

Hydrochloric Acid Recovery System for Galvanizers and Steel Manufacturers

With the escalating cost of waste disposal and scarcity of sites, galvanizers and steel manufacturers are seeking alternative methods of industrial waste control. The overriding industry trend seems to be toward on-site recovery and recycling. Furthermore, recent regulations have clearly indicated the relative desirability of on-site recovery.

Beta Control Systems, Inc., of Beaverton, Oregon, develops, manufactures, and installs state-of-the-art, closed-loop systems for recovering and recycling hazardous industrial wastes. With the help of a NICE³ grant from the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency, Beta plans to develop an on-site hydrochloric acid (HCl) recovery system for galvanizers and small- to medium-sized steel manufacturers.

■ **Challenge:** Although HCl recovery technology has been developed for large-scale steel manufacturers, no cost-effective method is available for galvanizers and small- to medium-sized steel plants. Beta introduced technology for sulfuric acid recovery in 1986. However, designing a system for an HCl acid recovery system has been more challenging.

■ **Solution:** Over the past 5 years, Beta has developed an HCl recovery system that the company plans to test at the pilot scale and then introduce to the marketplace. This system will recycle used acid solution from pickling, a process that cleans and removes rust from raw steel by dipping it into a tank of hydrochloric or sulfuric acid. After continuous pickling, the acid loses its effectiveness and must be replaced. Previously, the acid was transported to deep injection wells for disposal, but those wells are now permanently closed.

In the HCl recovery system, used acid is pumped through a pre-filter to an evaporator, where it is heated until the water and acid vaporize, leaving only concentrated iron chloride. The iron chloride is pumped to a storage tank for sale or disposal, or is converted to a crystal. The water/acid vapor cools and condenses, then descends through an absorption column into the stripper, where the acid is concentrated and pumped to the pickling tanks. The remaining water vapor moves into the condenser and is scrubbed of any residual acid. This scrubbed solution can be reused as rinse water in the pickling process.

This technology will allow industry to recover HCl at the source, eliminating disposal costs. Moreover, a non-hazardous, saleable by-product-iron chloride-will be generated. This

by-product can be used in fertilizer, animal feed, waste treatment, and as an etchant.

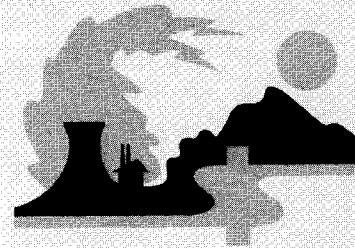
■ **Energy Savings:** The HCl recovery system eliminates the cost of fuel to transport wastes and chemicals to neutralize HCl; it also substantially reduces the cost of electricity. Projected energy savings are 5 billion Btu (5.28 trillion joules)/yr.

■ **Environmental Benefits:** Because the only by-product of the HCl recovery process is a non-hazardous, saleable metal chloride, this technology generates no hazardous wastes. Beta estimates annual waste reduction of spent HCl and neutralized sludge of 200 tons/unit and projects industry-wide HCl waste reduction of 42,000 tons (38,094 metric tons)/yr by 2010. Also, with the availability of recycled HCl, the demand for virgin HCl will decrease.

■ **Economic Savings:** This technology is economically attractive because it is less expensive than transporting and disposing waste acid, plus it eliminates the associated long-term liability. The total savings for a typical (small- to medium-sized) galvanizer using HCl to pickle steel are projected to be \$260,600 each year.

■ **Applications:** When the HCl recovery system is ready for introduction into the marketplace, the untapped 60% of galvanizers who are currently using HCl to pickle steel will have a cost-effective method of waste control. The system will also be helpful to the steel manufacturing market, which is dominated by HCl-based pickling. Potential future markets for this system include specialty metals and electronics markets.

NICE³



Partners: Beta Control Systems, Inc., Oregon
Department of Energy
SIC Code: 3823
Cost: \$245,608 (Industry share: \$100,000)
Energy Savings: 5 billion Btu (5.28 trillion joules)/yr
Environmental Benefits: Waste reduction of 200 tons (181 metric tons)/yr/unit
Economic Savings: \$260,600/yr
National Impact (2010): Waste reduced by 42,000 tons (38,094 metric tons)/yr
Applications: Steel manufacturers and galvanizing plants
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NATIONAL INDUSTRIAL COMPETITIVENESS through ENERGY ENVIRONMENTAL ECONOMICS

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