the formation of hydrogen sulphide, which also causes corrosion and generates odours. Sulphate can also interfere with the formation of cupric hydroxide scales, thus increasing the potential for metal release.

Cooling tower Problem related to Treated ETP water:

Scaling:

Scaling is really only a major problem in secondary and tertiary effluent, although blow-down is an essential component of cooling tower operation. MF/RO treatment leads to high quality water where the concentration of scale forming species is very low leading to low blowdown rates. Three techniques may be used to overcome scaling problems.

Biological Growth

There are two main factors that assist biological growth, microbes and the nutrients that support them In general the presence of microbes in the reclaimed water should be minimal due to the requirements imposed by regulatory bodies on its use .The problem arises from the introduction of micro-organisms from external sources from airborne dusts and aerosols and in the ability of these micro-organisms to reproduce. It is generally accepted that biofilms exist on all surfaces and problems associated with biofouling control
come not from the influx of micro-organisms, but from the increase in nutrients available to them.

Where a tertiary treated recycled water is being used, industry often increases the biocide by 20% to ensure no fouling is encountered until a more scientific study of the case can be made and more reasonable levels used .It is generally recommended not to use shock treatment to give a high residual, but longer chlorination times giving lower residual as these are more effective and safer for wood structured cooling towers.

Foaming

The main cause of foaming is surfactants present in the water. Surfactant contamination due to algae can also occur at the sewage treatment plant. While this is rare it is important to keep in mind if a foaming event occurs.

Corrosion

Where copper and copper alloys are used one of the main concerns is ammonia. Catastrophic failure of copper-based components through stress corrosion has been reported at concentrations as low as 2 mg.L-1 of ammonia. In lower quality recycled water, such as tertiary treated recycled water used in refinery, nitrification is important in order to convert the ammonia to nitrate . Chlorides are also a significant issue in regards to corrosion due to its ability to accelerate the process either through complexing with the dissolved metals preventing passivation or generating local acidity. Significantly this is also a problem for reinforced concrete.

Present of Anaerobic species in recyle water influences MIC i.e. microbiological induce corrosion.

Fouling

For Recycle water cooling tower the major culprit is fouling, suspended inpurities , turbidity and other organic contaminant in reclaim water causes formation of heavy organic deposition of fouled matter as well its promote heavy bio mass.

Problem related to treated water application in Boiler

Corrosion

This high level of concentration of contaminants can, however, lead to significant problems with respect to corrosion and deposition. In general the higher the operating pressure of the boiler, the worse the potential problem is .This is complicated by the increased corrosion rates witnessed as a result of the higher temperatures in the boiler and pre-boiler in particular. In general very high purity water should be used, with significantly low levels of dissolved solids. Table shows the recommended levels of the American Society of Mechanical Engineers (ASME) .The concerns with feed water concentrations are corrosion in the pre boiler and deaerator as well as in the boiler itself.

The most significant problem with respect to corrosion in boiler systems comes from dissolved gases, primarily oxygen. This comes about for two main reasons. Firstly, it is directly responsible for corrosion. Most corrosion reactions require the presence of oxygen to occur. The high temperatures present in the boiler and in the steam infrastructure only help to accelerate this. Secondly, and perhaps of greatest significance, is the effect that oxygen has on the destruction of passivating films typically used to protect steel and copper in boiler systems

The concentration factor of contaminants in a boiler, the high temperatures of the water and the localisation of the evaporation also leads to high potential for deposition and scaling in a boiler system [56]. Scaling can be particularly destructive leading to increased heat loads to achieve the same heat transfer and can lead to the rupture of a boiler.

Crystallization in boilers tends to be slower and therefore a more structure and tenacious scale forms that is resistant to most physical and chemical cleaning techniques Also once scale starts to form, the restriction of water circulation in the boiler can further accelerate its formation .

Steam Purity:-

Further plant operations using steam can be significantly impacted by a poor quality of steam. This poor quality arises from carryover, which is liquid and solid components being carried with the steam into other sections of the plant. Carryover occurs to some degree in all boilers and it is only the extent and the effects of carryover that can be reduced.

The carryover of solids from the boiler entrapped in water droplets is a particular concern to the operation of mechanical parts such as turbine, where erosion or fouling can occur. The higher the

TSS of the feed water, the greater the amount included in carryover. Dissolved salts can also be an issue as they can precipitate from the water droplets and can significantly increase corrosion

Below are the suggested control limit for reuse of treated ETP as a boiler.

For Boiler:

Parameters	Recommended control limit up to 10 Kg/cm2	Recommended control limit up to 105 Kg/cm2
Cupper	0.05 ppm	0.05
Fe	0.3 ppm	0.05
TSS	5 ppm	0 ppm
pH	8.8-9.0	9-10
T.H	1.0	0
Turbidity	5.0	0.5
SiO2	10	0.1
Alkalinity	100	40
Mn	0.1	0.01
HCO3	120	48
TDS	500	200

We had collected various samples along with boiler water. As per the last analysis of boiler water, iron ppm is nil. we have reanalyzed the sample specifically for iron test and found that iron ppm is nil. Suspended solid in boiler water is higher. It is clearly indicate that reddish water of boiler water is not related with iron. We also tested the sample by adding oxidizing agent and found that all colour is disappear which clearly indicates the sample contains organic matter instead of iron contaminant.

The specified limit of TOTAL organic carbon is below 1 ppm (mg/l) as per **ASME**. (American society of mechanical Engineer) .

Recycle water or effluent treated water may contain significant amount of organic compound which can serve nutrient for micro-organism such bacteria, fungi, yeast and algae. These micro organism effect and generate sludge inside the boiler. High organic load in effluent treated water promote excess fouling materials or suspended solid in the boiler.

Compiled By : Zakir Atashbajiwala
Vice President –Technical & Marketing
91 9879104405