TECHNICAL NOTES

Fats, Oils & Grease (FOG) in polyethylene gravity drainage pipes

Scope

The document is applicable for the following:

- Polyethylene gravity sewer pipes
- Fats, Oils, Grease (FOG) in PE rehabilitated sewer pipes
- Rehabilitated gravity sewer pipes (pipe cracking)

Executive Summary

There is limited information on the subject of fat deposits or oils and grease build up in PE sewer pipes. Although 'fat balls' are not new in sewers there is a lack of published papers on the matter for PE pipe. We have anecdotal stories from South Africa where they have significant problems with the build-up of FOG in PE pipes which are used for sewer rehabilitation (pipe cracking or bursting) in sizes DN 150-250.

We have attempted to put together what we know about this subject from our field experience over the last 20 years of using PE in gravity sewers in New Zealand and the following is our experience & opinions on this subject.

What we know

Fats, Oils, and Grease form on the internal walls of gravity PE pipe in the typical 'tide area' and they 'pool together' in dips or low spots in PE pipes where there is insufficient gradient or uneven gradients and the waste water stops moving.

All Polyolefin's exhibit this same issue so it is nothing to do with the grade or type of PE or PP material being used.

This issue is not commonly seen with open cut laid pipes that are well bed unless the gradient is very shallow, uneven, the pipe is poorly bed, or is over sized and the sewer velocity is very low allowing stationary waste water.

FOG, like most substances will not stick to PE and any build-up flushes away completely with flows >1.6m/s. Jet cleaning using pressure water is typically used to remove FOG problems.

The issue in rehabilitated sewers using pipe cracking may be the undulations or dips (sagging) in the PE pipe as it passes through the cracked host pipe. For example, pipe collars in earthenware pipe (RRJ sockets) may crack on the bottom of one pipe as they are burst and the next collar cracks on the top, so the pipe follows this path and as the PE is flexible it travels in waves which creates the dips allowing waste water containing fat to stop moving during low flows. This stationary wastewater allows fats and oils to rise to the surface and to group with other fats combining with fats sitting on the tidal area of the pipe wall. We believe this is where 'fat balls' may be created due to low velocities and stationary waste water in pipes.

In PVC pipe and PE pipe with high ring stiffness (PE ≥ SN 12 / SDR ≤ 21) the pipe is naturally rigid, so it's unusual in laid pipes of both PVC and PE that the pipe does not inherently maintain a continuous gradient (unless bedding is particularly poor) therefore you don't get stationary waste water ponding and in our experience less common to see FOG in laid pipe or PE pipes with high SN values.

The other problem we see from pipe cracking in sewer rehabilitation is engineers over size the rehab pipe. If the host pipe is a DN 150 earthenware pipe and it is cracked with a 200 OD SDR 26 pipe, the new ID is 185 and the pipe has a 7mm wall thickness, therefore velocity is reduced due to the larger diameter and the thin wall the pipe flexes as it follows the old pipe location creating dips in the pipe gradient leading to pooling.

We have not seen FOG issues in larger PE pipes > DN 225 (250 OD).

Summary & Conclusions

1. Reduce pipe SDR (≤ SDR 21) to increase pipe rigidity and reduce the chance of sagging and therefore ponding
2. Don't over size pipes, keep the diameter small to maintain higher velocity and higher tidal marks
3. Maintain gradients of ≥ 1% in PE design where possible
4. Anything above 1.6m/s FOG will generally not occur as PE is self-cleaning at this rate

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