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Getting below the surface

A diver is trying to find out why steel in the Twin Ports' harbor corrodes so quickly

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With a syringe and spatula in tow, Chad Scott will be plunging into the Duluth-Superior Harbor a lot in the coming weeks.

Scott, a diver and principal partner of AMI Consulting Engineers P.A., began collecting clues Tuesday in the hope of finding what is eating away at steel in the Twin Ports' harbor.

David Bowman, a project manager for the U.S. Army Corps of Engineers in Detroit, is coordinating a \$300,000 federal effort to figure out why steel submerged in the harbor is corroding at a rate that's up to 10 times faster than scientists would expect to see in fresh water. The state of Minnesota has chipped in another \$100,000 to assist.

For now, the problem seems to be confined to the Twin Ports, Bowman said.

If corrosion continues, and steel in the harbor is damaged to such an extent that it requires widespread replacement, the cost could be staggering.

A previous study prepared for the Corps of Engineers estimated the cost to replace the steel pilings that gird the harbor's waterfront could be more than \$100 million. Replacing the ore docks and other steel structures would add even more to the bill.

So, with a brush and spatula in hand, Scott will collect and bag samples of the filmy growth that coats damaged sections of steel pilings. He also will use a hypodermic needle to explore what's happening within the blister formations found in some corroded areas.

The samples will be kept refrigerated until they can be examined by Randall Hicks, a University of Minnesota Duluth biology professor.

Using DNA testing, Hicks aims to identify what types of microorganisms are present, in areas where submerged steel is corroding and where it is not.

Scott said he plans to dive the Canadian National Railway dock in Two Harbors today to collect samples of the film that forms on steel structures elsewhere in Lake Superior. Scott said he has seen no similar corrosion on the Two Harbors structure and believes it can serve as a useful control for the Twin Ports study.

"We want to see if there are differences in the microbial communities we find," Hicks said. "If there are differences, we need to start focusing on those organisms that are active and that may be helping to accelerate corrosion."

In particular, Hicks is curious to see if testing reveals the presence of either iron-oxidizing or sulfate-reducing bacteria -- both of which have been implicated in other types of corrosion.

Bowman said Scott also will test water quality alongside the Twin Ports' piers. He'll collect samples and document the turbidity, conductivity, temperature and acidity of the water. He'll also note the levels of dissolved oxygen, salt and other nutrients to see if anything stands out.

As part of his job, Scott will map out the damage that has already been done to steel structures in the port, methodically documenting how pervasive pitting is at different water depths and how far the metal has been penetrated.

Scott first became concerned about the extent of steel corrosion in the harbor after exploring a U.S. Coast Guard pier in the late 1990s. He discovered some H-beams that had fist-sized holes in them caused by corrosion.

But Scott said he encountered skepticism when he documented other damage in the harbor and voiced concerns about what was happening to steel structures there.

"Initially, there was a lot of disbelief that we could have this kind of corrosion problem in fresh water," Scott said.

He credits Jim Sharrow, facilities manager for the Duluth Seaway Port Authority, for helping to bring attention to the issue.

Adolph Ojard, the Port Authority's executive director, agreed.

"Jim is a professional engineer, and as he analyzed this issue, he came to the conclusion that, yes, there was indeed something going on that needed to be studied," Ojard said. "I can't say enough good things about Jim and the tenacity he has shown. He has grabbed this issue and followed it through."

Scott said the study now under way could play a key role in quantifying and comprehending the issue.

"We need to understand the problem before we try to fix the whole harbor," he said.

Plans call for placing metal plates called coupons at different locations around the harbor to observe how quickly corrosive forces act upon them.

Bowman said by weighing and examining the coupons periodically, the research team will assess the rate of corrosion.

"I've seen the pitting start within one year of new steel being installed in the harbor," Scott said.

Bowman said he hopes the monitoring will continue into the future. He believes the results will become more valuable and illuminating over time.

"We want this to be a living database," Bowman said.

Sharrow said the U.S. House of Representatives has provided \$300,000 in continued funding for the corrosion study in its 2007 budget, but the Senate has not made a similar appropriation, yet.

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