

## **Assessment and Rehabilitation of Piping Inside Water and Wastewater Treatment Plants**

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### **ABSTRACT**

Many pipelines within water and wastewater treatment plants that were constructed within the last 50 years are nearing the end of their service lives. Owners have invested in condition assessments to help them make the difficult decision to repair or replace these pipelines. There are many types of condition assessment methods that can be used to determine the existing condition however, this paper will discuss a data-driven approach. Rehabilitation of the pipelines with protective coatings can also be challenging due to limited access and limited construction schedules. Important factors to consider when selecting protective coatings based on case histories are discussed.

Key words: Asset Management, Condition Assessment, Corrosion Assessment, Coatings and Linings, Protective Coatings, Waste Water, Water Treatment, Infrastructure, Pipelines, Rehabilitation

### **INTRODUCTION**

#### **DIRECT CONTACT SENSORS AND LOCAL TESTING**

##### Broadband Electro Magnetic Thickness Testing

Broadband electromagnetic testing is a non-destructive frequency-independent application of electromagnetic or eddy current systems that produces a thickness profile of a pipe. The BEM scan is not affected by background electromagnetic interference, and the test frequencies can be adjusted to the specific pipe material and site conditions. This technology allows for the assessment of ferrous metal pipe thickness. Metallurgic changes in the pipe composition, as formed by corrosion processes such as graphitization can be identified. The BEM assessment of a pipe can be performed externally or internally and does not require intimate contact with the metal surfaces. Removal of coatings, mortar, or insulation from pipe surfaces up to two inches is not required.

The BEM scan is performed using a handheld antenna tool within the excavation (Photo 1). The antenna is moved 360 degrees around the circumference of the pipe. Typically, a full-circumference scan of the pipe can be completed in two to four hours, making it possible to perform multiple scans within a day of field work. The handheld antenna is moved around the pipe taking successive readings, which are stored on a computer. An example of the BEM equipment set up is shown in Photo 1 and Photo 2.



Photo 1. BEM Scanning of mortar-coated metallic pipe.



Photo 2. BEM scanning of cement mortar coated steel pipe.

The data is post-processed to provide a contour map of thicknesses from the surveyed sections. The data collected can be used to determine the apparent wall thickness as well as provide an indication of internal and external corrosion. With the BEM information correlated to the nominal pipe wall thickness, a rate of corrosion can be established and, using a mechanistic model, an estimated remaining life of the pipe can be predicted.

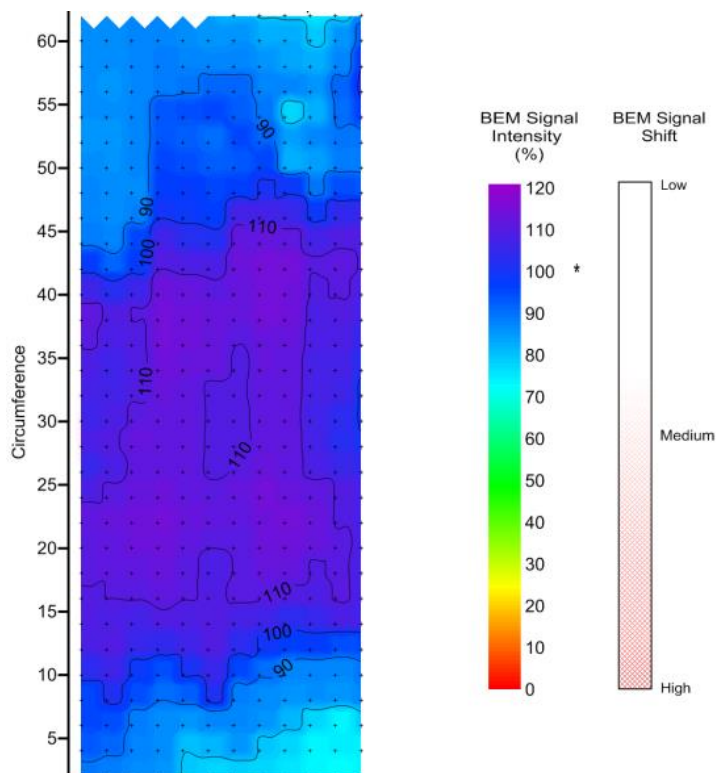


Figure 1. BEM contour map of thickness measurements

## A-Scan Ultrasonic Testing

Ultrasonic testing (UT) is a non-destructive evaluation technique used for the determination of metal wall thickness. High-frequency sound waves are transmitted through one side of a metal wall from a transducer. When the sound waves reach the other side of the metal wall, a fraction of the waves will echo back to the transducer. The metal thickness is determined by recording the time it takes for the sound wave to travel through the metal and return.

Most A scan gauges record point measurements of an area less than 1/4-inch in diameter. Pinpointing internal corrosion can be challenging using A scan UT and is best suited for general assessments if no prior corroded areas have been identified. The owner must be aware that 100% of the surface will not be tested with an A scan gauge unless significant time and budget are allocated to do so. If the surfaces of the structure to be tested are uneven due to corrosion or severe pitting, the transducer may not be able to record a reading. Therefore, measurements with a pit depth gauge are recommended on heavily pitted surfaces.

Direct access to the surface to be tested is required by UT and can limit the amount of surface area that can be tested. UT with a handheld gauge may require a ladder or scaffolding for overhead surfaces or digging a trench and building soil shoring for buried pipelines. Certain exterior coatings such as felt wraps, tape wraps, and thick coal tar enamel will have to be removed before conducting UT. Testing the exterior of a water or wastewater pipeline that is in service does not affect the measurements. If the interior of the pipeline needs to be tested, bypassing flow, dewatering, and lock-out tag-out procedures must be conducted in order to do a physical entry or insert an in-line scanner such as multi-sensor inspection technologies that measure pipe wall thickness.



Photo 3. Example of A scan UT testing on a 96-inch diameter pipeline.