

Case study of severe deterioration of galvanized steel water piping system

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The main aim of this case study will be to investigate the state of a drinking water system in one of the Slovenian public buildings. The goals of this study are: 1) to determine the current condition of drinking water, 2) to assess the extent and the type of corrosion damages on the system, 3) to test the elements and to find a cause for deteriorations, and 4) to propose the most optimal rehabilitation of the system.

This case study will be performed on a water supply system built in 1992. There is very little information available on the materials used and the design of the system, since the detailed construction plan is not available. Drinking water system was made from galvanized steel pipes, while accessories, fittings and valves, were most probably made from brass. For the last 10 years a water softening system is used to prevent the accumulation of limescale on the heaters. No chemical or thermal disinfection of the system is used.

The problems on the installation became obvious in 2016, when boiler room was renewed and all old taps and showers were replaced with automatic (water saving) ones. The high amount of solid material in the water is causing the failures of these sensitive taps on a daily basis. However, no leakage was noticed in the last 10 years. In the first phase of this investigation the general inspection of the building and its water supply system will be performed. Visual part of the system will be inspected and the places for water pipes sampling will be determined. In parallel, the sampling of drinking water will be performed on several locations, to cover cold/hot and flowing/standing water parts of the system.

In the second phase of the investigation, samples of pipes will be collected and subjected to detailed analyses. The identification of water pipes properties will be performed by cross-sectional metallographic analysis (type, seams), chemical analysis and determination of Zn coating thickness. The current state of a drinking water system will be evaluated by determination of the thickness of the remaining inner Zn coating, observation of the corrosion products (visual, SEM/EDS analysis, Raman analysis), assessment of the extent and type of corrosion damage under corrosion products (visual and SEM/EDS analysis). Water analysis on chemical and microbiological properties will be presented and the relation of corrosion to water chemistry will be shown. FTIR analysis will be performed in order to investigate biofilm formation in cold and hot water systems.

On the basis of all investigations, the most optimal rehabilitation will be proposed.