Post-Project Survey of Sulfate Resistant Anti-Corrosion Coating Method

(Research of FY 2017-2021)

1. Purpose

This report describes a field study of wastewater treatment facilities applying sulfate-resistant anti-corrosion coating methods and a long-term investigation of anti-corrosion coating mortar tentatively applied at the existing facilities. The research aims to find out issues of "Corrosion Control Guidelines for Sewerage Concrete Structures" (JS Corrosion Control Manual) to improve the technology.

2. Investigation contents

(1) **Post-project survey of sulfate resistant anti-corrosion coating method**

In 2017, the first year of the investigation, a questionnaire survey was conducted on municipal WWTPs nationwide to find out their use period of anti-corrosion coating layers, the presence of their deterioration, and inspection/investigation status. After the second year, an investigation was conducted in the existing facilities, including the corrosive environment of facilities such as corrosive environment indicators in liquid/gas phases and deterioration status of anti-corrosive layers, including adhesive stability and sulfide intrusion depth.

(2) **Follow-up investigation on the test application of sulfuric acid-resistant mortar**

The ten-year follow-up investigation was conducted for sulfuric acid-resistant mortar, experimentally applied at the existing facilities, for

their deterioration status and corrosive environment. The follow-up research was completed in 2019.

3. Outcomes of This Year

This year's survey targeted two WWTPs 1 and 2. They have applied an anti-corrosion coating layer of type C or D standards from the application type lining method. The application site is the sludge thickening tank at Facility 1 and the first settling tank at Facility 2. Table 1 shows the survey results.

Table 1. Summary of the post-project survey results

		WWTP #1	WWTP #2
Target facility		Sludge thickening tank	Primary settling tank
Anti-corrosion coating layer			
Standards		Type D	Type C
Material		Epoxy resin	Polyurea resin
Years in service at the time of survey		23	20
Corrosive environment survey			
Gas phase environment survey			
Hydrogen sulfide gas (average)	ppm	4.3	16.6
Degradation condition survey			
Adhesion strength	N/mm2	2.69	1.29
Corrosion layer thickness	mm	0.77	2.53
Physical property test			
Sulfide intrusion depth	μm	13.33	36.67
Sulfide intrusion depth ratio	%	1.7	1.5

- Hydrogen sulfate gas concentration in the gas phase showed both facilities have a corrosive environment recognizing concrete corrosion that the Corrosion Control Manuals classify.
- Each facility's rate of sulfide intrusion depth (corrosion layer thickness divided by sulfide intrusion depth) was 1.5 and 1.7%, and their

intrusion of sulfate ions stayed within the anti-corrosion coating layers.

- Each adhesion strength was 2.6 and 1.2N/mm2, and facility 2's adhesion strength was below the quality standard of 1.5N/mm2 indicated in the Corrosion Control Manuals.

The post-project survey from 2018 to 2020 for six facilities having applied anti-corrosion coating lining, including the above, showed the following trends.

- A facility having a higher hydrogen sulfate gas concentration tended to have a deeper sulfate intrusion. On the other hand, a sulfate ion intrusion stayed within the anti-corrosion coating layer in any location or facility. It means anti-corrosion technology secured the blockage of sulfate against concrete bodies.
- Four facilities showed less adhesion strength than the quality standard suggesting degradation of adhesion strength by aging.

4. Future Plan

The investigation will continue in the same manner and accumulate knowledge. The research will study the validity of quality standards of the anti-corrosion coating layer provided in JS Corrosion Control Manuals and feedback on its results to the manuals.

Keywords: **Anti-corrosion coating layer, Hydrogen sulfide, Sulfide intrusion depth, Adhesive stability**