MERCURY, SO\textsubscript{x} AND DUST CONTROL

BREF – BEST AVAILABLE TECHNIQUES REFERENCE
FOCUS ON MERCURY REDUCTION

Based on local conditions and individual requirements, ANDRITZ works closely with its customers to develop a tailor-made solution.

REFERENCES

References and current projects from ANDRITZ in the field of air pollution control technologies.

A PRODUCT RANGE FOR ALL REQUIREMENTS

Clean environment for a better tomorrow. ANDRITZ is a leading global supplier of innovative air pollution control technologies with more than 30 years of experience and over 200 installations around the world.

SOx AND DUST REDUCTION

Energy savings, reduced maintenance costs, and only minor adjustments to local conditions clearly speak for ANDRITZ’s FGD-plus technology. The unique design benefits set the FGDplus apart from comparable technologies.

SMART SOLUTIONS INTEGRATED INTO EXISTING SYSTEMS

Several design options are available to choose from depending on the upstream processes and potential pollutants to be filtered out, including tailored solutions for industrial applications. Our goal is the removal of acid gases (SOx, HCl, HF), particulate matter, mercury (Hg), heavy metals and nitrogen oxides (NO), dioxins and furans.
A product range for all requirements

**WET LIMESTONE FLUE GAS DESULPHURIZATION (FGD)**

ANDRITZ offers wet limestone flue gas desulphurization (FGD) scrubbers with high reliability and availability based on a well-known principle of washing flue gas with limestone suspension and generates gypsum as a saleable end product. We have enhanced this basic process and now offer the most advanced scrubbing technology (FGDplus).

**POWER STATION APPLICATIONS:**
- Wet limestone flue gas desulphurization
- FGDplus
- Mercury removal

**INDUSTRIAL APPLICATIONS (INCL. EFW AND BIOMASS PLANTS):**
- Wet flue gas cleaning
- Multi-stage scrubber
- Combined systems

**DRIY FLUE GAS CLEANING (FGC)**

ANDRITZ dry flue gas cleaning processes are based on circulating fluidized bed technology and offer an ideal solution for flue gas cleaning downstream of conventional thermal power stations, biomass incineration plants, RDF-fired boilers (Refuse Derived Fuels), or Energy from Waste plants and other industrial applications.

**POWER STATION APPLICATIONS:**
- Turbo-CDS
- Dry sorption

**INDUSTRIAL APPLICATIONS (INCL. EFW AND BIOMASS PLANTS):**
- TurboSorp
- Dry sorption

**DENOX/SCR**

ANDRITZ utilizes the Selective Catalytic Reduction (SCR) process technology for the denitrification of flue gas – as high- and low-dust as well as tail-end configuration. Dioxins and furans can also be decomposed with the SCR tail-end configuration.

**POWER STATION APPLICATIONS:**
- SCR (high-dust application)
- SCR for combined cycle power plants (CCPP)

**INDUSTRIAL APPLICATIONS (INCL. EFW AND BIOMASS PLANTS):**
- Dry Sorption Processes (DSI) with sorbent injection

**FABRIC FILTER & ELECTROSTATIC PRECIPITATOR (ESP)**

Dust filters in the form of fabric filters or electrostatic precipitators are used as the second stage in the ANDRITZ TurboSorp process. In addition these filter types are applied in Dry Sorption Processes (DSI) together with an upstream sorbent injection, with Calcium or Sodium based or carbon based adsorbents. Finally ANDRITZ offers fabric filters or ESP’s as stand-alone equipment for particulate separation after all kinds of incineration processes or other industrial applications.

**POWER STATION APPLICATIONS:**
- Electrostatic Precipitator (ESP)
- Fabric Filter Installations

**INDUSTRIAL APPLICATIONS (INCL. EFW AND BIOMASS PLANTS):**
- Dry Sorption Processes (DSI) with sorbent injection

ANDRITZ patented washwater hydrocyclone for mercury reduced gypsum dewatering.
Smart solutions integrated into existing systems

An European Union wide harmonization of dust, NOx, SOx and mercury limits in large-scale combustion plants ("BREF regulations" - Industrial Emissions Directive 2010/75/EU) requires each member state to implement newly specified emission ranges through national limits within a fixed period of four years (deadline: 18-Aug-2021). The tightening of these limits will be a major challenge for existing plants. Therefore, smart solutions integrated into existing systems are required. ANDRITZ’s experience shows that every plant has the potential to realize the required improvements of SOx, NOx, dust and mercury removal with reasonable operational adjustments and manageable plant expansions. For this reason, ANDRITZ takes a holistic approach, especially when it comes to optimizing existing plants. Our goal is to work closely together with our customers and offer a reliable and cost-effective process solution. Based on many years of experience in the design, supply and construction of turnkey air pollution control systems as well as multiple in-house developments in the areas of mercury, dust and SOx removal, ANDRITZ is perfectly equipped to implement the BREF regulations.

CUSTOMER REQUIREMENTS
• Tightening of emission values for several pollutants
• Plant optimization required ("every plant has some potential")
• Sustainable solutions for stable operation taking account of the operating environment (disposal costs, ...)
• Manageable operating costs
• Short response times between individual load ranges
• Multi-pollution control solutions (e.g. combined SOx and dust separation)

BREF (BEST REFERENCE) REQUIREMENTS
• Mandatory implementation period for dust, Hg, SOx, NOx, ...
  by August 17, 2021
• Mandatory increase in the efficiency of the entire plant

ANDRITZ VALUE PROPOSITION
• Innovative solutions (e.g. mercury-free gypsum)
• Assessment of the entire process chain for all pollutants (internal loops, sink formation)
• Consideration of long-term behavior (e.g. Hg re-emissions)
• Merging of several requirements in a move towards multi-pollution control
MACRO VIEW

ANDRITZ patented washwater hydrocyclone
Mercury reduction
Keep it simple!

Minimizing mercury emissions in a power plant process requires an integral view of all possible mercury sources and sinks across the entire flue gas cleaning path.

This applies to both, fly ash removed in the electrostatic precipitator and potential by-products such as gypsum and sewage sludge. Equally important is accurate information about all factors influencing mercury oxidation, absorption and adsorption after the boiler outlet.

With this information and right interpretation of the data, mercury flows can be influenced with known technologies. In simple terms, the mercury removal process of every air pollution control system can be divided into three main areas (see fig. 1).

Based on local conditions and individual requirements, ANDRITZ works closely with its customers to develop a tailor-made solution. The focus is on individual core products (see fig. 2).

ANDRITZ technologies
ANDRITZ can draw on know-how in all relevant areas of mercury control; from oxidation to stabilization and separation. The models illustrated herein were specifically developed for the applications. These models go far beyond an instantaneous observation based on individual measurements, but rather make a long-term view possible. This is essential for a realistic assessment of the overall process in terms of re-emissions, a targeted sink transfer and sustainable operational safety (see fig. 3).

The ANDRITZ technologies show their strengths especially when compared to its operating costs. For example, the bromine-based oxidation - exclusively offered by ANDRITZ - is evidently the most cost-effective solution currently available on the market. This cost advantage is even visible in combination with conventional processes (CaBr₂ + low cost PAC dosing compared to high effective PAC dosing).

Sustainable solutions
ANDRITZ focuses on sustainable solutions, also considering possible negative impacts. For example, the issue of corrosion is part of the process determination. Within this perspective it is important to consider, that bromine in flue gas is not unusual. It is found in any coal, where halogens are available. In general, compared to the chlorine content in the coal, roughly 1 to 3% thereof is bromine.

This is also the effective operation range, which ANDRITZ recommends for any additional bromine dosing onto the coal. Therefore, corrosion effects based on additional added bromine can be excluded.
SOx and dust reduction
Keep it simple!

FGDplus is a technology developed and patented by ANDRITZ to improve SOx and dust removal. After several years of R&D and optimization, ANDRITZ was able to install its first FGDplus references in power plants beginning in 2014 (see fig. 1).

During the development of the FGDplus technology, ANDRITZ paid particular attention to the robustness of the system and the prevention of material build-up. These features were proven successfully in all bituminous coal and lignite-fired reference projects. The resulting higher operational reliability compare to other air pollution control technologies is, amongst other things, based on the chosen layout and optimized piping design (see fig. 2).

In all our reference projects, FGDplus elements made out of PP were used. These operate successfully even at high inlet temperatures up to 190°C. The successive R&D including testing of the FGDplus technology in a large industrial pilot plant (up to 50,000 Am³/h) at RWE Niederaussem gave ANDRITZ the advantage to develop precise design models by plotting all main inlet parameters examined under real operating conditions. This comprehensive design model enables ANDRITZ to make detailed predictions of achievable removal efficiencies as well as operating conditions of all auxiliary equipment.

Energy savings, reduced maintenance costs, and only minor adjustments to local conditions clearly speaks for ANDRITZ’s FGDplus technology. The unique design benefits set the FGDplus apart from comparable technologies. An operation with almost no material build-up, especially under critical operating conditions, is another key advantage.

### REFERENCES

<table>
<thead>
<tr>
<th>PROJECTS</th>
<th>BOILER</th>
<th>INSTALLED UNITS</th>
<th>SO2 EMISSION (mg/m³)</th>
<th>DUST EMISSION (mg/m³)</th>
<th>FOCUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Niederaussem Block G (GER) – RWE</td>
<td>660 MW</td>
<td>1 x Ø 18,5 m</td>
<td>200</td>
<td>&lt; 7</td>
<td>energy saving</td>
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<td>Taicuan (CN) – Datang</td>
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<td>Nanjing (CN) – Tongfang</td>
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<td>≤ 5</td>
<td>Dust removal</td>
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<td>Tusimice II (Cz) – CEZ</td>
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<td>2 x Ø 14,5 m</td>
<td>200</td>
<td>&lt; 20</td>
<td>SO₂ removal</td>
</tr>
</tbody>
</table>

**Fig. 1: FGDplus technology references**

**Fig. 2: Reference FGDplus Niederaussem 2014**
References

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Task: Development of ANDRITZ WashWater Hydrocyclone Technology
Year: 2012

HG SEPARATION, BENCH SCALE – ANDRITZ TECHNIKUM, GRAZ, AUSTRIA
Task: Optimization and comparison tests of ANDRITZ Washwater Technology, with various suspension from full scale FGD installations
Customer: Steag AG, E.ON, Verbund AG
Year: 2014 – 2016

HG SEPARATION, FULL SCALE – SEVERAL CUSTOMERS (LIGNITE)
Task: Demonstration of ANDRITZ Washwater Hydrocyclone Technology
Customer: LEAG, RWE
Year: 2016

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Task: Balance of plant for fate of mercury within the whole APC system
Year: 2016

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Task: Bromine Dosing, Bromine+ Dosing, KAT Dosing, Stabilization
Customer: LEAG, MIBRAG mbH, eins energie in sachsen GmbH & Co. KG
Year: 2016, 2017

FGDPLUS – TUŠIMICE II CZECH REPUBLIC
Task: SOx, dust removal
Year: 2017
CLEAN ENVIRONMENT FOR A BETTER TOMORROW

ANDRITZ is a leading global supplier of innovative air pollution control technologies. Our product range combines 30+ years’ experience with the specific knowledge gained from over 200 installations around the world. ANDRITZ offers high-end technologies and is a partner you can rely on. Contact us all over the world.

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