Solving the scaling problem

The formation of scale inside pipelines is a scourge for many landholders. It is not just inconvenient and expensive to clean up, but can cause loss of productivity or even lead to death of stock.

Scaling is a process related to a change to the natural state of the water supply. It can be triggered by physical, chemical or biological factors in the water supply or distribution system. The problem is more prevalent with the reticulation of groundwater supplies.

Scale formation

The likelihood that water will deposit scale can be gauged through a water analysis. A measure of water hardness, pH and ratio of chlorides to carbonates are indicators of the likelihood that water will deposit scale.

Scale formation is usually related to some change, either physical or chemical, in the water or in the distribution system. For example a rise in temperature, change in pressure or change in pH can trigger the formation of scale. The release of carbon dioxide from water when pumped from bores/wells can trigger a chemical reaction which can lead to the deposition of scaling compounds.

Scale is usually a mineral compound consisting mainly of calcium or magnesium carbonates or calcium sulphate. The main culprit is calcium carbonate deposits. In many cases it is mixed with other substances such as iron or sand grains.

Test for scale material

One sure way of determining whether or not the material that is causing the blockage is calcium or magnesium carbonate is to test with hydrochloric acid. By placing a few drops of the acid on a sample of the encrustation it will fizz as it reacts with calcium or magnesium carbonate. If there is no reaction you are faced with a different problem.

Water analysis

Where the problem is suspected to be caused by chemical deposition, a water analysis is necessary to help devise a suitable remedy. Otherwise the treatment could be hit and miss.

Treatment methods

Scaling of pipes can occur in many situations ranging from domestic to stock and irrigation reticulation. The methods of treatment suggested in this facts sheet are not tailored towards any one particular application.

Common treatment methods are:

- reduce water hardness
- reduce pH of water
- use sequestering agents in the water
- check pipeline operation
- treat pipes periodically
- replace pipeline
- install a 'water conditioner'.

Hardness reduction

Reducing water hardness can be achieved in one of the following ways:

- water softener
- reverse osmosis
- lime softening.

Water softeners exchange calcium and magnesium ions for sodium ions. They are available commercially for a range of applications. The ion exchange medium requires periodic 'recharging' to replace sodium ions. A water analysis is required to ensure that the process will do the job.

Reverse osmosis reduces the concentration of all ions (by about 90%) in water by forcing water under pressure through a semi-porous membrane. These units are designed for a variety of uses from the single domestic to urban applications. In reducing the salinity of the feed water, a by-product is wastewater high in salts that can pose a disposal problem.

A water analysis of the supply source is required especially as scale deposition can be a problem within the units themselves. The sizing of the unit will also depend on water use.

Lime softening is a process of adding hydrated lime to water in order to precipitate calcium carbonate. The amount of lime required will depend on hardness levels. The process requires a settlement period and its overall effectiveness is governed by the pH of the water. Lime softening is usually confined to applications where constant monitoring can be afforded.

Reduce pH

Reducing pH means acidifying the water. This can be done by adding hydrochloric or sulphuric acid to the water to lower pH below 6.0 units. Acidifying the water aims to keep scale forming calcium and magnesium ions in solution as the water moves through the pipeline. Be aware that reducing pH could cause corrosion in metal pipework.

Sequestering agents

Adding sequestering agents (scale inhibitors) such as sodium hexametaphosphate to water may inhibit the precipitation of scale. They may also form a lining on the pipe wall to deter the deposition of scale.

One such agent, sodium hexametaphosphate, is marketed under the trade name of 'calgon'.

Pipeline operation

Precipitation of scale forming compounds can be accelerated if there are constrictions in the pipeline. A change in the flow pattern can mean a change in pressure or velocity that will trigger precipitation in susceptible waters. You should ensure that unnecessary bends or constrictions such as a change in pipe diameter, are eliminated.

A change to a pipe of larger diameter could be considered if flow velocities are high.

Calcium carbonate may also precipitate out if there is a change in water temperature. In situations where the pipeline is near to or at ground surface, it can absorb sufficient heat to cause deposition. This is particularly so where flow is intermittent and long periods of no flow in the hot sunlight are likely.

Treat pipelines

If encrustations in pipelines occur over a long period of time or the blockage is not major, it could be worthwhile just cleaning the pipeline periodically. Complete blockages can be treated with acid. Hydrochloric acid will dissolve carbonate scale. If metal pipework is involved 'inhibited' hydrochloric acid must be used to minimise corrosion/attack on the metal surface.

Once you have determined the frequency that scaling becomes a problem, you know when treatment should occur. In a long pipeline, isolate/break the line in the vicinity of the blockage and empty it of water. Introduce acid at the upstream end and allow sufficient time for it to work. Thoroughly wash the line with clean water when finished. If practical, recirculating the acid is the most effective way of removing scale.

Flushing with an acid solution before the problem becomes too great should be considered.

Replace pipeline

The cost and inconvenience of treating the water supply or cleaning out the pipeline must be weighed up against replacing the line. For example if the encrustation takes a long time to develop and the pipeline length is short, it may be worthwhile abandoning the blocked line and replacing it.

Replacing the pipeline with a larger diameter pipe may extend its life before further blockages occur.

Water conditioner

Water conditioners have been marketed in one form or another for many years, with a somewhat controversial history. They have not been totally accepted by the scientific community mainly because the results cannot or have not been quantified.

At this stage no recommendation can be given as to the suitability of such devices for water treatment. If considering their use you should seek a guarantee from the supplier that it will do the job. A water analysis should be made available to the supplier.

Further information

For more information contact a local groundwater consultant. You will find their contact details in the yellow pages under the headings of 'Natural Resources Consultants' or 'Boring and Drilling Contractors.'

Fact sheet W32—*Sampling your water supply* is related to this topic.

More information on groundwater or other natural resource management topics is available on the Natural Resources and Water web site: <www.nrw.qld.gov.au>.

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For further information phone 13 13 04