**PHORGOTTEN PHENOMENA**

**Longevity of a Graphitized Cast Iron Water Main**

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Graphitization is a corrosion phenomenon associated with grey cast iron. This material consists essentially of flakes of graphite in an iron matrix. The iron constituent corrodes out because of the same multitude of corrosion reactions that affect ferrous metals, leaving behind the graphite and some corrosion products. The resultant pipe surface looks normal, often exhibiting the original mill markings. When struck with a hammer or similar metal object, however, the pipe responds with a rather dull “thunk” rather than the sharp “clang” usually heard from sound metal. Graphitized pipe is also relatively soft, and one can carve into it with a chisel or other sharp object.

Graphitization usually occurs in three ways. Sometimes just the surface of the pipe graphitizes, forming a graphitic coating on the exterior. Frequently, this protects the pipe very well, leading to long service. At other times, a plug of graphite develops in the pipe wall. This pipe may serve for years, but if a pressure surge or water hammer occurs, the plug may blow out. The hole left by the plug is often greatly enlarged by the out-rushing water, creating a large penetration. Finally, the whole wall may graphitize, and if the pipe is subjected to a heavy earth load or perhaps a washout under a joint, a circumferential break occurs; hence the common term “water main break.”

This isn’t to say that graphitized pipe won’t do its job for a long time. Here’s a case in point. Some time ago, I was on a job in Boston and came across a water company crew excavating a main. I am always curious about pipeline excavations as I like to see what (and maybe who!) is in them. I introduced myself to the crew, and discovering my interest in corrosion, they explained that this main was just under 100 years old. There had been no problems with it, but it was felt that the interior of the pipe needed to be cleaned, so they were cutting out a joint to begin the cleaning process.

I had the opportunity to examine the removed joint. It looked pretty good and there wasn’t much tuberculation on the interior. It sounded like it might be graphitized from the sound I heard when I banged on it, so I decided to give it the chisel test. I obtained a good knife from my tool kit, and sure enough, I could carve well into the pipe. Here was a fully graphitized main that had been serving quite successfully for a very long time. And, so long as it is not subjected to physical shocks or earth loads, I suspect it will be delivering water to the citizens of Boston for a long time in the future.

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