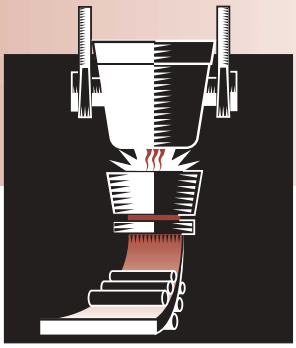
STEEL
Success Story



HYDROCHLORIC ACID RECOVERY SYSTEM

On-Site Hydrochloric Acid Recovery System Helps Steel Manufacturers Handle Wastes

Benefits

- Through 2000, has cumulatively saved over 280 billion Btu
- Recycles waste HCl for reuse, eliminating disposal of spent HCl and neutralized sludge
- Reduces demand for virgin HCl, conserving petroleum feedstock
- Through 2000, has cumulatively saved $3.6 million because of reduced costs for transporting and disposing of waste acid
- Eliminates long-term liabilities of waste disposal
- Generates a saleable by-product (iron chloride) that can be used in fertilizer, animal feed, and waste treatment applications
- Through 2000, has cumulatively reduced NO_x emissions by 74 tons and CO_2 emissions by 19,000 tons

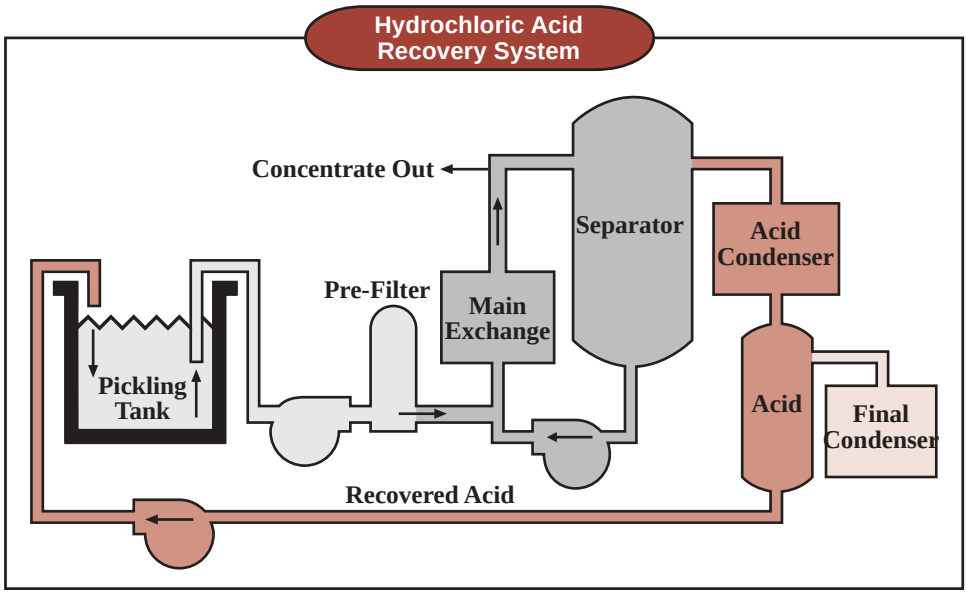
Applications

This system can be used in many applications including: galvanizing operations, steel manufacturing, and some specialty metals and electronics manufacturing.

The cost to transport and dispose of spent hydrochloric acid pickling solutions used by steel manufacturers to clean and remove rust is rising, and the number of toxic chemical disposal sites are quickly diminishing. Disposal site closures and rising disposal costs have manufacturers scrambling to find a cheaper and environmentally safe way to deal with spent acids. However, many manufacturers do not have the funds to develop entirely new processes.

Beta Control Systems, Inc., of Beaverton, Oregon, had a better idea. They pursued recovering and recycling the hydrochloric acid so its useful life can be lengthened and disposal can be deferred or even eliminated.

The U.S. Department of Energy's NICE^3 (National Industrial Competitiveness through Energy, Environment, and Economics) Program thought Beta's hydrochloric (HCl) acid recovery system showed merit, especially because it was designed to meet the needs of small- to medium-size manufacturing plants. In 1993 NICE^3 awarded Beta and the Oregon Department of Energy a $97,000 cost-shared grant to help the company market its system. "It also allowed us to present our system to an international forum," said Bryan Cullivan, Beta president and founder.



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Technology Description

Although HCl acid recovery technology exists in the market for large-scale steel manufacturers, no cost-effective method had been developed for galvanizers and small- to medium-size steel plants until Beta developed its new system between 1989 and 1994. The new HCl recovery system recycles used acid solution from the pickling process. Without recycling, waste HCl solution is disposed of by injection into deep wells or the acid is neutralized and the waste is then transported to a disposal site. With the new recovery system, acid is pumped through a prefilter to an evaporator where it is heated until the water and acid vaporize, leaving only concentrated iron chloride that is recuperated. The water/acid vapor is condensed into HCl, reconcentrated, and pumped to the pickling tanks. "The key advantages of our system include total recovery of all parts of the potential waste. The acid is recovered, the water reused, and the concentrated product is sold at a profit," said Cullivan.

Beta's Hydrochloric Acid Recovery System

"Our system was created to help find a more ecological way to deal with spent acids"

– Fred Thiem
Beta Chemist

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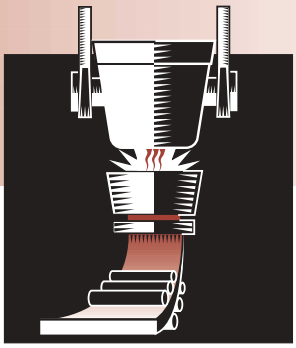

Project Partners

- Beta Control Systems, Inc.
  Beaverton, OR
- Cal West
  Long Beach, CA
- Galvanizers, Co.
  Portland, OR
- Oregon Department of Energy
  Salem, OR

Technology Benefits

The acid recovery system delivers significant savings. Currently, a typical small- to medium-size steel manufacturing plant spends $14 per ton to clean its products. With Beta's recovery system, manufacturers can slash that cost to just $3.40 per ton. The system costs about $250,000. Beta estimates a 73 percent internal rate of return, with a payback of 1.4 years for a one-gallon-per-minute system. Moreover, acid recovery requires minimal labor, and the life expectancy of a recovery system exceeds that of a conventional acid neutralization system by at least 3 years.

The recovery system also saves energy. Steam consumed at about 3 cents of energy per gallon of acid processed is needed to drive the reaction that recovers the acid compared with about $3 per gallon to neutralize acid, the process currently used to ready acid for disposal. Additional energy is saved by eliminating the acid-neutralization step and the need to transport and dispose of waste. An HCl acid recovery system operating at full capacity (25,000 liters processed per day) is estimated to save about 24 billion Btu per year over conventional transportation and disposal energy use. Since 1993 the systems operating in the United States have saved over 280 billion Btu.

"A wise man once said, 'When the well is dry, we will know the worth of water,'" said Cullivan. "The savings from resource recovery is measured in more ways than just energy and labor costs against disposal costs. When resources are wasted or turned into hazardous materials, they will never be returned. The greatest competition for acid recovery is cheap disposal–not other technologies. When good conservation laws are drafted and enforced unilaterally, the market will expand worldwide," he said. "Steel makers are faced with negative publicity and poor public perception–the steel industry is typically thought of as 'dirty.' Hauling highly corrosive, hazardous waste from the plant is a risky venture with high visibility and liability," he added.

November 2001

Commercialization Success

Since 1993 Beta has refined its recovery process and commercialized its system. Early users of the HCl recovery process are located in Saukville, Wisconsin, Long Beach, California, and Tampa, Florida. Beta has sold six systems in the United States as well as nine others in Europe, Asia, Mexico and the Middle East.

These companies are recycling their pickling acids and are also venturing into the agricultural product market. The ferrous chloride by-product of the recovery process can be sold for up to $100 per ton. Cullivan noted that "one of our customers who spent over $8,000 per week for the disposal of spent pickling acid now sells the ferrous chloride by-product from our system for a net profit of $2,000 per week after operating costs."

According to Beta Chemist, Fred Thiem, the company's recovery system was not developed to create revenue for its clients. "Our system was created to help find a more ecological way to deal with spent acids. The real benefits of this technology are process control and cost minimization," he said. The installation of this equipment in Wisconsin has lead to two separate pollution-prevention awards presented by the state.

Industry of the Future — Steel

Through the Office of industrial Technologies (OIT) Industries of the Future initiative, the Steel Association, on behalf of the steel industry, has partnered with the U.S. Department of Energy (DOE) to spur technological innovations that will reduce energy consumption, pollution, and production costs. In March 1996, the industry outlined its vision for maintaining and building its competitive position in the world market in the document, ***The Re-emergent Steel Industry: Industry/ Government Partnerships for the Future.***

OIT Steel Industry Team Leader: Isaac Chan (202) 586-4981.

NICE^3 – National Industrial Competitiveness through Energy, Environment, and Economics: An innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry. This grant program provides funding to state and industry partnerships for projects that demonstrate advances in energy efficiency and clean production technologies. Awardees receive a one-time grant of up to $525,000. Grants fund up to 50% of total project cost for up to 3 years.

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