Water management in steel industry – state of the art and challenges

at Joint Cross Cutting Issue Workshop Water Efficiency in Process Industry

Thorsten Thörner
Agenda

- Water management in steel industry
- Challenges for water management
- Sustainable steel production
Water management in steel industry

Water consumption is always a function of water availability in connection with:

- Energy efficiency
- Treatment efficiency
- Legal regulatory
- Safety and health requirements

Source: worldsteel

The life cycle of water

IN

Use

Treatment

OUT

Treatment of water can be biological, chemical or physical.

Water is used for cooling and in the steelmaking processes.
Steel industry – integrated plant and electric arc furnace

Source: Stahl-Zentrum, 2017
Water use in iron and steel industry – integrated steelworks

› Cascade system from cold rolling mill to blast furnace

› Using rainwater

Source: Eurofer
Water use in iron and steel industry – integrated steelworks

1.200.000.000 m³/y
~97 % recirculation and cascade use
< 3 % refilled with fresh water
~ 1,6 % losses as evaporation, bond, etc.
~ 1,2 % discharge as waste water

Source: Eurofer
Water use in iron and steel industry – Electric arc furnace

Direct cooling
› Optional: slag treatment

Indirect cooling
› Oven cooling
› Top gas cooling

Process water
› Top gas cleaning

Top gas cleaning water
Top gas Cooling water
Oven Cooling water
Optional: EAF slag treatment

Electric arc furnace
### Water types in iron and steel industry

<table>
<thead>
<tr>
<th>Application</th>
<th>Media</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Cooling</td>
<td>Water</td>
<td>Hot rolling, casting, quenching</td>
</tr>
<tr>
<td>Indirect Cooling</td>
<td>Water</td>
<td>Oven cooling (e.g. blast furnace) Machinery cooling</td>
</tr>
<tr>
<td>Various applications</td>
<td>Water</td>
<td>Descaling</td>
</tr>
<tr>
<td></td>
<td>Water</td>
<td>Gas washing (e.g. blast furnace)</td>
</tr>
<tr>
<td></td>
<td>Water</td>
<td>Water-jet vacuum pump operation for vacuum treatment of steel</td>
</tr>
<tr>
<td></td>
<td>Water</td>
<td>Material conditioning (e.g. slag granulation)</td>
</tr>
<tr>
<td>Further liquid media</td>
<td>Emulsion / cleaning agent</td>
<td>Cold rolling / degreasing bathes</td>
</tr>
<tr>
<td></td>
<td>Inorganic acids / water</td>
<td>Pickling / rinsing</td>
</tr>
</tbody>
</table>

**Definition:**

Contact water/direct cooling: water with direct contact with (hot) steel e.g. hot rolling, quenching

Non-contact water/indirect cooling: water without product contact, e.g. machine or oven cooling
Example – Water treatment flow sheets

Treatment of waste water in iron and steel industry varies from simple heat exchange for cooling water up to complex pollutant removal in various process waters.
Challenges for the steel industry in water management

› Review Water framework directive (WFD)
› Ordinance on facilities for the handling of substances hazardous to water
› German strategy for micro-pollutants
› Energy efficiency in water management
BDI’s proposals for the review of the Water Framework Directive (WFD)

› Maintain the broad thrust of WFD but review the interaction between objectives and derogations (articles 4.5 and 4.7 WFD)
  › Less stringent environmental objectives (divergent management objectives) - Art 4.5 WFD
  › Formulation of the derogation in article 4.7 WFD
› Frame deterioration ban and improvement aim in more practical terms (article 4 WFD)
› Review phasing-out obligation (article 16.6 WFD) and delete if appropriate
› Modify “one out-all out”
› Mechanisms for assessment of chemical status
› Improve possibility to designate artificial / heavily modified water bodies
Ordinance on facilities for handling substances that are hazardous to water

Steel industry use different types of substances that are hazardous to water in different processes

› Process examples: Secondary metallurgy, warm and cold rolling, coating, storage of substances, etc.
› Substances examples: coolants and lubricants, hydraulic fluids, acids, salt, organics

Protection of the water is quite necessary in connection with the water management

› Steel industry expert organization “Überwachungsgemeinschaft von Betreibern von Anlagen zur Erzeugung, Be- und Verarbeitung von Metallen (Metallanlagenbetreiber) e. V. (ÜMet)“
› Trainings for “Fachbetrieb nach WHG”
› Inspection by experts
German Strategy for micro-pollutants

German Strategy for micro pollutants focused mainly on

› Human and Veterinary drugs,
› biocides,
› plant protection products,
› industrial and household chemicals or
› body care and laundry detergents

The strategy process is still ongoing.

Steel industry is probably affected with regard on biocides in water cycles to keep them clean or to prevent Legionella for example.
Energy efficiency in water management becomes more and more important

Examples

› water reduction,
› energy efficiency of pumps and
› heat recovery

Achievements:
During the last 30 years Steel industry in Germany reduced the Water intake by 75 %

→ Along with energy efficient pumps this means less energy for water extraction, water treatment and water circulation.
Holistic approach to water management

› It is necessary to assess the effectiveness of water reuse in an integrated manner, taking all environmental aspects into consideration.

› Resource efficiency should consider actual consumption i.e. difference in intake and discharge (of the same or better quality), as well as availability aspects and influences on other resource categories such as energy.
Sustainability in steel industry in Germany

Steel - committed to sustainability

**WATER**

Water is a particularly worth protecting and a vital resource. Therefore, the steel industry developed an almost closed water cycle in production. Every drop of water is used statistically hundreds of times in modern cycles again before it leaves the plant.

**Approaches**

- Optimize recirculation and cascade use
- Reduction of specific water consumption by another 5 percent
Thank you for your attention!

Contact:
German Steel Federation
Thorsten Thörner
+49-211-6707-870
Thorsten.Thoerner@wvstahl.de

8.2.2018 Water management in steel industry• Thorsten Thörner