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

(Research of FY 2017-2021)

1. Purpose

This survey investigates wastewater treatment facilities applying sulfate resistant anti-corrosion coating method for their corrosive environments and deterioration status of anti-corrosion coating layers. The purpose of the survey is to find out issues of sulfate resistant anti-corrosion coating method in "Corrosion Control Guidelines for Sewerage Concrete Structures" to improve the technology through the investigation.

2. About the Investigation

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

In 2017, researchers conducted a questionnaire survey to municipal WWTPs nationwide to overview the deterioration status. After 2018, they have investigated the corrosive environment and deterioration status of anti-corrosive layers caused by sulfuric acid for sewerage facilities applying the sulfate resistant anti-corrosive coating method. In 2020, they investigated four facilities of four WWTPs.

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

The investigation dealt with the sulfuric acid-resistant mortar, experimentally applied at the existing facilities in 2018. The investigation items were:

- The mortar's deterioration status
- Corrosive environment
- Deterioration status of test specimens with exposure test under the mentioned corrosive environment

FY 2020 was the last year of the research period.

3. Outcomes of This Year

Table 1. Post-project survey results of sulfate resistant anti-corrosion coating method

		A WWTP	B WWTP	C WWTP	D WWTP
		Primary settling tank	Gravity thickening tank	Sludge storage tank (Mixing tank)	Primary settling tank
Anti-corrosion coating	standards	Coating & lining (Type C)			
	Anti-corrosion material	Epoxy resin with ceramic powder	Epoxy resin	Vinyl ester resin	Epoxy resin
Anti-corrosion coating layer's application periods		21 years	17 years	17 years	12 years
Gas phase	H_2S gas concentration [ppm]	Average: 8.4 Max:32.0	Average: 37.0 Max:181	Average: 21.4 Max:150	Average: 11.4 Max:52.0
	Surface pH	5	3	6	7
Appearance		Lifting and flaking on wall surface	Lifting and flaking on beams or trough wall surface	Look healthy with no lifting or flaking	Look healthy with no lifting or flaking
Adhesion strength[N/mm^2]		1.66	0.39	4.07	0.96
Concrete neutralization depth[mm]		0	0.4	4.8	0
Thickness of anti-corrosion coating layer [mm]	Design value	3.0 and over	0.7 and over	1.0 and over	0.7 and over
	Measurements	1.80	0.80	1.17	0.76
Sulfur invasion depth[mm]		1.451	0.138	0.096	0.021
Sulfur invasion depth/Design value[%]		-	19.7	9.6	3.0
Sulfur invasion depth/Measurements[%]		-	17.3	8.2	2.8

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

Table 1 describes investigation results targeting four facilities of four wastewater treatment plants. All facilities have a corrosive environment

because their surface pH of gas-phase is acid or neutral. While the facilities have been running for over ten years which is normal service life, their sulfur penetration depths stay in the anti-corrosive coating layers. It shows that the anti-corrosive coating layer's shielding capability, its primary function, works properly.

In the WWTP A and B, their coating layers have shown floating and flakes on their surface. On the other hand, in the WWTP B and D, their coating layers have had less adhesive strength than the primary performance of 1.5kN/mm2. Therefore, it suggests that adhesive decreasing does not always coincide with deterioration in appearance, and the coating layer has a technical issue on the stable adhesive strength.

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

Photo 1. Test application site and specimens

Photo 1 describes the appearances of test application site and exposure test specimens. Though the test site is in the gas phase of the primary settling tank and under the corrosive environment with an average H_2S concentration of 11ppm, neither the test spot nor test specimens showed any appearance changes. These results verify that test applied sulfuric acid-resistant mortar kept its anti-corrosive performances, sulfuric acid-resistant,

isolation, and durability, after ten years under the actual corrosion environment.

4. Future Plan

The survey will investigate the deterioration status and corrosion environment of anti-corrosion coating layers beyond the expected service life to clarify the relationship between their deterioration and corrosion environment.

Keywords: **Anti-corrosion coating layer, Adhesive stability, Depth of sulfur invasion, Sulfuric acid-resistant mortar**