Emission reduction by an order of magnitude – Results from the post-combustion capture pilot plant at Niederaussem

Peter Moser, Sarah Wallus, Tobias Ginsberg, **RWE Power AG**
Iven Clausen, Georg Sieder, Gustavo Lozano, **BASF SE**
Torsten Stoffregen, Frank Rösler, **Linde Engineering Dresden GmbH**

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CO_2 Capture Pilot Plant Niederaussem

In a nutshell

- Flue gas from lignite fired power plant: 1,550 m^3_N/hr
- CO_2 product: 7.2 t_{CO2}/day; capture rate 90%
- Absorber / regenerator packing type and height corresponds to full scale
- Instrumentation: 275 measuring points
- MOC tested at several different locations
- Commissioning and start-up 2009, availability of 97%
- Budget of RWE for phases I/II: 15 Mio. €
- 40% funding by German Federal Ministry of Economics and Technology (0327793 A-F)
- Phase III being planned

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CO_2 Capture Pilot Plant Niederaussem

Targets

- Performance test of solvents without plant limitations
- Materials of construction under real-life conditions
- Fine tuning of simulation model
- Emissions control concepts
- Long time behavior
- Operations experience

Test runs

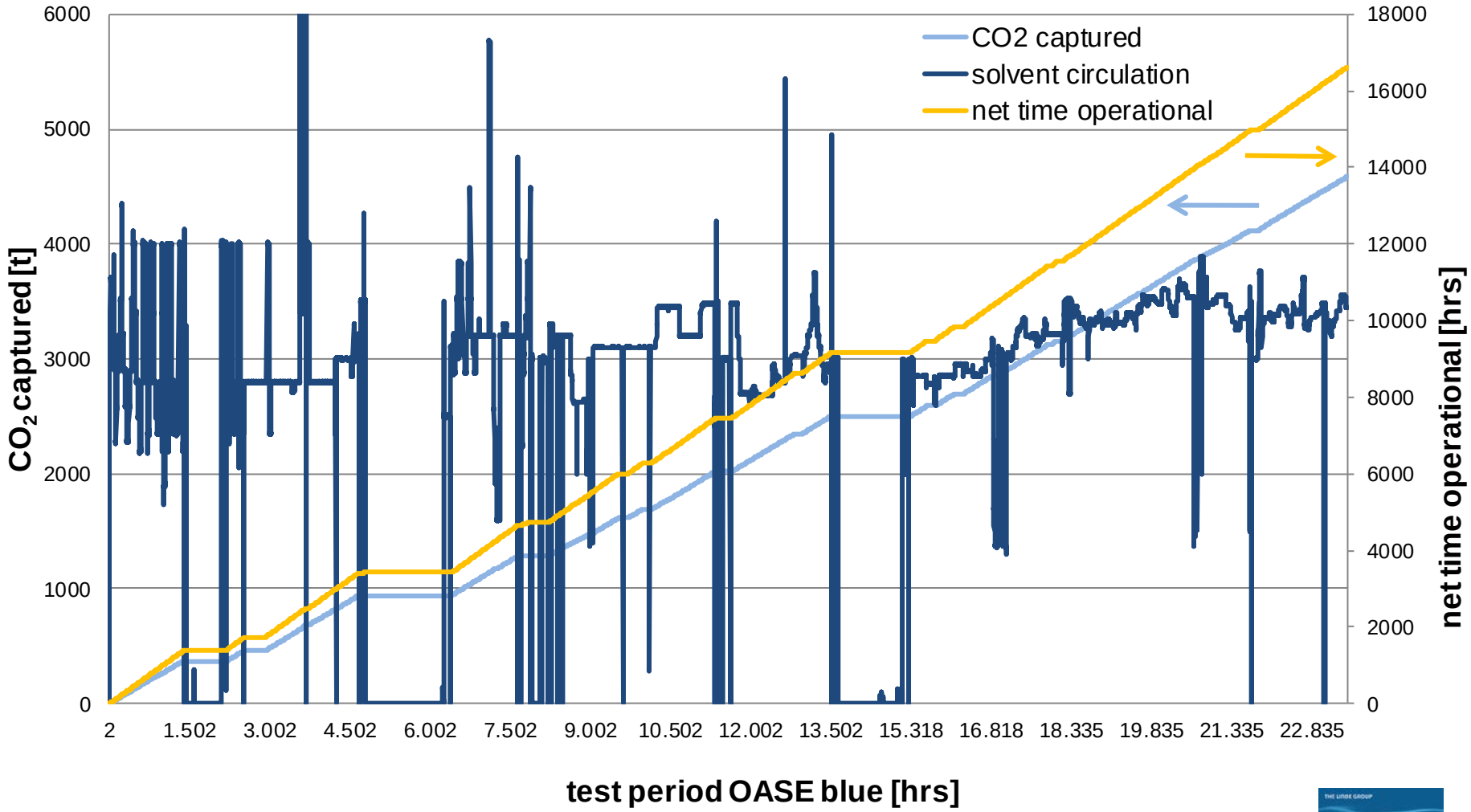
- MEA > 5,000 hrs
- OASE® blue > 23,000 hrs / 16,000 hrs
  in plant / in operation

plant availability > 97%

➡ **all targets achieved at given dimensions**

Test runs history

OASE® blue



CO_2 Capture Pilot Plant Niederaussem

Set-up For Coal Fired Power Plant

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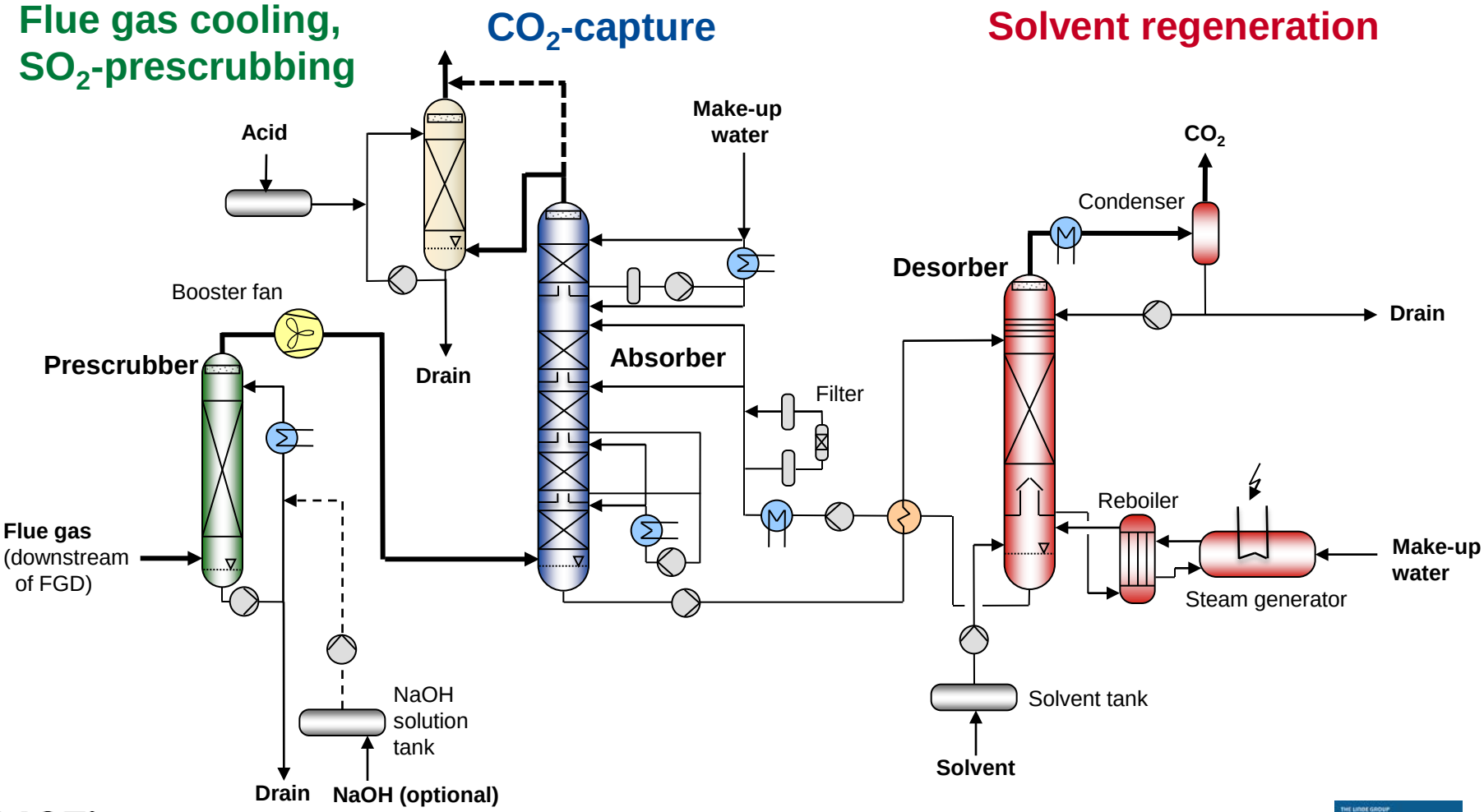

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Measures for emission reduction I

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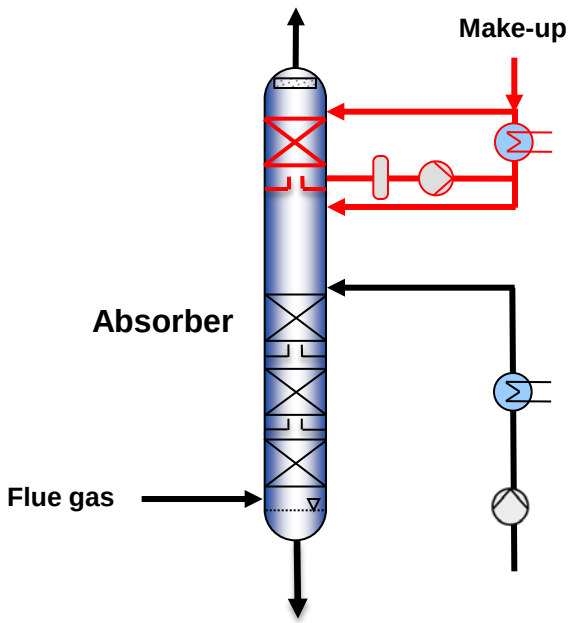
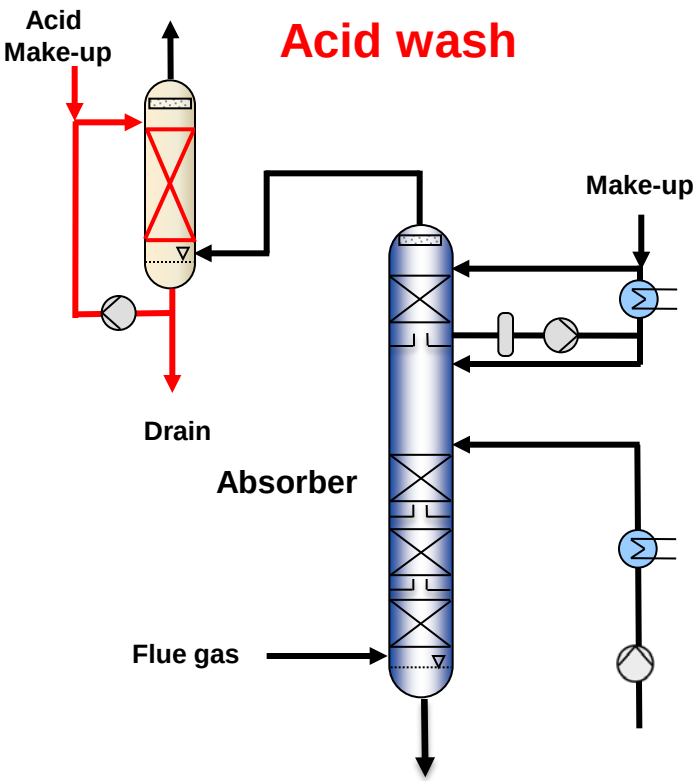
Water wash



- amine emission in equilibrium to water phase
- equilibrium = f (p,T, x_{amine})
- limited effect on aerosols
- no waste stream generated

Acid wash



- amines chemically bound to acid
- range of reasonable pH values
- limited effect on aerosols
- waste stream generated

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Measures for emission reduction II

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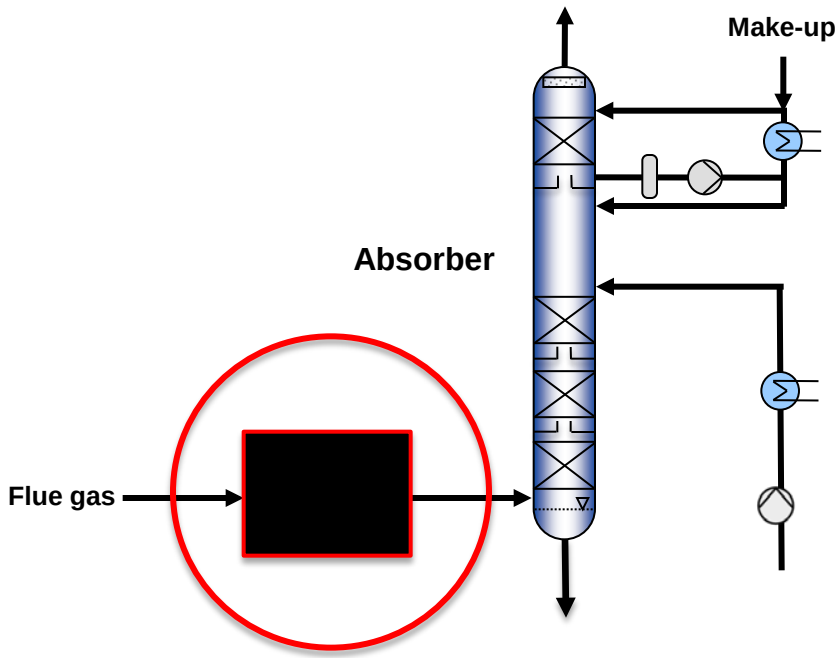
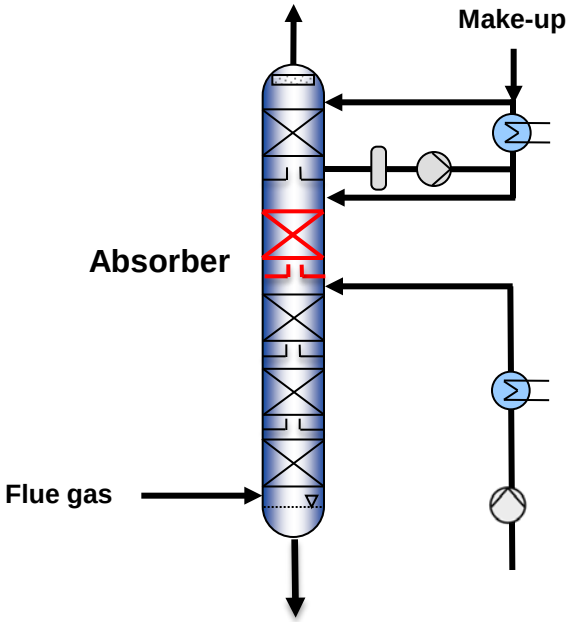
Upstream treatment



- prevents aerosol enhancers
- keeps amine system cleaner

"Dry" bed

- patented -



- no additonal liquid stream
- no waste stream generated
- very little pressure drop

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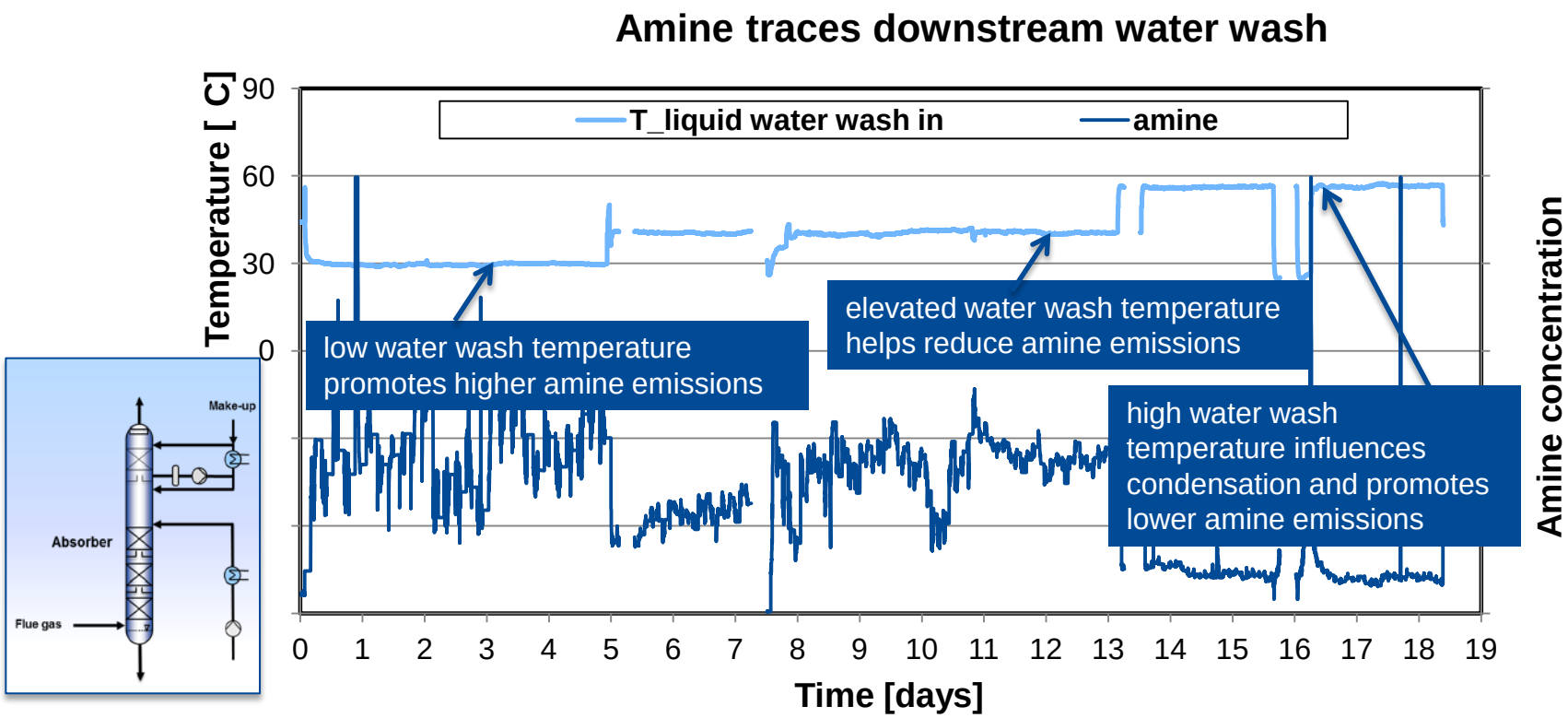
Effect of water wash temperature on emissions

OASE blue run



- **effects of water wash not in accordance with equilibrium thermodynamics**
- **aerosols and their abatement explain findings**

Emission reduction by upstream measure

OASE blue run

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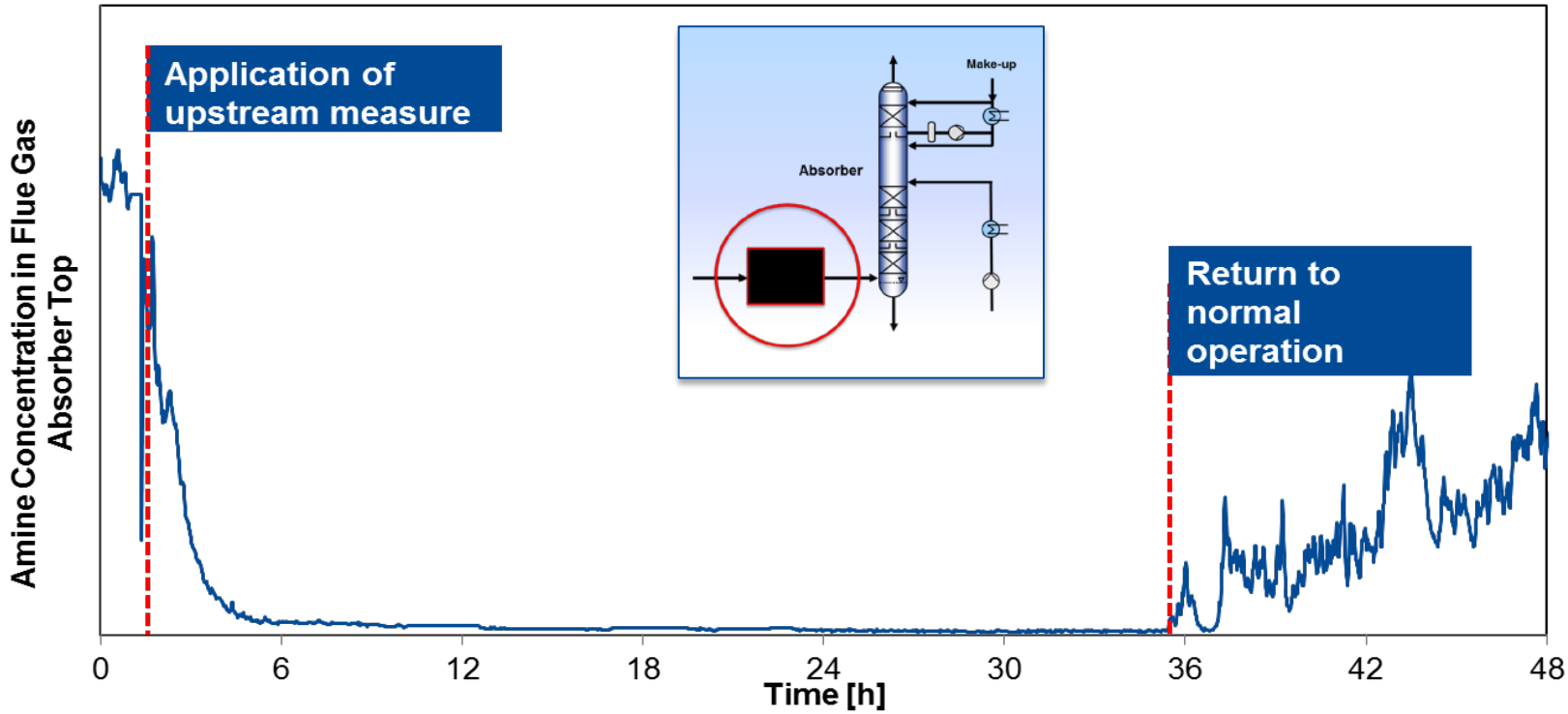
Amine traces downstream water wash



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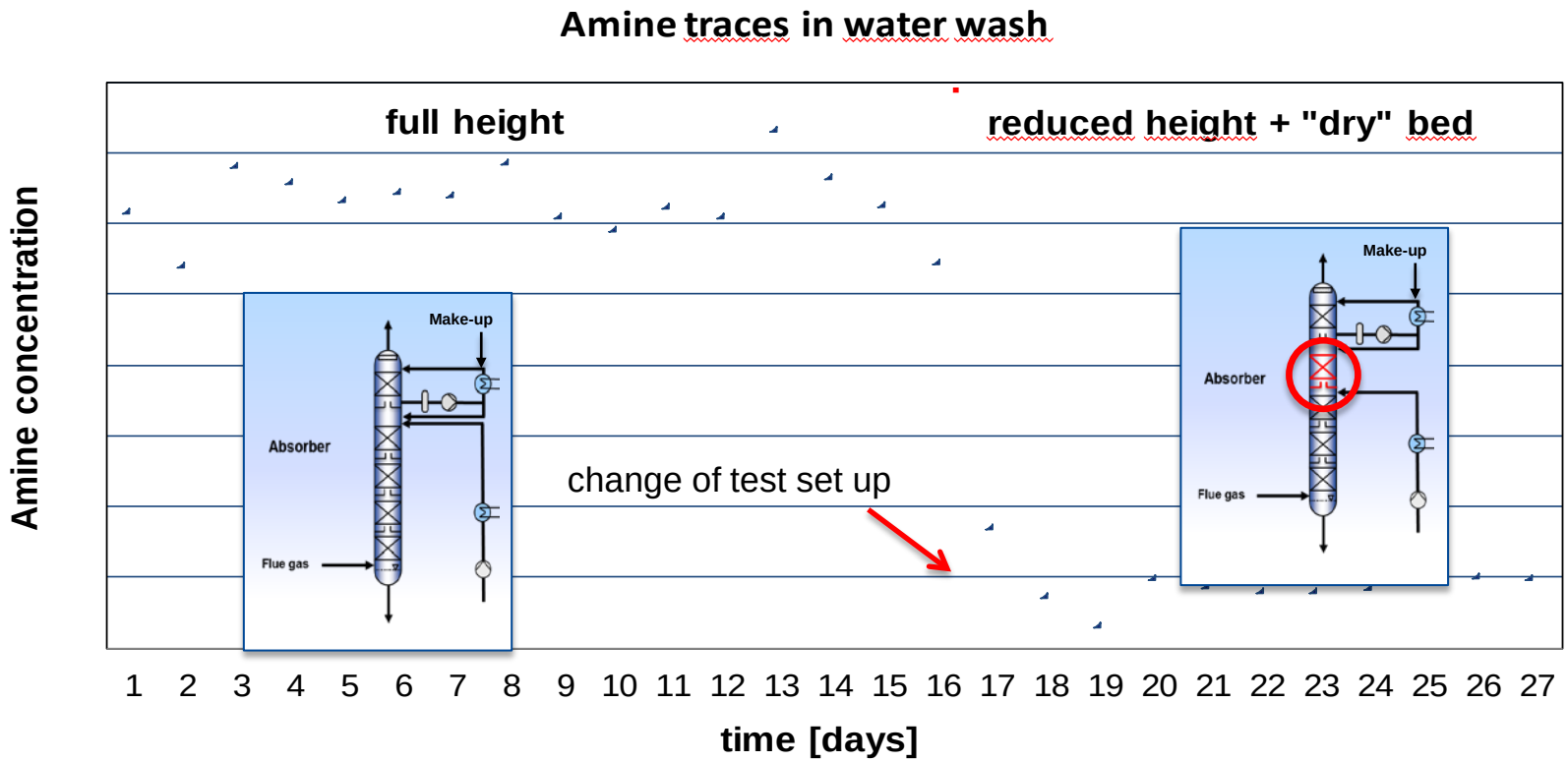
flue gas pre-treatment can reduce amine emissions in case there is potential for aerosols

Emission reduction using a “dry“ bed

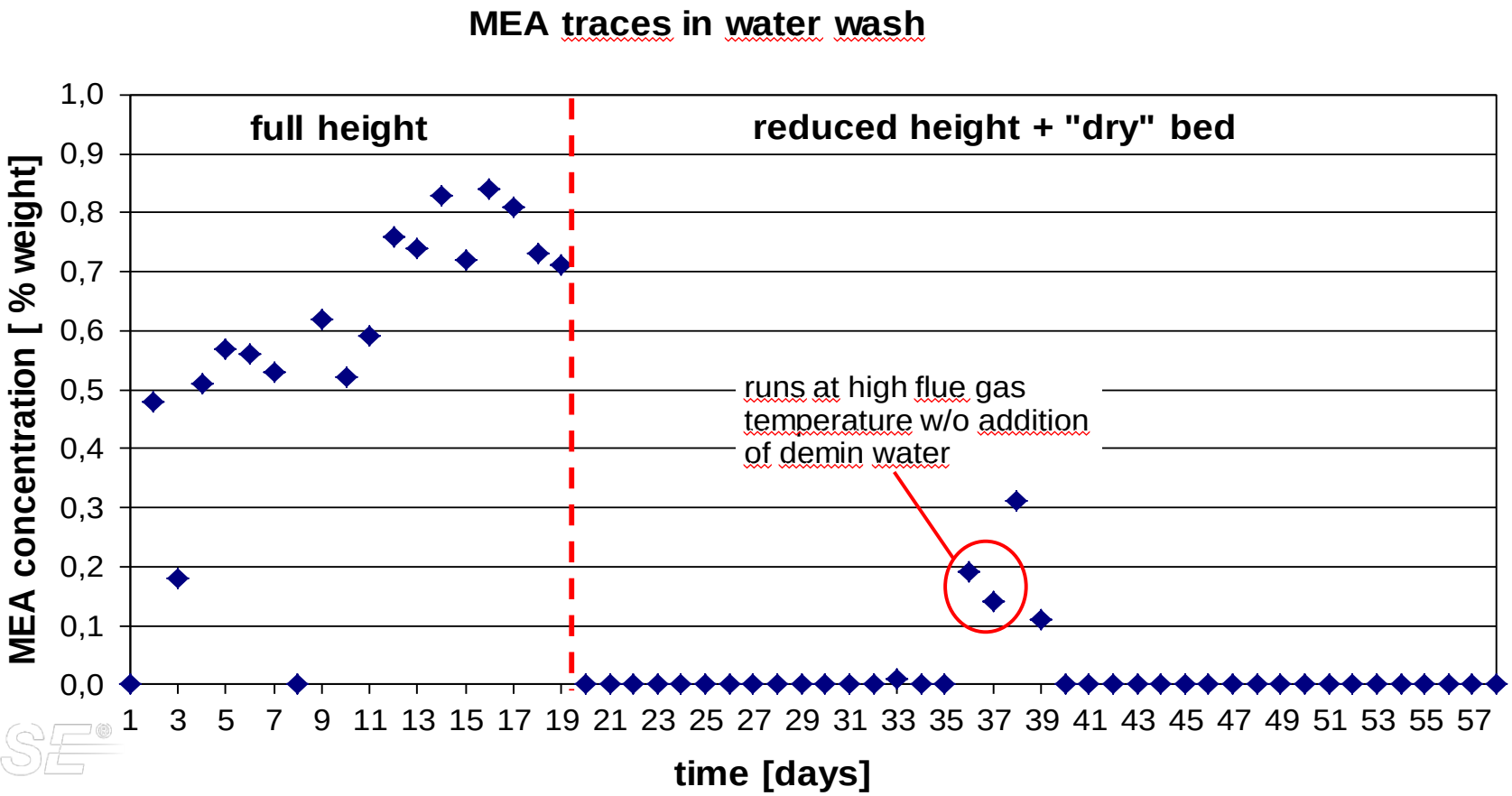
OASE blue run



- “dry“ bed is a simple measure to reduce emissions by an order of magnitude
- CAPEX ↘, acid wash column mostly can be avoided
- OPEX ↘, no additional liquid cycle and no waste stream

Emission reduction using a “dry“ bed

MEA run



Discussion

- different methods to reduce emissions to the atmosphere are available
- individually combined measures will provide best fit to local requirements
- application of water wash unit needs careful temperature control in case aerosols are being built
- upsteam measure can greatly help reduce emissions based on aerosol formation
- “dry“ bed is a viable option to reduce costs and additional waste water

Research cooperation of an operator, an engineering company and a technology provider is a perfect set-up for successful process development.

Outlook

for phase III

- understanding of aerosols and particles formation and abatement
- innovative non-thermal solvent reclaiming

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The responsibility for the contents of this publication rests with the authors.

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