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Safety and hygiene aspects of the operation of a sewage transportation system

1. Introduction

Selecting proper sewage transportation system does not only consist of investment costs and the amount of energy used to transport one meter of sewage. There are also certain EU regulations which specify the technical requirements for a certain group of products, which take precedence over the national regulations.

There are also binding national regulations in existence. However, it is not the regulations, but adherence to these that becomes problematic. Every state has its own customs, they saying goes. In this very case, one could even speak of every commune, district or public utility company each having their own customs. The degree to which industrial safety regulations are respected usually depends on the level of the awareness on the part of decision-makers in relation to potential threats and real accidents, including the fatal ones. The awareness of itself is not always sufficient to reach decision makers and to demonstrate to them alternative and safer solutions. My intention in this article is highlight the complexity of industrial safety issues related to the operation of the key elements of the sewage transportation system, such as deaeration and aeration chambers (columns), flushing and draining chambers and sewage pumping stations.

2. Deaeration and aeration chambers (columns) and flushing and drain chambers

2.1 Valid regulations

In the case of typical solutions where aeration and deaeration valves are installed in manholes, their operation is regulated by the rules included in the Decree by the Minister of Labour and Social Policy dated 26 Sept. 1997 concerning the general industrial safety regulations (Journal of Laws from the year 2003, No. 169, Item 1650). The key regulations relate to §87.1. Work in a tank can be undertaken and conducted, …, once the following requirements have been fulfilled:

1) the tank is to be drained and cleaned initially by washing, blowing through with steam or an inert gas, and blowing through with air; …

89.2 The worker who enters inside the tank needs to posses individual protective gear, and the following in particular:

1) safety straps with a lifeline attached to an adequately tough element of the external structure;

2) a safety helmet and protective clothing;

3) personal safety equipment to isolate the respiratory system.

§89.3 The individual protection gear of **the supporting person needs to be the same as the gear of those workers who enter the inside of the tank.**

Fig. 1 presents the way in which the abovementioned regulations are respected.

Fig. 1. Disassembly of the deaeration and aeration valve in a manhole ø1200 mm (conditions of life and health hazard**:** the practice is that the valve is disassembled after previous entering the manhole, and then it is taken to the workshop).

2.2. Classical and modern solutions

Standard waste pressure conduits possess aeration and deaeration installations, flushing installations and waste (liquid) drain systems.

Different solutions are used for the aeration and/or deaeration of waste conduits in the form of concrete manholes or special shielding columns without manholes.

Different solutions are used for the flushing and draining of waste from waste pressure conduits in the form of concrete manholes or full-passage sewage hydrants. When using new system solutions, one may install both a deaeration and aeration valve and a standpipe on a pressure pipeline, in the same shielding column without a manhole. This guarantees reliable pressure flushing of a waste pipeline in any direction (owing to the proper system of gate valves). This system facilitates a safe operation of a pressure waste pipeline from the ground surface only (cf. Fig. 2).

Fig. 2. Safe disassembly of the valve from the ground surface (the valve is replaced with a valve in working order, or a stopper is installed).

3. Sewage pumping stations

3.1 Valid regulations

In the light of the Decree by the Minister of Spatial Economy and Building Engineering dated 1 Oct. 1993 and concerning industrial safety in sewage treatment plants (Journal of Laws No. 96 Item 438), a wet chamber of a sewage pumping station is treated as a wet well.

In connection with the above, the following regulations are binding related to §37.5. A worker's entry to a wet well needs to be preceded by the activities referred to in §33: 1. Entering rooms or hollows by screens must be preceded by an examination of the air purity and oxygen content; 2. Those workers who are entering the hollow room by the screen ought to possess devices which detect dangerous and harmful gases and safety straps with a lifeline of a proper length; 3. A worker who is going down into the rooms or hollows by the screens needs to be supported by at least two persons; 4. Over the entry or the manhole to the room or the hollow, a device needs to be located which would make it possible to get the worker out should this worker collapse or lose consciousness; 5. **Those who are supporting the worker need to possess at least two breathing apparatuses, lifelines and mobile devices designed to get a casualty out from the hazardous place, with his head being positioned upwards.** 6. The company's manager decides about the number of the supporting workers and the number of breathing apparatuses.

3.2 Classical and modern solutions

Pumping stations with a wet retention chamber (a wet well) with submersible pumps placed in it constitute a classical example of a sewage pumping station (Fig. 3).

Fig. 3. A classical pumping station with a wet chamber and submersible pumps after several years of operation

However, if we attempt to modernize such pumping stations in order to ensure a greater safety of operation then we need to provide them with flush valves, properly shaped bottoms etc. Nevertheless, tank pumping stations with a wet chamber and submersible pumps being modernized in this way are much more expensive and then one needs to consider the use of a pumping station with a dry pump chamber (Fig. 4). If at the same time we would like to do away with costly deaeration and aeration valves (which are troublesome in operation) on pressure pipelines, then we can use a pneumatic sewage pumping station (Fig. 5).

Fig. 4. Pumping station with a dry chamber and pumps in the dry mode after several years of operation

Fig. 5. A pneumatic sewage pumping station with working displacement tanks in the dry chamber

5. Conclusions

One should decide whether to continue with the classical systems and to be at odds with the valid industrial safety regulations, or whether to consider the use of modern solutions, which take into account all the aspects of the operational safety of wastewater transportation systems. This is a question just like in Hamlet: "***To be, or not to be: that is the question***... *To die, to sleep--No more-- To sleep--perchance to dream: ay, there's the rub,* ***For in that sleep of death what dreams may come***."

May this not be just dreams about a safe deaeration and aeration chamber.

References:

1. Journal of Laws from the year 2003, No. 169, Item 1650

2. Journal of LawsNo. 96 Item 438

3. *Non-return valves for pumping stations of sewage including fecal matter:* Part 1. PP1/2006, Part 2. PP2/2006, Part 3. PP4/2006, Part 4. PP3/2007, Part 5. PP2/2009.

4. A quotation from *Hamlet* by W. Shakespeare