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RE-Konnect

Risk Engineering Bulletin

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In Focus: Steel Plants

Did You Know?
Interesting Facts about Steel

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Brief on Steel Industry

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Blast Furnace Explosion, UK Plant

Engage
Solve Questions and Win Prizes

Editor's Note

The increasing presence of Indian Steel companies in the global market testifies improvement in the operational parameters of Indian plants affected through establishment of new state-of-the-art plants and their continuous modernization and implementation of de-bottlenecking and technology up gradation schemes in the older plants. At the same time energy efficiency of the plants in terms of coke rate and power consumption has also improved through better management of facilities. Thus the average techno-economic parameters of an Indian plant vis-à-vis international benchmarks show that the Indian plants are fast catching up with the best in the world.

It is however observed that steel making processes being of robust nature and involving huge cost of material inputs and machines, it is always prone to potential material damage and consequent business interruption losses. Such losses can be prevented or at least minimized by proper Risk Management in Steel Plants, which shall be instrumental towards increasing productivity levels and shall also be helpful in arranging insurance covers with better terms from insurers and re-insurers in the international market.

In this issue of RE-Konnect, we provide you a brief overview, specifically focusing on steel plants, steel making process, major challenges faced by Indian steel industry and a case study on steel plant explosion. The idea is to get you familiar with some specific aspects related to steel industry.

Did You Know?

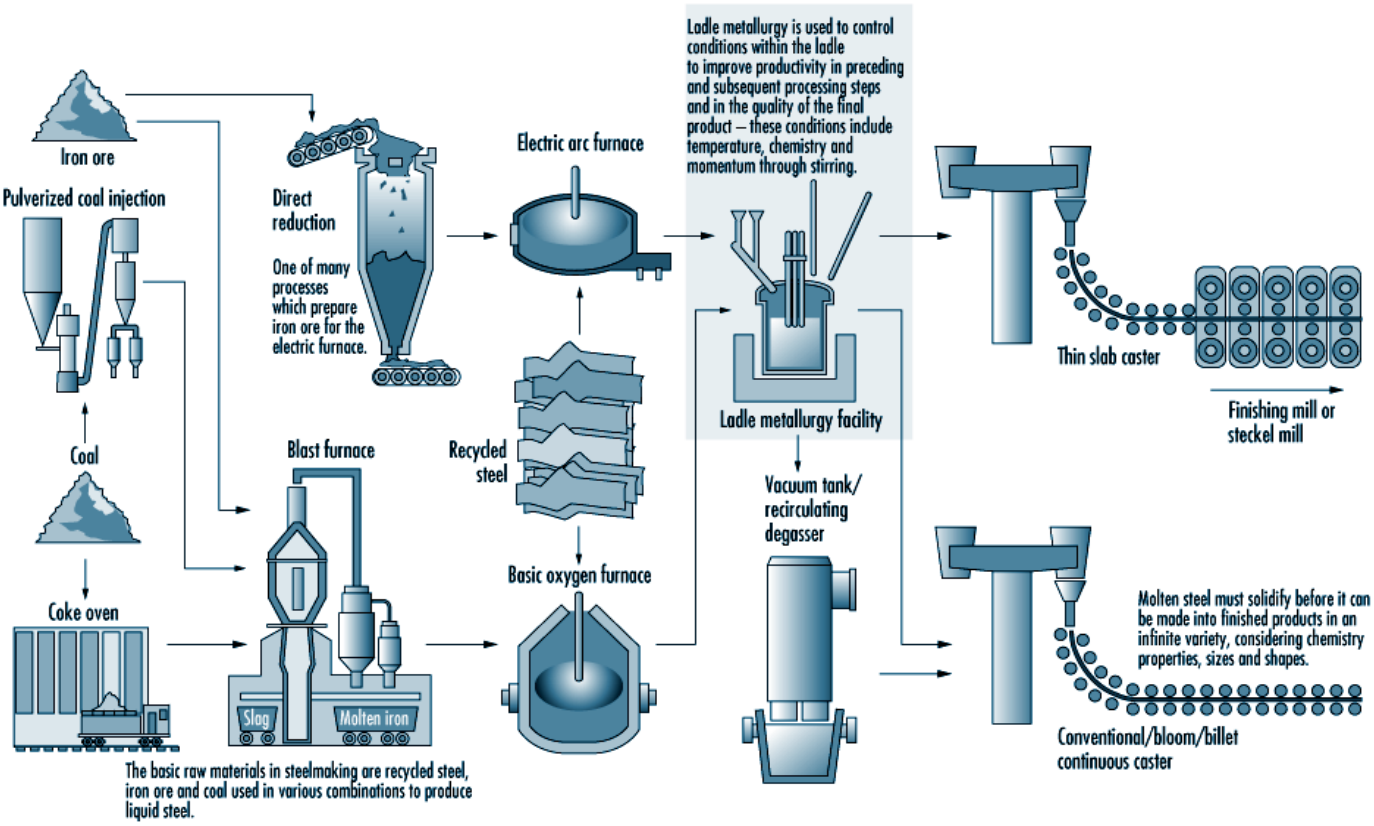
- Steel is roughly 1,000 times stronger than iron in its purest form, and it can be recycled without loss of strength.
- Almost 69 percent of steel which is more than 80 million tons is recycled in North America each year, which is more than paper, aluminium, plastic and glass combined.
- Steel was first used for skyscrapers in 1884 with the Home Insurance Building in Chicago.
- Because steel and iron expand when heated, the Eiffel Tower (1887), is about 6 inches taller in the summer than the winter.
- Steel bridges are four to eight times lighter than those built from concrete. The Golden Gate Bridge (1937) required 83,000 tons of steel whereas half of that amount would be required today.
- Two-thirds of all canned goods' packaging is made out of steel. More than 600 steels cans are recycled every second in the United States.

Industry Overview

Steel is considered to be a vital component of development in any modern economy. The level of per capita consumption of steel is treated as one of the important indicators of socio economic development and living standard of the people in any country. India continually posts phenomenal growth records in steel production. In FY16, crude steel production in India was 89.8 MT, with the total crude steel production growing at a CAGR of 12.61 percent over the last five. The steel sector contributes 2 per cent to the GDP of the nation and provides 6 Lakh jobs in the country.

Manufacturing Process

Steel making begins with Iron making. For iron making, the essential feature is the blast furnace, where iron ore is melted (reduced) to produce pig iron. At a temperature of 1,600°C the pig iron melts and collects at the bottom of the furnace. The furnace is removed periodically, and the pig iron may then be poured into pigs for later use or into ladles where it is transferred, still molten, to the steel-making plant. Pig iron contains large amounts of carbon as well as other impurities (mainly sulphur and phosphorus). It must, therefore, be refined. The carbon content must be reduced, the impurities oxidized and removed, and the iron converted into a highly elastic metal which can be forged and fabricated. This is the purpose of the steel-making operations. There are two types of widely used steel-making furnaces: the *basic-oxygen process converter*, where steel is made by blowing air or oxygen into molten iron and *the electric arc furnace*, where steel is made from scrap iron and sponge-iron pellets.



Source: American Iron and Steel Institute.

Major Challenges

India has terrific competitive benefits in the steel industry, but there are some major challenges that are not allowing the industry to graduate to higher production levels. One of the biggest challenge areas for the industry is human resources. Other challenges include capital, low potential utilisation, inferior quality products, low productivity etc.

Lack of Capital

The iron and steel industry is highly capital intensive and to remain competitive both domestically and globally, a steelmaker has to keep updating/upgrading its facilities and process which demands large amount of capital investment. But this increased volatility in financial markets over the last few years has forced investors to become risk averse. Investors want early returns with short-term investments, but our country's steel growth from here on will need long-term investments in new technologies and the infrastructure.

Raw Material Troubles

With an extended fall in steel prices globally, steel making raw materials have been in a tough spot. Most of the material offers touched an all time low in a decade and trading below or close to breakeven. The implosion in prices is attributed to large oversupply of the raw material and prolonged dullness in Chinese economy; which also resulted in high over capacity in steel and losses.

Shortage of Metallurgical Coal

Although India has huge deposits of high grade iron ore, her coal reserves, especially high grade cooking coal for smelting iron are limited. Many steel plants are forced to import metallurgical coal. For example, steel plant at Vishakhapatnam has to import coal from Australia.

Low Productivity

The per capital labour productivity in the country is at 90-100 tonnes for steel industry, whereas it is 600-700 tonnes per person in Korea, Japan, and other steel producing nations. It will require retraining of the workforce to increase the labour productivity.

Low Capacity Utilization

Easy availability of cheaper imported steel products, extended raw material issues related to availability and prices of ores and coal, reduced operating margins etc the steel industry in India has been on an average operating at about 60% capacity utilization level.

Huge Demand

Even after low per capita consumption rate of steel, the demand for iron and steel is increasing every day and huge chunks of iron and steel are to be imported in order to meet the demands. In order to save invaluable foreign exchange, productivity needs to be increased.

Inferior Product Quality

The secondary steelmaking route may not be comparable to the blast furnace route of steelmaking when it comes to quality. As a matter of fact, more than 50% of steel in India is made through the secondary route. Low amount of interest in modern technologies and weak infrastructural facilities lead to a process of steel making that is more time consuming, expensive and even yields inferior quality products. Such a situation has also forced Indian users to import better quality steel from abroad.

Case Study

Explosion in Blast Furnace, UK Plant

In November 2001, Blast Furnace exploded at a UK Plant, killing three employees and seriously injuring 12 employees and contractors. Many more suffered minor injuries and shock. The entire furnace, which with its contents weighed approximately 5000 tonnes, lifted bodily at the lap joint, rising some 0.75 m from its supporting structures, leading to the explosive release of hot materials and gases into the cast house.

The outcome of the explosion was unprecedented in the steel-making industry, but was the result of many failings in safety management by the company over an extended period. The explosion occurred after a prolonged attempt – over two days – to recover the furnace from a chilled-hearth situation caused by cooling water ingress. The immediate cause was the mixing of water and hot materials within the lower part of the furnace; the precise mechanism remains a matter that is not fully resolved. The event attracted considerable public attention locally, nationally, and internationally within the wider steel-making industry.

Lessons Learnt

The investigations identified a number of learning points for the plant and its blast furnace operations, the wider steel industry and other manufacturers. The lessons below are presented as a summary which include procedural, engineering, human factors and reliability issues.

Safety Management

Lesson 1 The Company should review the role and function of the Safety Department. It should be better integrated into operational and engineering management.

Lesson 2 Predictive tools for the assessment and management of risk should receive greater use within the steel industry and other process industries: example Hazard and Operability Studies (HAZOPS), Failure Modes and Effects Analysis (FMEA), Fault Tree Analysis (FTA), Process Hazard Review (PHR) and Layers of Protection Analysis (LoPA).

Lesson 3 Sufficient cooling water for furnaces should be available at all times; the supply systems should have an adequate level of reliability built into the system. This reliability should be brought about by good engineering design (including an adequate level of redundancy) and suitable maintenance, and should be monitored to indicate any threats to its integrity.

Design and Instrumentation

Lesson 4 Speed in locating furnace cooling water leaks is essential. Rapid leak detection relies on good engineering, adequate detection protocols and suitably trained and competent operators.

Maintenance

Lesson 5 Maintenance, inspection and, where appropriate, testing of plant and equipment associated with the reliable delivery of water to furnaces should be paramount. The potential effects of lack of maintenance, inspection and testing in terms of safety should be clearly understood. There should be adequate prior communication between works departments when any maintenance or other work that may potentially affect safe plant operation or reliability is proposed. Formal protocols should be considered for this. Safety-critical items should be identified and protocols and priorities established for their maintenance, inspection and testing.

Management of Change

Lesson 6 A formal system of pre-modification risk assessments should be instituted for any changes (including changes to operating parameters) proposed to safety-related plant and equipment. This should be coupled with post-modification safety reviews. The management of change system should include evaluation and assessment not only by the engineering and operational functions, but also by appropriately experienced and competent safety professionals. All such changes should be carefully recorded and subsequently re-evaluated to determine their actual operational impact.

Decision Making

Lesson 7 In emergency situations, there should be management arrangements such that there is a clear 'line of responsibility' for decision making. There should be no doubt whatsoever as to who is making which decisions.

Lesson 8 Decisions made by managers under pressure from adverse plant or process conditions present a potential source of significant error. Adequate training and experience is essential, but more precise decision-making protocols should be available for foreseeable circumstances to guide and inform decision making. Careful consideration should be given to providing emergency event-simulation training etc to build operator confidence and skills in emergency conditions.

Human Factors

Lesson 9 The awareness of the danger of water/metal and water/slag explosions should be raised among all employees engaged in processes where this is a risk. The degree of risk presented by molten materials coming into contact with water continues to be not fully appreciated.

Lesson 10 The process risks associated with safety-critical plant, especially ageing plant, should be thoroughly understood through rigorous assessment processes, with these being subject to regular review. Specifically, with water systems on blast furnaces, a 'leakage tolerant' attitude should not be allowed – especially with older furnaces. Such raised acceptance of water leaks increases the risks of an adverse event occurring at some point.

Engage

Answer the following questions to win Amazon Coupons worth Rs 500 each. Send the answers to editor.bulletin@tata-aig.com
Five winners of this quiz will be announced in next issue.

1. A huge heap of old iron waste material is discovered by you. In which furnace should you put them for efficient processing?
   a) Basic-Oxygen Furnace b) Electric-Arc Furnace c) Blast Furnace d) Any of these

2. In the Case Study discussed which of the following is the most critical procedure in the immediate aftermath of the situation?
   a) Business Continuity Planning b) Management of Change c) Emergency Response Planning d) Failure Modes and Effect Analysis

3. A thorough training on the perils and dangers of the processes involved would have the most impact on which of the following category of "Lessons Learned"?
   a) Decision Making b) Safety Management c) Maintenance d) Human Factors

Winners of the Quiz in Previous Issue

(We received a tremendous number of correct answers and had to decide based on lucky draw)

- Asha NC | Marsh India Insurance Brokers Pvt. Ltd.
- Bharat Mody | J.B. Boda Insurance broker Pvt. Ltd.
- Aseem Agarwal | Aon Global Insurance Brokers Pvt. Ltd.
- Ujwal Nagdeote | Almondz Insurance Brokers Pvt. Ltd.
- Vishal Purohit | Tata AIG General Insurance Company Ltd.

Answers to the Questions in Previous Issue

1. Floating 2. China 3. Silicon

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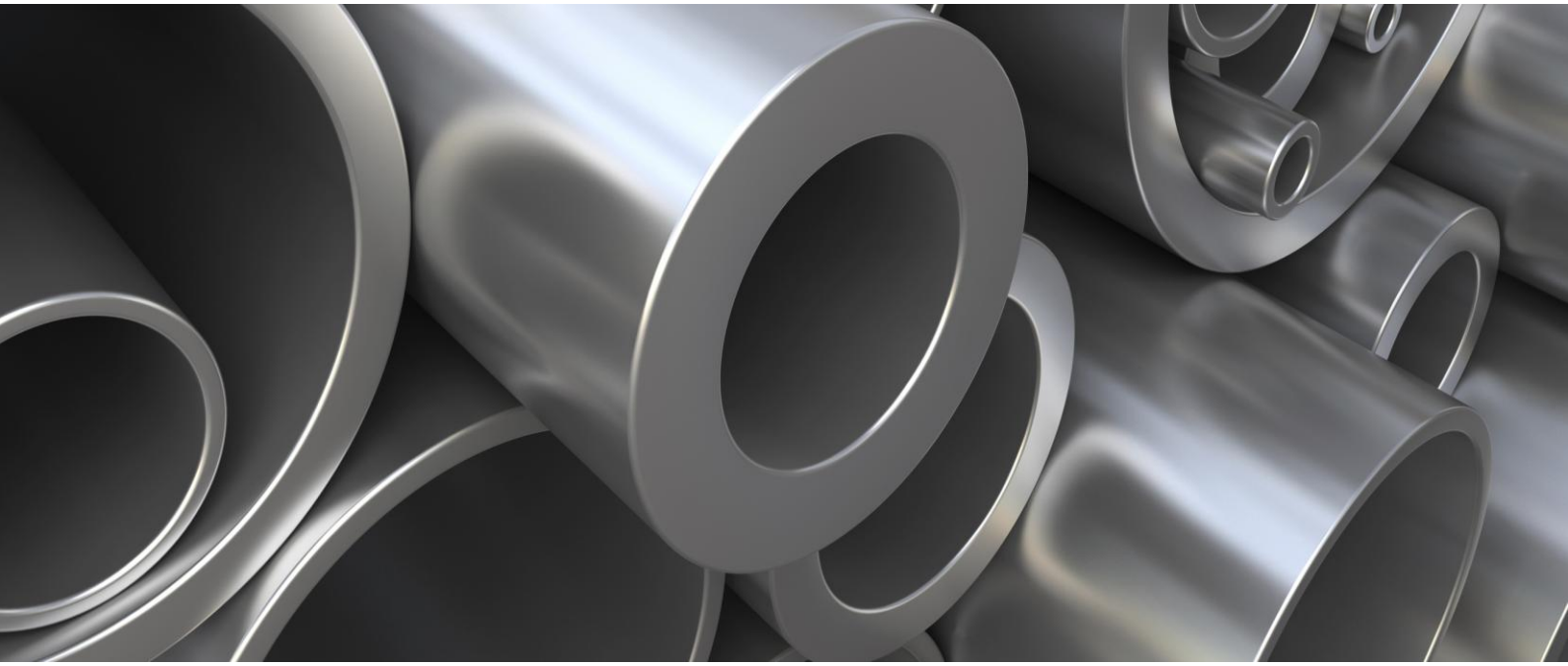

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