

# STEEL

## Project Fact Sheet



## RECYCLING ACID AND METAL SALTS FROM PICKLING LIQUORS

### BENEFITS

- Domestic energy savings over the current process of almost one million barrels of crude oil equivalent per year
- Cost savings in hundreds of millions of dollars per year by eliminating the need to neutralize and bury waste pickling liquor in landfills
- Eliminates the burying of neutralized pickling waste, resulting in enormous environmental benefits
- Produces saleable by-product
- Global energy savings would be on the order of about 2 to 3 million barrels of crude oil equivalent per year
- Saves 250 million gallons per year in waste sulfuric acid
- On-site facility
- Economical small size
- Simple continuous operation

### APPLICATIONS

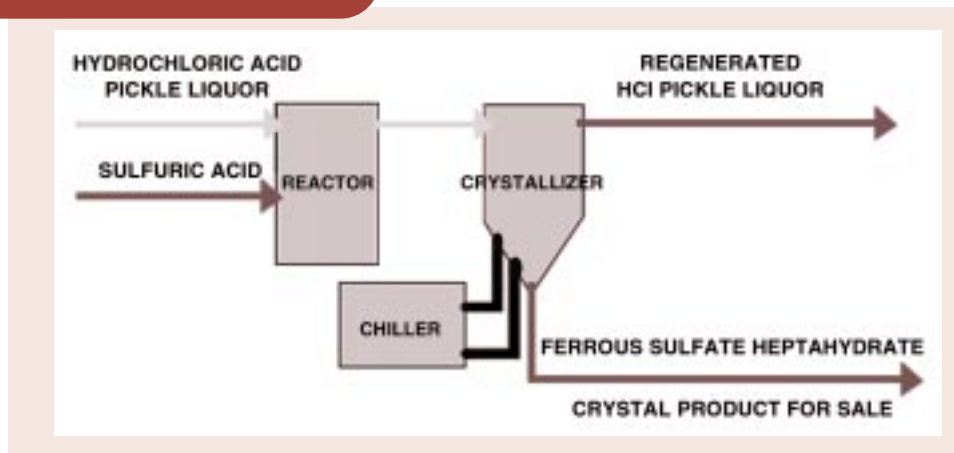
This invention was developed for the iron and steel industry. About 15,000 companies in this industrial area can benefit from the economic and environmental advantages of this new process.

## REGENERATING HYDROCHLORIC ACIDS FROM METAL FINISHING PICKLING BATHS REDUCES COSTS, WASTES AND PRODUCES A FERROUS SULFATE BY-PRODUCT

For many iron and steel processing companies, Pickliq® Hydrochloric Acid Regeneration, a new process for renewing the wastewater (called pickling liquor) used to remove oxide coatings from metal, promises to be a cost-saving and environmentally friendly solution to the current removal method. This new technology replaces the roasting method of regenerating spent pickling liquor that produces FeO sometimes as a by-product, but often as a waste. Most companies neutralize the spent liquor with lime and send the resulting neutralized waste to landfills.

While economics often dictate that spent liquor be transported to central roasting facilities, Pickliq® Hydrochloric Acid Regeneration can be located onsite, avoiding costly transportation of waste and is economical for most facilities. Ferrous sulfate heptahydrate crystals are produced as a by-product. This commodity is in demand and is marketable. Recycling acids from pickling baths significantly reduces the costs and environmental concerns associated with neutralizing and disposing of solid waste from metal finishing. In addition, because the zero-discharge process also produces a saleable by-product, the acid and metal salts from the pickling liquor, it is economically appealing.

### RECYCLING PICKLING LIQUOR



By replacing the costly neutralization and dumping method currently used in metal finishing, the steel industry can increase savings by recycling and reselling the spent pickling liquor.



## Project Description

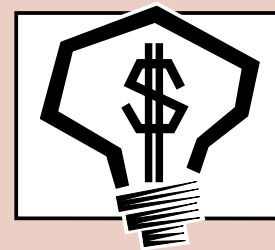
**Goal:** The goal of this project is to build the initial full-scale modules of a production prototype regeneration unit at an operating steel mill. The inventor proposes to construct this plant as a joint enterprise with the Green Technology Group and Chester Engineers, a division of U.S. Filter, and the operating company of the mill.

The invention is a process for regenerating and recycling hydrochloric acid from pickling baths used in metal finishing operations. The process differs from the general technologies now in use because it uses sulfuric acid to regenerate hydrochloric acid from pickling liquor. The regeneration is based on the ability to crystallize ferrous sulfate from hydrochloric acid containing ferrous chloride by adding sulfuric acid to the spent pickling liquor. Then, purified hydrochloric acid is recycled back into the process. The inventor's process is thus a zero (waste) discharge process that in addition produces a saleable product. The inputs to the process are the waste pickle liquor and only enough makeup sulfuric acid to replace the sulfuric acid that becomes part of the product.

Green Technology Group is developing this new technology with the help of a grant funded by the Inventions and Innovations program through the Department of Energy's Office of Industrial Technologies.

## Progress and Milestones

- ✓Developed the basic physical chemistry.
- ✓Bench tested the regeneration process.
- ✓Bench tested the crystallization of ferrous sulfate heptahydrate from regenerated acid.
- ✓Built pickling simulator.
  
- Assemble regeneration pilot on trailer lab.
- Operate pilot test of process and pickling.
- Design and build prototype plant.
- Economic and technical report and proposal.
- Build commercial facility.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

## PROJECT PARTNERS

Inventions and Innovation Program  
Washington, DC

Green Technology Group  
Pawling, NY

## FOR PROJECT INFORMATION, CONTACT:

Douglas R. Olsen  
Green Technology Group  
58 North Quaker Hill Road  
Pawling, NY 12564  
Phone: (914) 855-0331  
Email: greentg@aol.com

## FOR PROGRAM INFORMATION, CONTACT:

Sandy Glatt  
Program Manager  
Inventions & Innovation Program  
U.S. Department of Energy  
1000 Independence Ave., SW  
Washington, DC 20585  
Phone: (202) 586-2079  
Fax: (202) 586-7114  
sandy.glatt@ee.doe.gov

Visit our home page at  
[www.oit.doe.gov](http://www.oit.doe.gov)

Office of Industrial Technologies  
Energy Efficiency  
and Renewable Energy  
U.S. Department of Energy  
Washington, D.C. 20585

## INDUSTRY OF THE FUTURE—STEEL

*Through OIT's 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: Scott Richlen (202) 586-2078.



DOE/GO-10099-686  
January 1999