Research Problem Statement – Sewage System Calcification

How could your research contribute to reduction of calcification on submarine sanitary systems?

Problem (and business need)

Regular consumption of low mineral water causes the average submariner to excrete more than 300mg of calcium per day. This is subsequently flushed in the sanitary system by sea water, which itself contains calcium at approximately 400ppm. Over time, this calcium deposits and builds up on the walls of the sewage pipework. In combination with the design of high velocity low bore pipework, this causes problems in the sewage systems for Astute class submarines. The calcium deposits further reduce the pipe internal diameter over time until flow is restricted and in worst cases prevented altogether, rendering the head (toilet) unusable. Whilst the platforms are deployed at-sea, the onboard marine engineering department regularly face problems with degradation of the heads and bathrooms which is unpleasant for ship staff. Figure 1 below shows an example piece of pipework with heavy calcium build up on the walls and the effect this has on the diameter and therefore flow through the pipe is evident.

Figure 1 A Piece of Pipework with Calcium Build Up on the Walls, Reduced Pipe Diameter and Restricted Flow

The issue requires maintenance whilst the platform is alongside in the form of mechanical rodding which is a dirty and cumbersome task. The use of highly concentrated descalers is restricted on Astute class platforms due to the risk of damage. A permanent preventative solution to a recurring problem is sought.

A more suitable solution has been proposed, in the form of a chemical additive that could be used to prevent the accumulation and adhesion of calcium deposits, acting as a scale inhibitor. The proposal is for this chemical to be added continuously throughout a platform's deployment. This chemical must however have a benign environmental profile and be non-corrosive or damaging to the sanitary system and equipment. This includes the CuNi pipework, the rubber O-ring seals and macerator ('the equipment').

A low-cost preventative method would increase the availability of the platform and minimise costly periodic maintenance for the heads. Moreover, this process may increase the material longevity of the pipework through life, as the exposure to other corrosive descalers would be reduced.

Sensitivity (e.g. whether commercial, official sensitive etc)

Not Official Sensitive. Solution could in theory be used in any marine environment.

Specifications (more information available on request)

Pipework is copper nickel (CuNi), pipe dimensions available

Scope

Desktop study; leading to development of trials

Potential Research Areas (not exclusive)

Metallurgy, Chemical engineering

Owner/Sponsor contact details

Mat Fullard