



The steel industry presents considerable fire risks: HKM steel slab casting plant in Duisburg–Huckingen.

### Special challenge

# Plant-specific fire prevention in the steel industry

The steel industry is booming. Production load is enormous – the steel plants run at full speed. It is very obvious how catastrophic the production downtimes and service disruptions would be due to a fire: the economic damage would amount to multimillions within the shortest period of time. The current increased investment into fire prevention is not unfounded. Tailor-made and adequate protection concepts are very important for the many fire risks in the steel industry.

Steel is a versatile material that is used in all important branches. The steel industry is definitely booming. The year 2007 was exceptionally successful for the German steel industry: crude steel production rose to a new record level of 48.55 million tons. Thus, Germany is the largest producer of crude steel in the EU. 2008 also promises to be a good year for steel worldwide. 1.4 billion tons are predicted for world steel production in 2008\*. With such high production loads equipment availability and process maintenance of the steel plants takes highest priority.



Blast furnace 5 (Rogesa) in the night.

### High risks

The fire hazard in the steel industry is immense. The warm and cold strip plants, welding machines, central control and hydraulics rooms, oil cellars, cable channels and diverse coating and staining units – all of these branches contain high risks. Production machines are particularly exposed to high risk of fire through oil or other flammable liquids and sediments together with hot components and electric ignition sources. Moreover, high risk results from significant unit related fire loads such as ►



plastics, lines and oil storage. Service disruptions and production downtimes could be a consequence. Even a small fire could paralyze an entire plant – with disastrous economic damage. Only adequate technical fire prevention can help avoid such fatal accidents effectively. The high fire load present fire prevention with a great challenge, but with a combination of different extinguishing equipment optimal complete protection of production machines and processes can be achieved. When designing customised prevention concepts, the various causes of fire as well as possible spread of fire should be taken into consideration above all.

### Use of complete fire prevention portfolio

Due to very different prevention purposes and processes in a steel plant, a large spectrum of fire prevention systems is necessary: fire on production machines can basically occur at any time. How fast it is detected and extinguished is decisive. Thus, the fire detection system is an important module of responsible security management. Fire detection units detect fire hazard and recognise initial fires 24/7. Depending on the area of application flame or heat alarms are used. To detect fire, a defined fire control system is acti-

vated, which is adjusted to different production processes in and on machines. This way fire can already be combated in the beginning.

To protect buildings – in particular large production halls as well as hydraulics and oil rooms underground – a sprinkler ►



Sampler at a ThyssenKrupp Steel furnace in Duisburg.



Stains in ThyssenKrupp plant in Duisburg.

#### Inf Box

#### The steel industry – an overview

Today, steel is one of the most important industry materials. The steel industry produces intermediate products, such as hot wide strips, forging parts, sheet metal, rails, long products, wire and pipes, which are then processed further to make end products. Through the permanent optimisation of the characteristics and processing possibilities of steel, a range of new fields of use are established. For example, materials and technology have been developed for automotive lightweight construction, which reduce the weight of a mid-range vehicle by more than 25% whilst simultaneously meeting ever-increasing safety requirements. Another important development is presented by ultra-high strength multiphase steel, which can be easily formed into bodywork and vehicle parts. Examples of innovative concepts in the construction sector are new products for the façade sector and solar technology photovoltaic modules with a steel basis. In household appliances, screens, modes of transport and packaging: steel is present everywhere.

Although the Earth's crust is made of up to 5% iron, the most important base material for steel, industry's demand for the raw material demand is not yet covered. At the beginning of 2003, the situation concerning raw materials changed dramatically, mostly as a result of increasing steel demands in China, India and Brazil. In today's society, it is impossible to meet the demand for raw material. In light of such developments, prices for raw materials and steel products have gone through the roof – steel is scarce and expensive. Furthermore, no reversal of this trend seems high; steel production and raw material demand will continue to increase further. The demand for iron ore can be met through the establishment of new mining plants..

#### The ten largest steel producing companies in the world

(in terms of the number of tonnes of crude steel produced annually)

<b>Mittal Steel Company N.V.</b> (The Netherlands, USA, Ukraine)	<b>60.9 million t</b>
fusioniert mit <b>Arcelor</b> (Luxembourg)	<b>45.2 million t</b>
<b>Nippon Steel</b> (Japan)	<b>32.4 million t</b>
<b>JFE GroupHolding</b> (Japan)	<b>31.6 million t</b>
<b>Posco</b> (South Korea)	<b>30.2 million t</b>
<b>Shanghai Baosteel</b> (People's Republic of China)	<b>21.4 million t</b>
<b>US Steel</b> (USA)	<b>20.8 million t</b>
<b>Corus</b> (The Netherlands, Great Britain)	<b>19.0 million t</b>
<b>Nucor</b> (USA)	<b>17.9 million t</b>
<b>ThyssenKrupp</b> (Germany)	<b>17.6 million t</b>

Source: [www.stahl-online.de](http://www.stahl-online.de)



system with a foaming agent admixture is used. This way, along with cooling of the fire water, other extinguishing effects are achieved: foam and film formation impedes oxygenation and suppresses the flame.

A fine spray system with open clearing nozzles protects objects; dynamic impulse and cycle batching, electrolytic coil coating, roll stands and welding machines amongst others can be protected by fine spray systems. A particularly intensive cooling effect as well as evaporation of a sticking effect results from generation of fog. Through this, fine spray systems provide highly effective fire prevention with low use of extinguishing water for object protection in open areas of a steel plant.

Sensible technologies, objects and areas such as EDP units, control rooms and control cabinets are protected by inert gas systems. They extinguish rather free of residue so that no damage can be caused by the extinguishing agent. Extinguishing is done by oxygen suppression with natural inert gases obtained from air such as argon, nitrate and carbon dioxide.

Special solutions for aspiration can be implemented with inert gas systems. Thus, for example, aspiration inerting is possible over a specific period of time in case of fire: oxygen concentration is dropped under 10 vol.-percent. Fire spreading is confined and explosive concentrations in discharge air are suppressed. Hazardous fire rollovers from one tub to another or to other areas like hydraulic or cable channels could be avoided effectively in this way. ■



Particularly efficient fire prevention: fine-sprinkling technology effectively uses the physical properties of water.



CO<sub>2</sub> cylinder: gas extinguishing system extinguishes without residue and damaging effects on sensible protection objects.

#### Technology Box

#### Fine Spray Technology: extinguishing with minimum water supply

Fine spray extinguishing systems offer highly-effective fire protection with low water requirements for specific applications. A special nozzle or sprinkler is used to achieve a fine spray of water, whilst the entire surface of the water is multiplied through the fine spectrum of drops. The water mist is especially effective for reducing the heat of the flames. The fire and surroundings are cooled immediately. Vaporisation of the extinguishing water in the fire is also associated with a large amount of heat production, and the resulting water vapour simultaneously hinders the oxygen supply to the fire source:

Fine spray sprinkler systems unite the advantages of fine spray technology with the targeted use of extinguishing water by the sprinkler system to offer an especially cost-effective water use. In the event of a fire, only the sprinklers located within immediate proximity to the fire source are activated. Fine spray sprinkler systems can therefore be installed to save maximum space, and are ideal for used in office and administrative buildings, hotels and underground garages.

Fine spray extinguishing systems with open spray nozzles are generally used to protect objects, such as cable ducts, engine test benches, paint boxes, pickling lines and presses. In order to effectively prevent a fire from spreading, the extinguishing water is sprayed finely over the whole protected area to stem the fire in just a few seconds.

For the protection of rooms and objects onboard ships, specially-designed high pressure fine spray systems are used. Such systems meet high requirements particularly onboard ships concerning the minimisation of space and weight conditions.