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Developing a GIS-Based Tool for the Management of Fats, Oils, and Grease (FOG): A Case Study of Thames Water Wastewater Catchment

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Abstract : Fats, oils and grease (FOG) are by-products of food preparation and cooking processes. FOG enters wastewater systems through a variety of sources such as households, food service establishments, and industrial food facilities. Over time, if no source control is in place, FOG builds up on pipe walls, leading to blockages, and potentially to sewer overflows which are a major risk to the Environment and Human Health. UK water utilities spend millions of pounds annually trying to control FOG. Despite UK legislation specifying that discharge of such material is against the law, it is often complicated for water companies to identify and prosecute offenders. Hence, it leads to uncertainties regarding the attitude to take in terms of FOG management. Research is needed to seize the full potential of implementing current practices. The aim of this research was to undertake a comprehensive study to document the extent of FOG problems in sewer lines and reinforce existing knowledge. Data were collected to develop a model estimating quantities of FOG available for recovery within Thames Water wastewater catchments. Geographical Information System (GIS) software was used in conjunction to integrate data with a geographical component. FOG was responsible for at least 1/3 of sewer blockages in Thames Water waste area. A waste-based approach was developed through an extensive review to estimate the potential for FOG collection and recovery. Three main sources were identified: residential, commercial and industrial. Commercial properties were identified as one of the major FOG producers. The total potential FOG generated was estimated for the 354 wastewater catchments. Additionally, raw and settled sewage were sampled and analysed for FOG (as hexane extractable material) monthly at 20 sewage treatment works (STW) for three years. A good correlation was found with the sampled FOG and population equivalent (PE). On average, a difference of 43.03% was found between the estimated FOG (waste-based approach) and sampled FOG (raw sewage sampling). It was suggested that the approach undertaken could overestimate the FOG available, the sampling could only capture a fraction of FOG arriving at STW, and/or the difference could account for FOG accumulating in sewer lines. Furthermore, it was estimated that on average FOG could contribute up to 12.99% of the primary sludge removed. The model was further used to investigate the relationship between estimated FOG and number of blockages. The higher the FOG potential, the higher the number of FOG-related blockages is. The GIS-based tool was used to identify critical areas (i.e. high FOG potential and high number of FOG blockages). As reported in the literature, FOG was one of the main causes of sewer blockages. By identifying critical areas (i.e. high FOG potential and high number of FOG blockages) the model further explored the potential for source-control in terms of ‘sewer relief’ and waste recovery. Hence, it helped targeting where benefits from implementation of management strategies could be the highest. However, FOG is still likely to persist throughout the networks, and further research is needed to assess downstream impacts (i.e. at STW).

Keywords : fat, FOG, GIS, grease, oil, sewer blockages, sewer networks
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