



**Structural Integrity Associates, Inc.<sup>®</sup>**



1. Soft Black Graphitization Pockets Visible on Pipe Edge When Cut



Plug type dealloying in a brass pipe



1. Sandblasted 10-Inch 40-Year-Old Cast Iron Pipe With Crack At Failure Location

## Selective Leaching and Its Importance in the License Renewal Process

Characterization of selective leaching is another key commitment for the License Renewal process. License Renewal typically requires a one-time inspection of a sample of cast iron and copper alloy materials that are directly exposed to water or soil. The inspection is to determine whether a loss of material due to selective leaching is occurring and whether it will cause concern in extending the plant's operation. Structural Integrity applies our expertise from years of experience in selective leaching detection and characterization.

### WHAT IS SELECTIVE LEACHING?

Selective leaching is a corrosion process in which one constituent of an alloy is preferentially dissolved by the environment, leaving the dealloyed metal weak and often porous. This "dealloying" may occur uniformly or locally, often without a measurable change in dimension.

### TWO TYPES OF SELECTIVE LEACHING

Selective leaching of cast iron (aka graphitic corrosion), which is used for piping, valves, pump casings, etc. in many water systems, results in a porous structure comprised of graphite flakes as the iron matrix selectively dissolves. Cast iron can be susceptible to graphitic corrosion from both the water and the soil sides.

Selective leaching of copper alloys involves preferential dissolution of the alloying element (Zn, Sn, Al, Ni) added to copper to improve its mechanical properties. The very thing that's making the copper strong is dissolving, leaving behind copper "sponge", further weakening the material and producing leakage through the porous material. Aqueous environments increase the likelihood of selective leaching.

### DETECTING SELECTIVE LEACHING

Selective leaching is best detected using two methods; Hardness Testing and Visual Examination.

1. Hardness Testing requires cleaning and disassembly of pump casings and valve bodies for access to the inside diameter. This is considered the most reliable method of detection and is the approach that most utilities have committed to for License Renewal.
2. Visual Examination is also often used and provides a recommended complementary measure to Hardness Testing. Because selective leaching (especially in cast iron) is difficult to assess due to the subtleties of color differences, it's important to have trained and experienced personnel, such as our experts at Structural Integrity, perform visual inspections.

For more information:

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## OUR SOLUTION

We use visual inspection and hardness testing to detect and quantify the extent of any selective leaching on potentially susceptible materials. Our multi-step process is customized to each client and entails some or all of the following:

1. Detailed review of selective leaching commitments
2. Optimum approaches to determining existence and extent of selective leaching (e.g., appropriately sized hardness indenters and loads)
3. Development of inspection procedures
4. Development of acceptance criteria
5. Performing selective leaching inspections
6. Modeling the responses to determine best approaches, probable resolutions, etc

We have extensive knowledge of all damage mechanisms, laboratory and field testing capabilities, the ability to assess continued fitness for service, repair/replacement designs, and the ability to adjust aging management program requirements based upon extensive industry experience. That is, we provide a complete solution package that is customized to each client's needs.

## WHY STRUCTURAL INTEGRITY

As many have found, we provide world-class knowledge and service to our projects and our clients.

- We've been an industry leader in materials degradation in power plants since the company was founded in 1983.
- We provide high level technical services to numerous nuclear facilities for license renewal commitments and aging management, including fatigue issues, irradiation embrittlement (e.g., pressure-temperature limit curves and LTOP concerns), buried piping, service water system piping and components, stress corrosion cracking and their global effects.
- We fully understand the environmental factors that influence selective leaching
- We apply the statistical rigor that is required to make good sense out of what we find (or don't find).

1. William S. Spickelmire, RUSTNOT Corrosion Control Services, Inc., *Corrosion Control Considerations for Ductile Pipe-A Consultants Perspective*, 2011 p 6-7

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