Metal Casting

Sector At-a-Glance	
Number of Facilities:	2,800
Value of Shipments:	$28 Billion
Number of Employees:	210,000

Source: U.S. Census Bureau, 2001[1]

Profile The metal casting sector[2] encompasses both foundries and die casting facilities. Metal casters are primarily small businesses that produce a wide range of goods, ranging from engine blocks and cylinder heads to jewelry and plumbing fixtures.

Metal casting facilities are located across the country, but most are concentrated in the Great Lakes states, Alabama, California, and Texas.[3]

Production Process The metal casting process involves pouring molten metal into molds, allowing it to cool, then removing the resultant casting. Die casters and foundries utilize different casting processes.

- Die casters produce non-ferrous (primarily aluminum) castings under high pressure in permanent metal molds.
- Foundries cast both ferrous and non-ferrous metals, using primarily disposable molds made of sand, wax, foam, or other materials. Foundries (but not die casters) must break apart their molds in order to remove the castings.

All metal castings require some degree of finishing to remove excess metal as well as dirt, grease, oil, oxides, and rust.

Partnerships The North American Die Casting Association (NADCA) and the American Foundry Society (AFS) have formed a partnership with EPA's Sector Strategies Program to improve the environmental performance of the metal casting industry. NADCA's membership includes corporate and individual members from more than 950 companies from the die casting industry.[4] AFS represents nearly 10,000 members of the die casting and foundry industries.[5]

Key Environmental Opportunities The metal casting sector is working with EPA to improve the industry's performance by:

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

Increasing Energy Efficiency

Given the energy-intensive nature of its manufacturing processes, reducing energy consumption is an important environmental focus for the metal casting sector. The most energy-intensive process in metal casting is the melting of metal, which accounts for approximately 55% of total energy costs.[6] Other energy-intensive processes include core making, mold making, heat treatment, and post-casting activities. Voluntary efforts are underway in the sector to reduce the energy requirements of these key processes.

Case Study: Industries of the Future

The U.S. Department of Energy's (DOE) Industries of the Future (IOF) program creates government-industry partnerships to accelerate technology research, development, and deployment in nine energy-intensive industries, including metal casting.[7]

Industry participation in the program is managed by the Cast Metals Coalition (CMC), which was founded by several trade organizations, including AFS and NADCA.[8] CMC has set measurable goals for 2020, including using 20% less energy to produce castings, compared to the sector's 1998 energy requirements of 320 trillion Btus.[9]

Some of the ways that CMC and IOF are moving toward meeting this goal include:

- *Encouraging the development of new technologies like the "lost foam" casting process, which could improve energy efficiency by as much as 27%;*
- *Increasing research on aluminum die casting alloys to reduce the weight of automotive castings, for a potential energy savings of almost 2 trillion Btus per year; and*
- *Developing software to optimize furnace controls to reduce coke/coal use by as much as 5%, for a potential energy savings of 400 million Btus per year per unit by the year 2020.[10]*

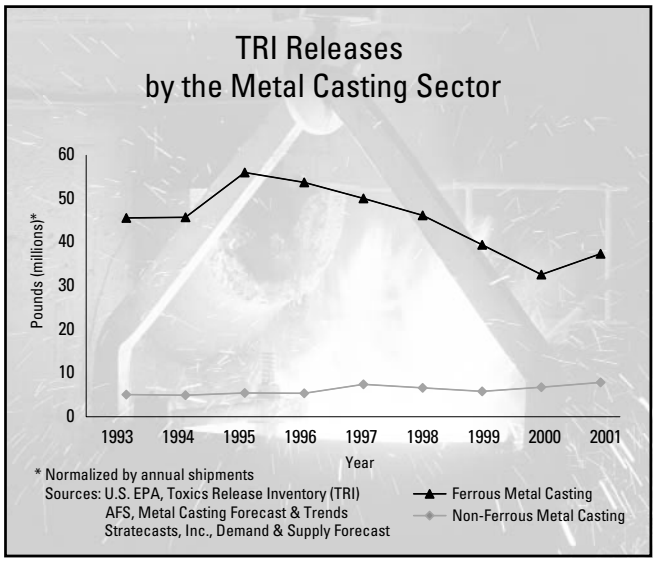
CMC and IOF have also set industry performance targets to develop environmental technologies to achieve 100% pre- and post-consumer recycling; 75% beneficial reuse of foundry byproducts, such as foundry sand; and the complete elimination of all waste streams.[11]

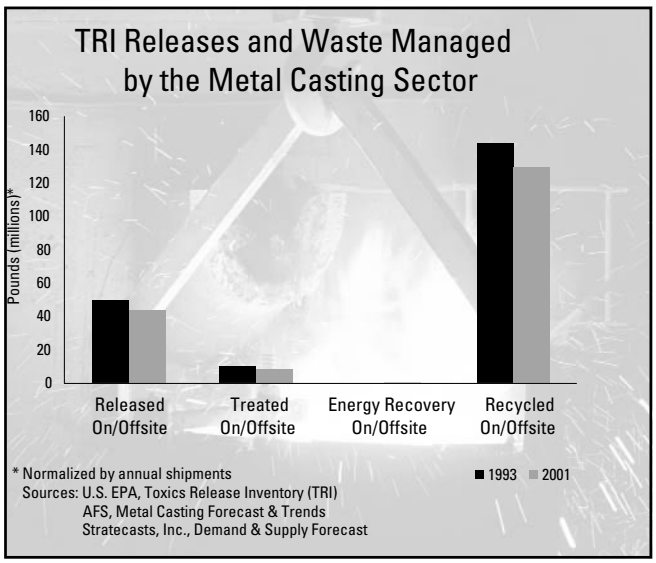
Managing and Minimizing Waste

The metal casting sector is working to reduce releases to the environment and increase the reuse of industrial byproducts like foundry sand.

Reduction in Environmental Releases

Metal casters use a variety of chemicals and report on the release and management of many of those materials through EPA's Toxics Release Inventory (TRI). Over the past decade, the sector has made progress in reducing wastes. Between 1993 and 2001, normalized TRI releases by metal casting facilities decreased by 11%. These reductions can be attributed to an 18% decrease in releases from the ferrous segment of the industry, which accounts for most of the sector's releases. During this time period, most of the sector's waste was managed through recycling.[12]





Beneficial Reuse of Foundry Sand

Foundries that use sand molds utilize vibrating grids and/or conveyors to shake the mold from the casting. These foundries then reprocess the sand to remove lumps, metal, impurities, and fine particles. Although foundries can recondition and reuse sand many times, the sand eventually loses the desired physical characteristics and must be sent for reuse elsewhere or disposed of in a landfill. Markets exist for the reuse of spent foundry sand, but many states restrict its use in construction applications such as roadbeds, even when the sand is non-hazardous.

In 1998, state foundry associations, AFS, and industry suppliers formed Foundry Industry Recycling Starts Today (FIRST) to develop options for the recycling and beneficial reuse of foundry sands.[13] One of FIRST's goals is to quantify reuse rates and set reuse goals in key states. Currently, only the state of Wisconsin requires reporting on the use and disposal of spent foundry sands. Based upon data collected from both generators and landfills, the Wisconsin Department of Natural Resources estimates that approximately 68% of the spent foundry sand generated in that state is beneficially reused.[14]

To encourage beneficial reuse, EPA released a review of state practices and regulations regarding foundry sand in 2002 as a resource for the industry and for states wishing to share best practices.[15]

Case Study: Beneficial Reuse by Resource Recovery Corporation

A Michigan cooperative, Resource Recovery Corporation (RRC), receives third-party foundry sands from many foundries, identifies beneficial reuse opportunities, and then provides a consistent supply of material to end users, such as a local asphalt company. RRC estimates that in 2002 its activities reused more than 41,000 tons of recyclable materials (including sand and metals) that would otherwise have been diverted to landfills. Since 1997, more than 210,000 tons of sand and 3,600 tons of metal have been reused through RRC.[16]

Conserving Water

In order to conserve water, the metal casting sector is exploring technologies for recovering and re-circulating the wastewater used to lubricate and cool dies during the die casting process.

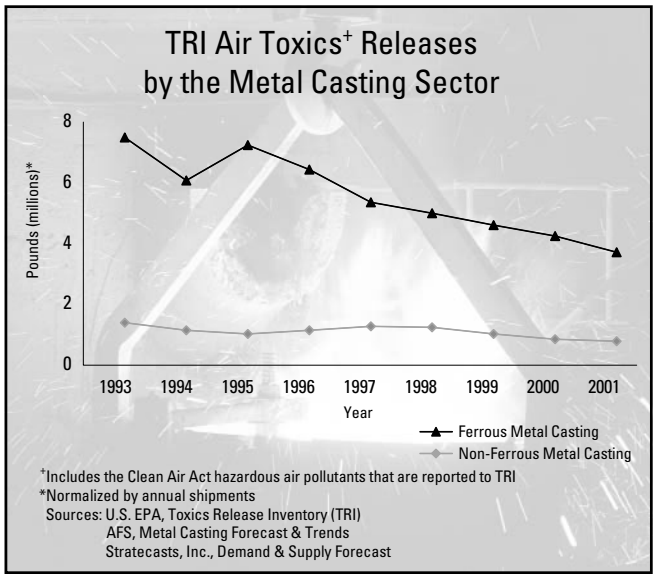
Case Study: Re-circulating Wastewater at Kennedy Die Casting, Inc.

Kennedy Die Casting in Worcester, MA, installed a wax and water-based lubrication system for its die cast machines, replacing one that was solvent-based. The new system re-circulates wastewater and reduces water discharges. Prior to the changes, Kennedy Die Casting used 7 to 8 thousand gallons of water per day. Currently Kennedy Die Casting uses 400 gallons per day.[17]

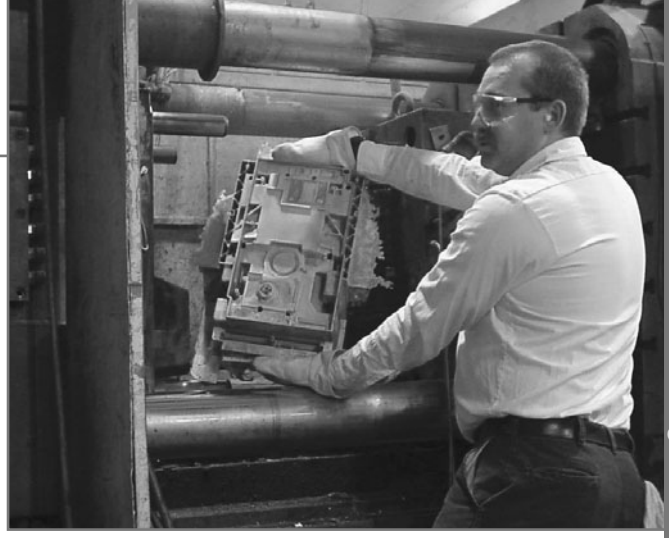
Reducing Air Emissions

The metal casting sector is working to reduce emissions of hazardous air pollutants (HAP), including organic air pollutants and metals. The organic air pollutants are primarily generated while making the core portions of the molds, shaking the mold away from the casting, and pouring the molten metal, while the metals are primarily generated during melting, pouring, and finishing processes.

Between 1993 and 2001, the normalized quantity of HAP releases, as reported to TRI, declined by 53% in the ferrous segment of the industry and by 60% in the non-ferrous segment.[18]



+Includes the Clean Air Act hazardous air pollutants that are reported to TRI
*Normalized by annual shipments
Sources: U.S. EPA, Toxics Release Inventory (TRI)
AFS, Metal Casting Forecast & Trends
Stratecasts, Inc., Demand & Supply Forecast



Promoting Environmental Management Systems

More than 50% of metal casting products are used by the automotive and transportation industries. Many automotive companies now require that their direct suppliers maintain environmental management systems (EMS) that are compliant with the ISO 14001 standard. To meet these supply chain demands, trade associations within the metal casting sector have taken an active role in encouraging the development of EMS by members.

Together with AFS, NADCA, the Indiana Cast Metals Association, and the Indiana Department of Environmental Management, the Sector Strategies Program has developed EMS tools for die casters and foundries, including customized EMS Implementation Guides and a brochure highlighting the financial benefits of EMS.[19] In addition, NADCA is a Performance Track Network Partner committed to encouraging top environmental performance through EMS.[20]

Many metal casters are finding that EMS can be an effective tool for performance improvement.

Case Study: EMS at Chicago White Metal Casting, Inc.

Chicago White Metal (CWM) in Bensenville, IL, implemented an EMS over five years ago. CWM is the first metal casting facility to be accepted into EPA's National Environmental Performance Track.[21] *Through its EMS, CWM has:*

- *Recycled an additional 4,000 pounds of plastic stretch film, 5,600 wood pallets, 177,000 pounds of scrap steel, 81,000 pounds of office paper, and 148,000 pounds of corrugated material;*
- *Reduced annual solid waste disposal by 75%; and*
- *Reduced natural gas usage by at least 45%.*[22]