Gases Management in Wastewater Collection Networks Mashhad- Iran

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Abstract

The study presented in this paper was conducted to compare operation maintenance methods on sewage collection networks. The effect of performing High Pressure Cleaning by Water Jet; Ventilation; and Water Flushing on the quantity of gases concentration was investigated at specific interval. These methods were applied at three existing sewage networks in western part of Mashhad-Iran. The paper concluded that to be effective, proactive maintenance must be performed on networks, which have gas emission problem to protect network crews and environment by specific interval. The results can be useful for management of environment protection and healthcare purposes.

Keywords: Sewerage Gas Management, Flushing, Water jet, Ventilation, Protect Environment and Crews

1. INTRODUCTION

Wastewater collection networks, due to the nature of their functions, carry various concentrations of odorous and toxic gases. The production rate and transport of these gases within sewer systems depend on various properties in the system piping.

Sewer gas is a generic name for a complex mixture of toxic and non-toxic gases which generally come from anaerobic decomposition, wastewater turbulence, and some byproducts of biologically mediated processes seen in the collection systems and breakdown of volatile organic compounds. Gases produced by domestic wastewater include hydrogen sulfide (H_2S), ammonia (NH_3), methane (CH_4), carbon dioxide (CO_2), and oxygen (O_2) which are commonly colorless, and also biological organisms, water vapor, and other chemicals. Among these gases, only hydrogen sulfide and ammonia are malodorous. The presence and concentration of these components can vary with time, composition of the sewage, temperature, and pH changes [1-3]. There are various methods with quite sophisticated control forms of such gases emission. Generally some of the dangerous and toxic components of sewer gas include hydrogen sulfide, ammonia, and oxygen lack.

Hydrogen sulfide is colorless, toxic and flammable gas that is responsible for the foul odor of rotten eggs and flatulence which is formed by biological and chemical processes in the sewage [3]. Being heavier than air, it tends to accumulate at the bottom of poorly ventilated spaces. Although very pungent at first, it quickly deadens the sense of smell, so potential victims may be unaware of its presence until it is too late. Most of the odors generated within the collection system are sulfur-based compounds and at continuous low exposure concentrations, most people can no longer smell hydrogen sulfide, making them unaware that they continue to be exposed to the gas [4-7]. Long term or lower concentrations exposure can result in eye irritation, a sore throat and cough, nausea, shortness of breath, fluid in the lunges, loss appetite, headache, and poor memory. These symptoms usually go away in a few weeks. The recognition threshold is 0.0047 ppm but the reported odor threshold for hydrogen sulfide gas varies greatly [3, 8]. H_2S has been reported as the leading cause of sudden death at the work space [9]. If sufficient oxygen or dissolved oxygen is present in sewage networks, H_2S will not be generated [10-11]. The Occupational Safety and Health Administration set an 8-hour permissible exposure limit of 10 ppm for hydrogen sulfide in the workplace, short time (15min) exposure limit 15 ppm with a maximum level of 50 ppm allowed for one time per 10 minutes if no other measurable exposure occurs [9].

Ammonia is a solution of NH_3 in water with a characteristic pungent or ammoniac odor with the recognition threshold level of 46.8 ppm [3]. The toxicity of ammonia solutions (NH_3) does not usually cause problems for humans but it depends on the concentration. The European Union classification of