# Iron & Steel

| Sector At-a-Glance | |
|---|---|
| Number of Facilities: | 95 |
| Value of Shipments: | $51 Billion |
| Number of Employees: | 140,000 |

Source: American Iron & Steel Institute, 2004[1]

## Profile

The iron and steel sector[2] manufactures the steel used in the production of a wide range of products, ranging from food storage containers, to defense applications, to ship hulls. In 2003, Indiana mills produced about 20% of domestic steel, with Ohio, Illinois, Michigan, and Pennsylvania leading the rest of the many other states in which steel is made.[3]

Advances in technology, changes in markets, and global competition have led to many changes in the iron and steel sector. More than 30 steel companies have declared bankruptcy since 1998.[4] The sector's workforce fell from nearly 170,000 in 1997 to approximately 140,000 in 2004.[5]

**Production Process** To produce steel, facilities use one of two processes, which utilize different raw materials and technologies.

- "Integrated" steel mills use a blast furnace to produce iron from iron ore, coke, and fluxing agents. A basic oxygen furnace (BOF) is then used to convert the molten iron, along with up to 30% steel scrap, into refined steel.
- "Minimills" use an electric arc furnace (EAF) to melt steel scrap and limited amounts of other iron-bearing materials to produce new steel.

The scrap metal used in steel production originates from sources such as scrapped automobiles, demolished buildings, discarded home appliances, and manufacturing returns. Finishing processes, such as rolling mills, are similar at both types of mills.

**Partnerships** The American Iron and Steel Institute (AISI) and the Steel Manufacturers Association (SMA) have formed a partnership with EPA's Sector Strategies Program to improve the environmental performance of the iron and steel industry. Together AISI and SMA represent the majority of U.S. steel companies.[6]

**Key Environmental Opportunities** The iron and steel sector is working with EPA to improve the industry's performance by:

- Managing and minimizing waste;
- Reducing air emissions;
- Increasing energy efficiency; and
- Promoting environmental management systems.

## Managing and Minimizing Waste

Two-thirds of U.S. steel is now produced from scrap, making steel America's most recycled material.[7] In fact, all new steel contains at least 25% recycled steel.[8] However, steelmaking still presents a variety of opportunities to remove undesirable materials from the recycling stream, increase reuse of co-products and byproducts, and reduce releases to the environment.

### Automotive Scrap Metal Recycling

Obsolete automobiles are an important source of scrap metal. In 2001, the steel industry consumed the steel from 14.5 million recycled automobiles, in turn generating enough steel to produce more than 15 million new automobiles.[9]

One pressing problem in the use of scrap from automobiles is the potential presence of mercury. Automakers have used mercury in various applications, but the most prevalent use was in hood and trunk convenience light switches in domestic automobiles. Automakers phased out the use of mercury in convenience switches in 2002, but millions of older vehicles that will be recycled in the next few years contain up to a gram of mercury per car in the switches. Currently, few automotive dismantlers remove these switches before the vehicles are flattened or shredded, so the mercury is carried into the recycling stream.

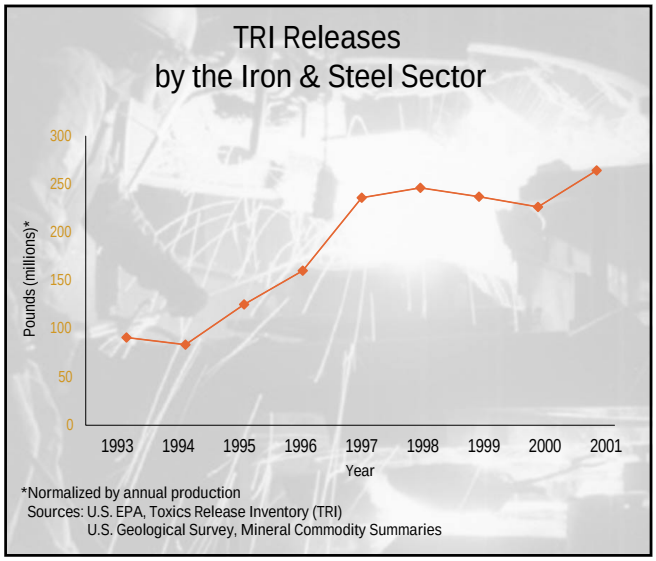
EPA, steelmakers, and other stakeholders are working to limit or prevent potential emissions of mercury from convenience switches and to reduce the use of toxic materials in new products. To this end, AISI and SMA participate in a coalition with dismantlers, shredder operators, and environmental groups, known as the Partnership for Mercury Free Vehicles.[10] The partnership is pursuing policy solutions, such as state legislation, to bring about the recovery of existing mercury applications and to limit future uses of mercury in vehicles. EPA is working with these and other stakeholders, including state agencies, to explore potential voluntary and regulatory solutions.

### Beneficial Reuse of Slag

Through the Sector Strategies Program, steelmakers and EPA hope to increase the beneficial reuse of materials generated during steel production. For example, iron or blast furnace slag, which is formed at integrated mills when iron ore, fluxing agents, coke, and other compounds combine, can be reused for construction and agricultural applications, such as road building aggregate, cement, or soil remineralization. In 2003, approximately 19 million tons of domestic iron and steel slag, valued at approximately $300 million, were consumed off-site.[11]

### Environmental Releases

Iron and steel facilities use a variety of chemicals and report on the release and management of many of those materials through EPA's Toxics Release Inventory (TRI). Between 1993 and 2001, normalized TRI releases by iron and steel facilities increased steadily, as new or upgraded air pollution control equipment generated additional pollution control residues for disposal. Recycling remained the predominant waste management method used in the sector, although energy recovery increased during this time period.[12]




## Reducing Air Emissions

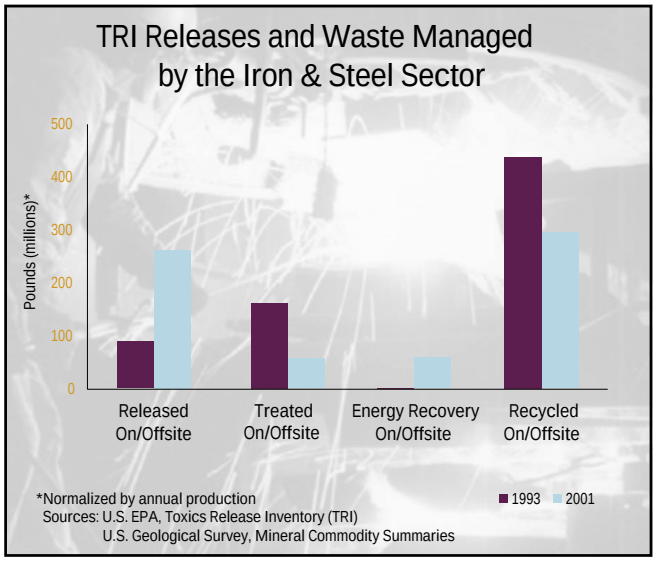
Steelmaking generates a variety of air emissions, including both hazardous air pollutant (HAP) and greenhouse gas (GHG) emissions.

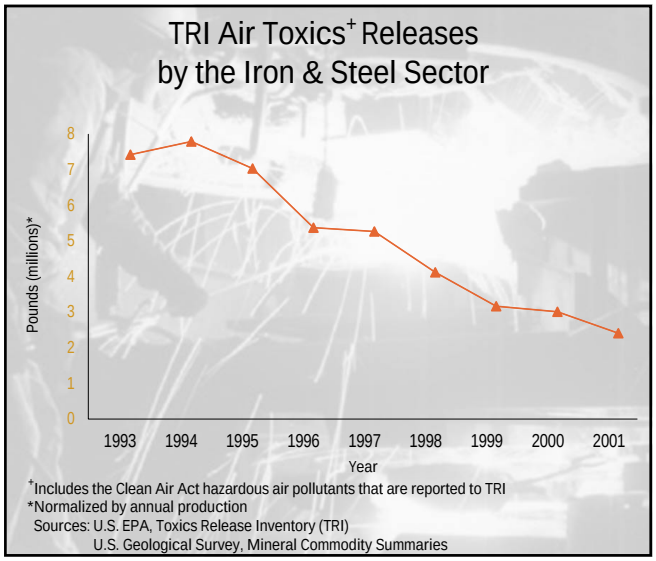
### Hazardous Air Pollutant Emissions

Depending upon their operations, common HAPs from iron and steel facilities include hydrochloric acid, manganese compounds, phenol, naphthalene, and benzene. Between 1993 and 2001, total normalized releases of HAPs, as reported to TRI, declined by 71% in the sector.[13] Much of this decrease is due to the installation of pollution control equipment to meet new air requirements, such as the Clean Air Act's New Source Performance Standards.

The operation of new or upgraded air pollution control equipment at steel mills often results in the generation of additional pollution control residues, such as EAF dust and filter cakes, whose disposal must be reported to TRI as a release. Therefore, TRI releases from the iron and steel sector rose between 1993 and 2001, while TRI-reportable air emissions declined.[14]

Depending on economics and other factors, EAF dust can be processed to recover zinc and other materials. When zinc prices are low, however, EAF dust is more likely to be disposed and reported as a TRI release.



### Greenhouse Gas Emissions

Steelmaking generates GHG emissions both directly and indirectly.

- Integrated mills produce carbon dioxide ($CO_2$), a GHG, when transforming coke and iron ore into iron.
- Both minimills and integrated mills consume significant amounts of electricity, the generation of which results in GHG emissions.

In 2003, AISI joined Climate VISION, a voluntary program administered by the U.S. Department of Energy (DOE) to reduce U.S. GHG intensity (the ratio of emissions to economic output).[15] To help achieve this goal, the industry is researching alternative means of production at integrated mills that would not generate $CO_2$, seeking to reduce or capture GHG emissions from current production methods, and exploring ways to increase energy efficiency.[16]

## Increasing Energy Efficiency

The iron and steel industry, which relies heavily on coal and natural gas for fuel, is one of the largest energy consumers in the manufacturing sector. In 1998, the industry used approximately 1.6 quadrillion Btus of energy, representing approximately 7% of all U.S. manufacturing use and 2% of overall domestic use.[17]

In a just-completed report to DOE, the industry reported achieving a 17% reduction in energy intensity per ton of steel shipped since 1990. Because of the close relationship between energy use and GHG emissions, the industry's aggregate $CO_2$ emissions per ton of steel shipped were reduced by a comparable amount during this same period.[18]

As part of their Climate VISION commitment, the industry has commited to increasing its energy efficiency by 10% by 2012 (from 2002 levels).[19]

### *Case Study: Energy Efficiency at North Star Steel*

*With help from DOE, North Star Steel conducted an assessment of its Wilton, IA, minimill to identify plant-level opportunities to increase energy efficiency and, in turn, reduce GHG emissions. In 2003-2004, the minimill completed two projects identified during the assessment. By installing carbon and oxygen injection in the EAF, as well as low-$NO_X$ burners and Level 2 controls on its billet reheat furnace, the mill saved more than 58 billion Btus of electricity and natural gas, for a reduction of more than 4 million pounds of $CO_2$ equivalents. These and other projects will contribute to the goal of North Star's parent company, Cargill, Inc., to reduce energy use by 10% by the year 2005.*[20]

### *Case Study: Landfill Methane Outreach Program*

*Jersey Shore Steel, in Jersey Shore, PA, and the Clinton County Landfill, both members of EPA's Landfill Methane Outreach Program, developed a methane gas reclamation project to use landfill emissions for energy at the rolling mill. Jersey Shore uses gas piped from the landfill to power its reheat furnace, saving 15% in energy costs and reducing GHG emissions by 71,000 tons of $CO_2$ equivalents per year.*[21]

## Promoting Environmental Management Systems

Most of the 20 integrated mills, and more than one third of the 75 minimills that produce carbon steel, have implemented environmental management systems (EMS).[22] To date, three iron and steel facilities have been accepted into EPA's National Environmental Performance Track. In addition, SMA is a Performance Track Network Partner committed to encouraging top environmental performance through EMS.[23] Through the Sector Strategies Program, EPA and its partners hope to increase the number of facilities with EMS.

### *Case Study: EMS at Nucor Steel*

*Through its EMS, Nucor Steel's Auburn, NY, minimill committed to use scrap tires as a substitute for coal in steelmaking, utilizing the tires' carbon, energy, and steel. Nucor consumed more than 600,000 tires in the first 18 months of the program, avoiding the use of 4,000 tons of coal.*[24]