# Impact of the wood-based industry on the environment


**Marius BARBU**
- Professor at “Transilvania” University Brasov
- Visiting Professor at University of Hamburg

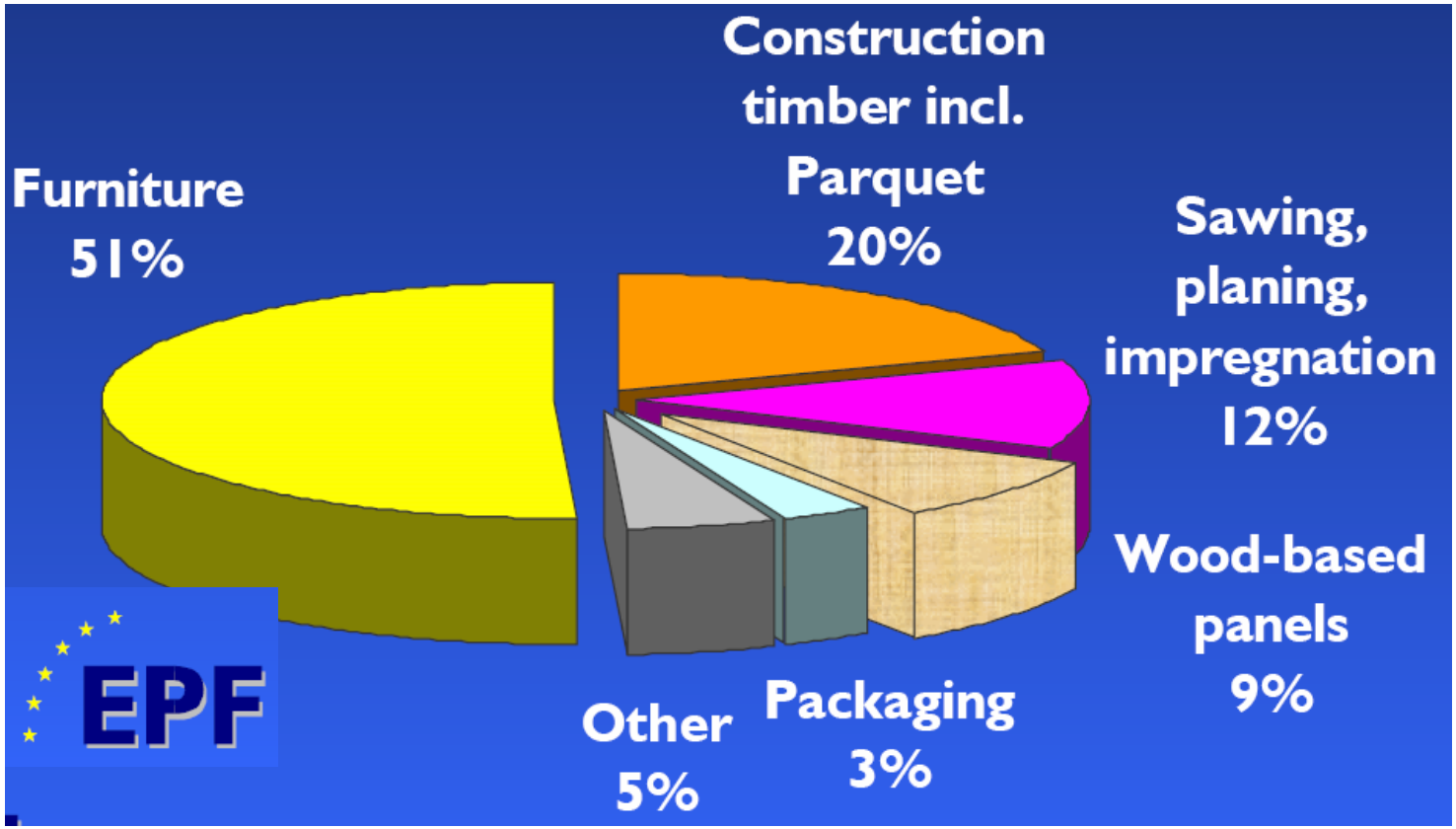
**Oliver STASSEN**
- Freelancer in environment protection of panels ind.

**Arno FRÜHWALD**
- Professor at University of Hamburg

# European wood processing industry

2007 (EC27): 230 bill. € / 2,3 M persons / 340.000 factories

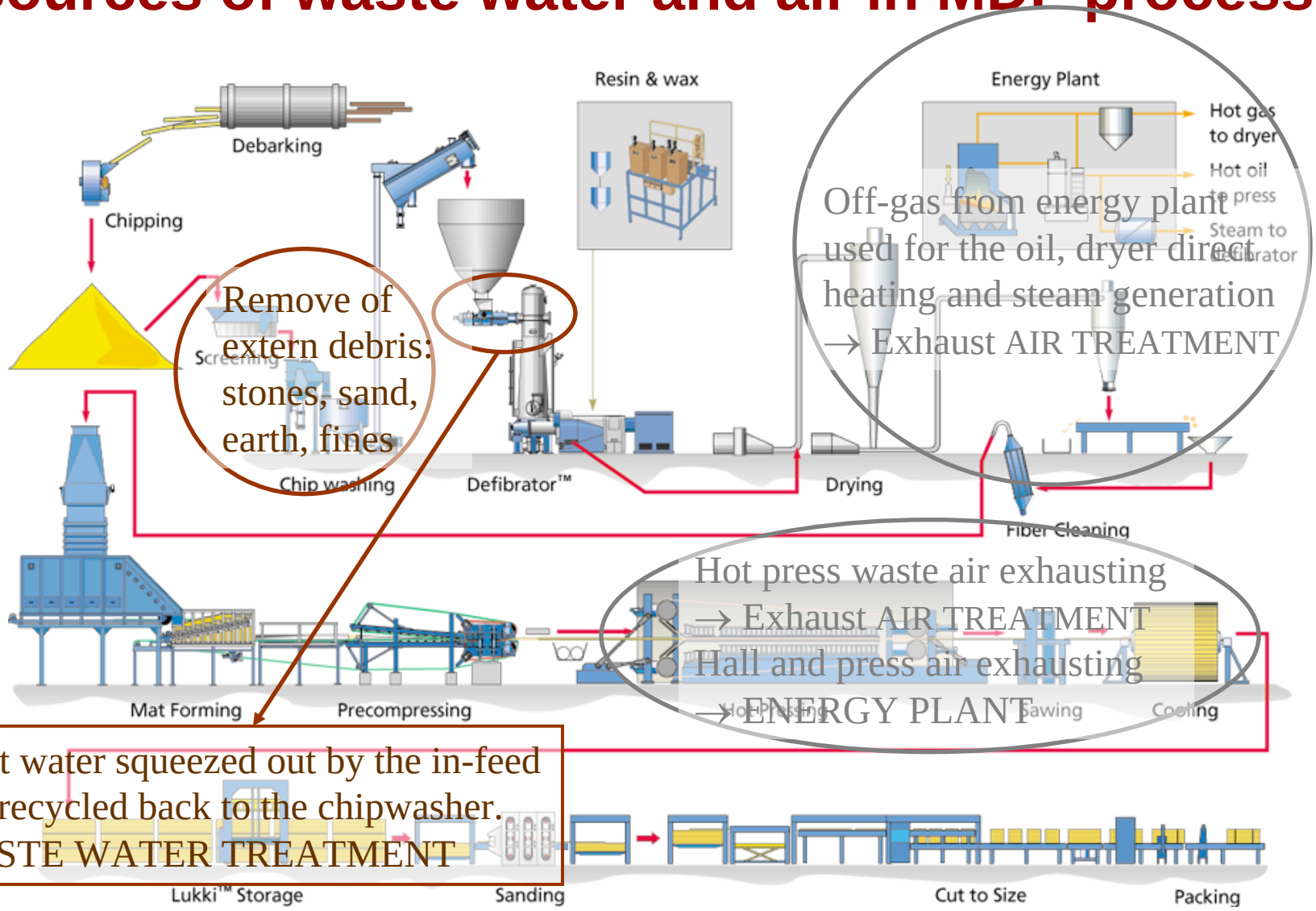
**Europe 2007:**
220 PB-mills
(45 M m³)
90 MDF-mills
(15 M m³)
14 OSB-mills
(4 M m³)
100 PY-mills
(3 M m³)
70 GLT-mills
(4 M m³)
60 Solid boards
(1 M m³)
250 Pellets mills
(4 Mio. t)



# VOC in the wood based panels industry

| Properties (mainly) | low - molecular | mid - molecular | high - molecular |
|---|---|---|---|
| Wood related representative substances | *Formaldehyde, Phenol, Ammonia, Alcohols, Carboxylic acid, etc.* | *Terpens, Pinens, Caren, Limonen, Myrcen, common Ligneous Aromatics, etc.* | *Resin acid, fatty acids, Paraffin, common wood tar, etc.* |
| Physical Condition | gaseous | mainly gaseous | particle aerosols after condensation "blue haze" |
| Water solubility | hydrophilic | partial | hydrophobic |
| Odour threshold | very low | higher | low |
| Odour nuisance | strong nuisance, pungent smell | Typical wood smell, aromatic | strong nuisance, pyrolytic |
| Separation Possibilities | by water solubility | oxidation and absorption | as ionized particle after quench |

# Sources of waste water and air in MDF process



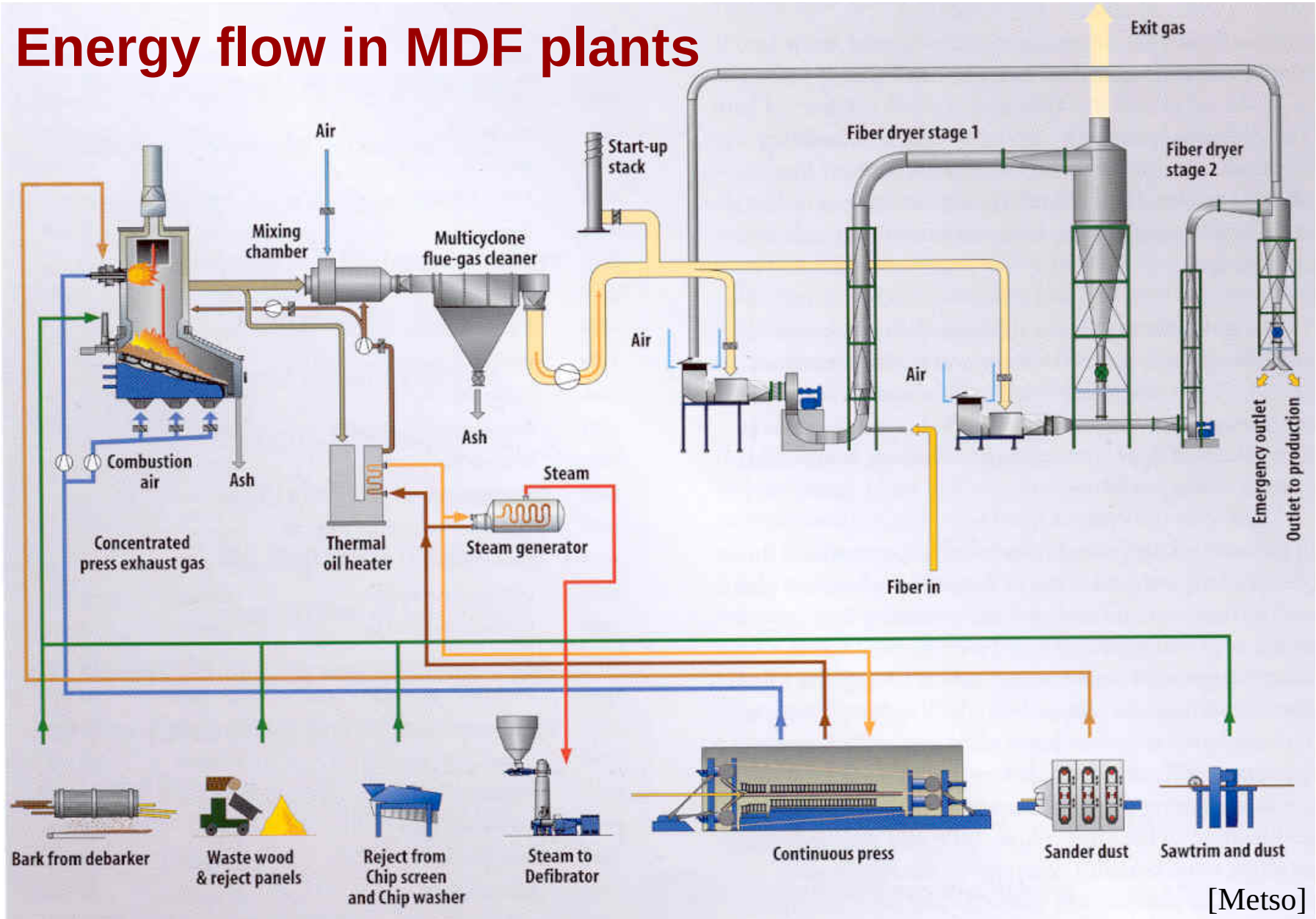

Remove of extern debris: stones, sand, earth, fines

Off-gas from energy plant used for the oil, dryer direct heating and steam generation
→ Exhaust AIR TREATMENT

Hot press waste air exhausting
→ Exhaust AIR TREATMENT
Hall and press air exhausting
→ ENERGY PLANT

Effluent water squeezed out by the in-feed plug is recycled back to the chipwasher.
→ WASTE WATER TREATMENT

# Energy flow in MDF plants




[Metso]

# Modern energy plant for MDF
## Fiberboard, Baruth: 90 MWh

*Fuel characteristics :*

- All wastes from the MDF and Flooring lines

*Combustion systems :*

| | | |
|---|---|---|
| - Grate firing : (60m² 16 t/h bark at 40-100% m.c.) | 46 | $MW_{th}$ |
| - Dustburner MDF dust : | 24 | $MW_{th}$ |
| - Dustburner Flooring dust : | 24 | $MW_{th}$ |
| ~~- Gas :~~ | ~~58~~ | ~~$MW_{th}$~~ |

*Energy output :*

| | | |
|---|---|---|
| - Hot gas : | 40 | $MW_{th}$ |
| - Thermal oil : | 50 | $MW_{th}$ |
| - Indirect steamproduction | | |


SNCR (sequentielle nicht K(C)atalytische Reduktion) = Entstickung mittels Harnstoff - N0x Wert vermindert und optimaler Ausbrand !

[Vyncke]

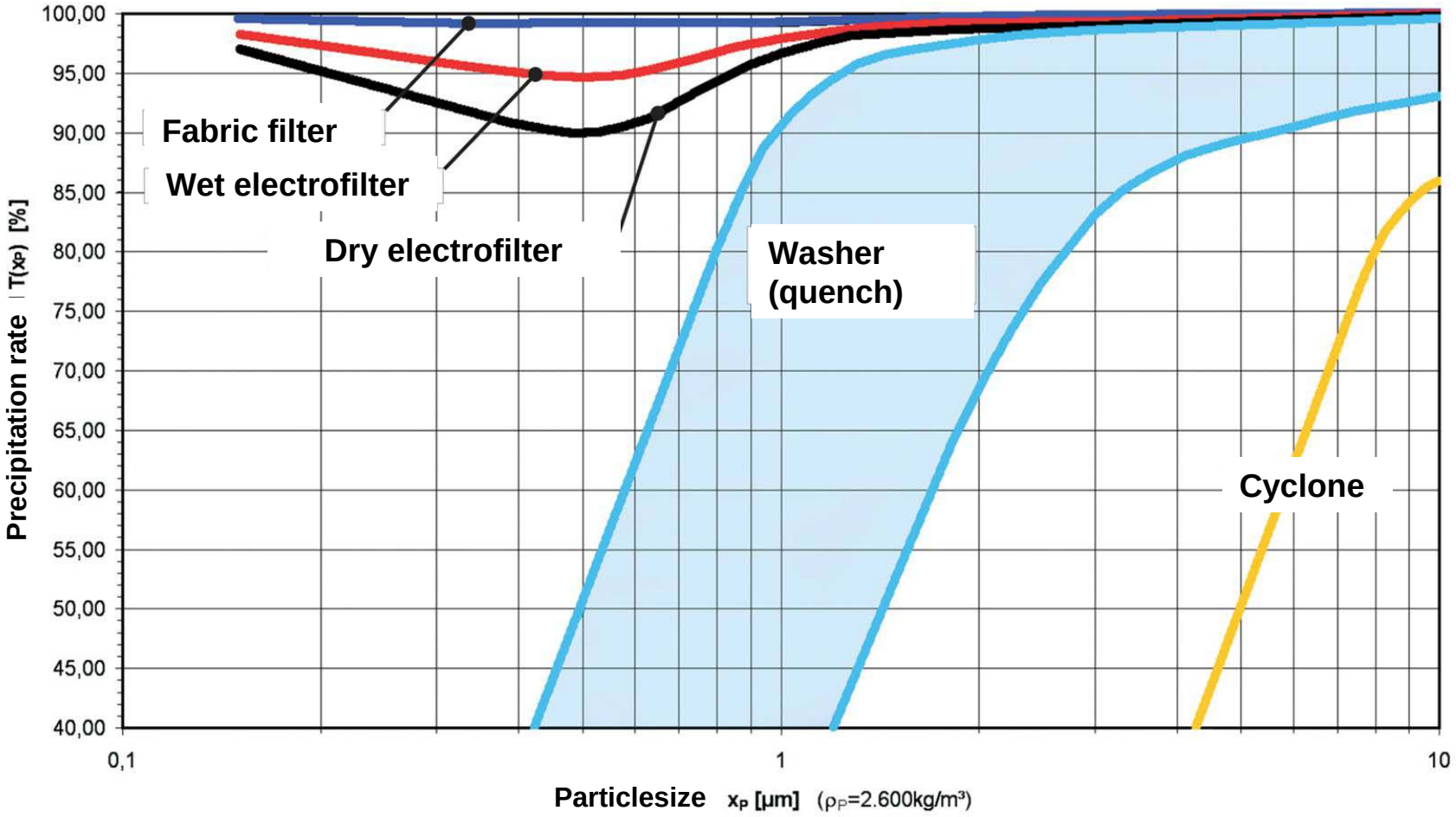
# Regulations for waste air emissions level

| | TA – Luft | IPPC | Method |
|---|---|---|---|
| Particulate Matter | 15mg/Nm³wet | 20mg/Nm³dry | VDI 2066/1 |
| Formaldehyde | 20mg/Nm³dry [1)] | 20mg/Nm³dry | VDI 3862/6 |
| VOC/COV - dryer | 300mg/Nm³wet | 130mg/Nm³wet | EN 12619 (FID) |
| VOC/COV - press | 0,06kg/m³produced panel | 130mg/Nm³wet | EN 12619 (FID) |
| O2 Correction | Drying process generally 17% | -- | -- |
| Odor | -- | -- | EN 13725 |
| Blue Haze | -- | -- | -- |

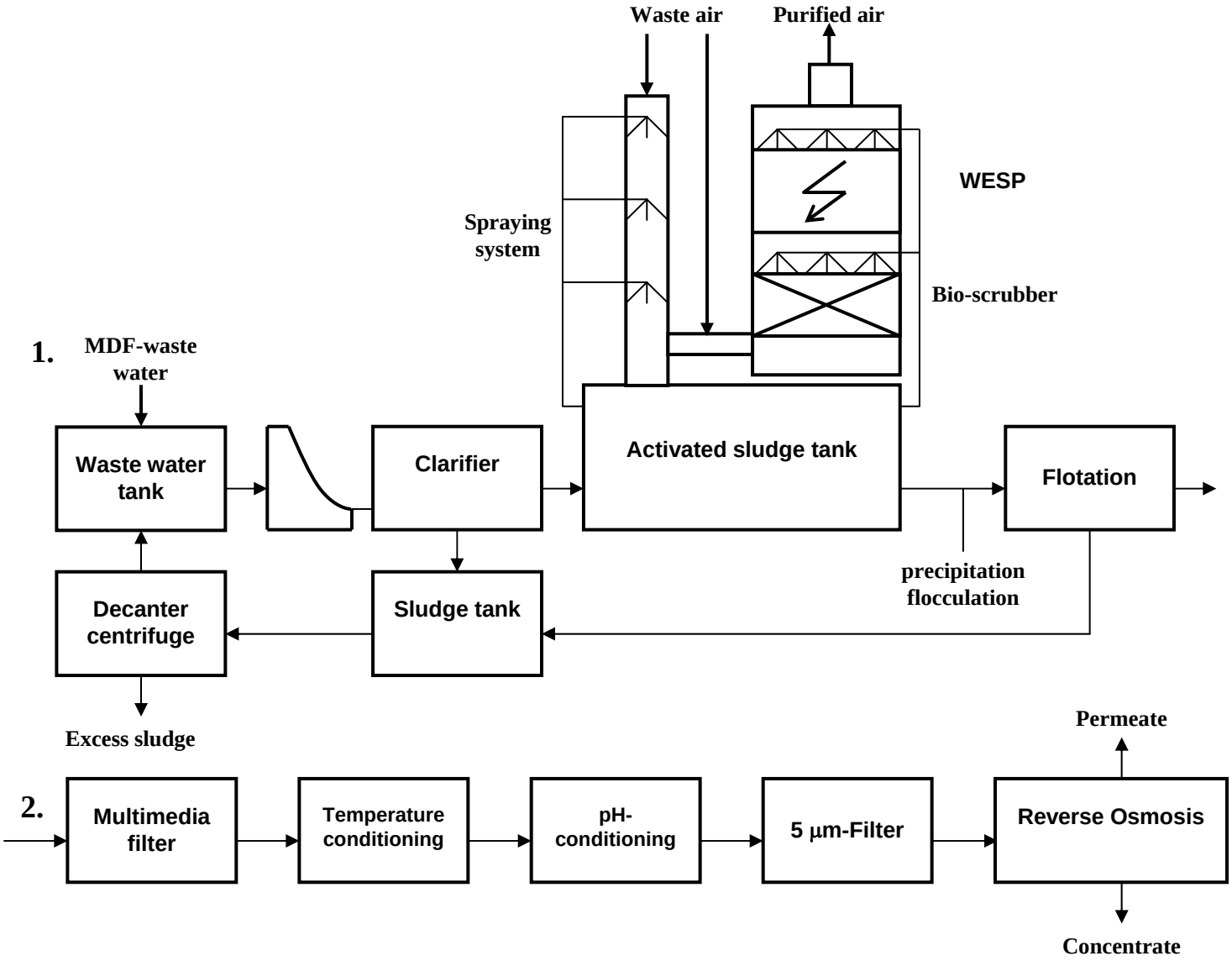
[1)] Class 1 substances (including acetaldehyde, formic acid, acetic acid)

[Scheuch]

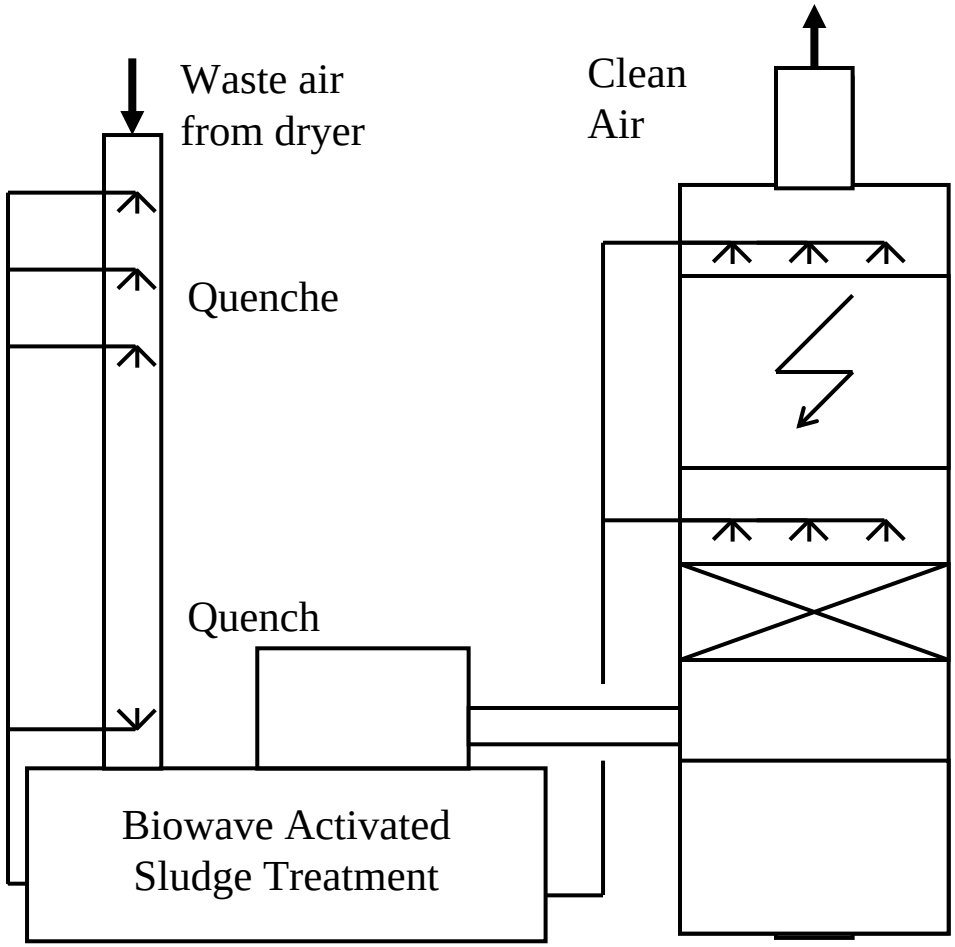
# Reachable precipitation rate for particles



# Combined waste water and air treatment plant



# General flow of waste air treatment




**Improvement of transmitting Formaldehyde**

- Quenche (Washer)
- Bioscrubber

**Dust- / Aerosolremovement**

- WESP

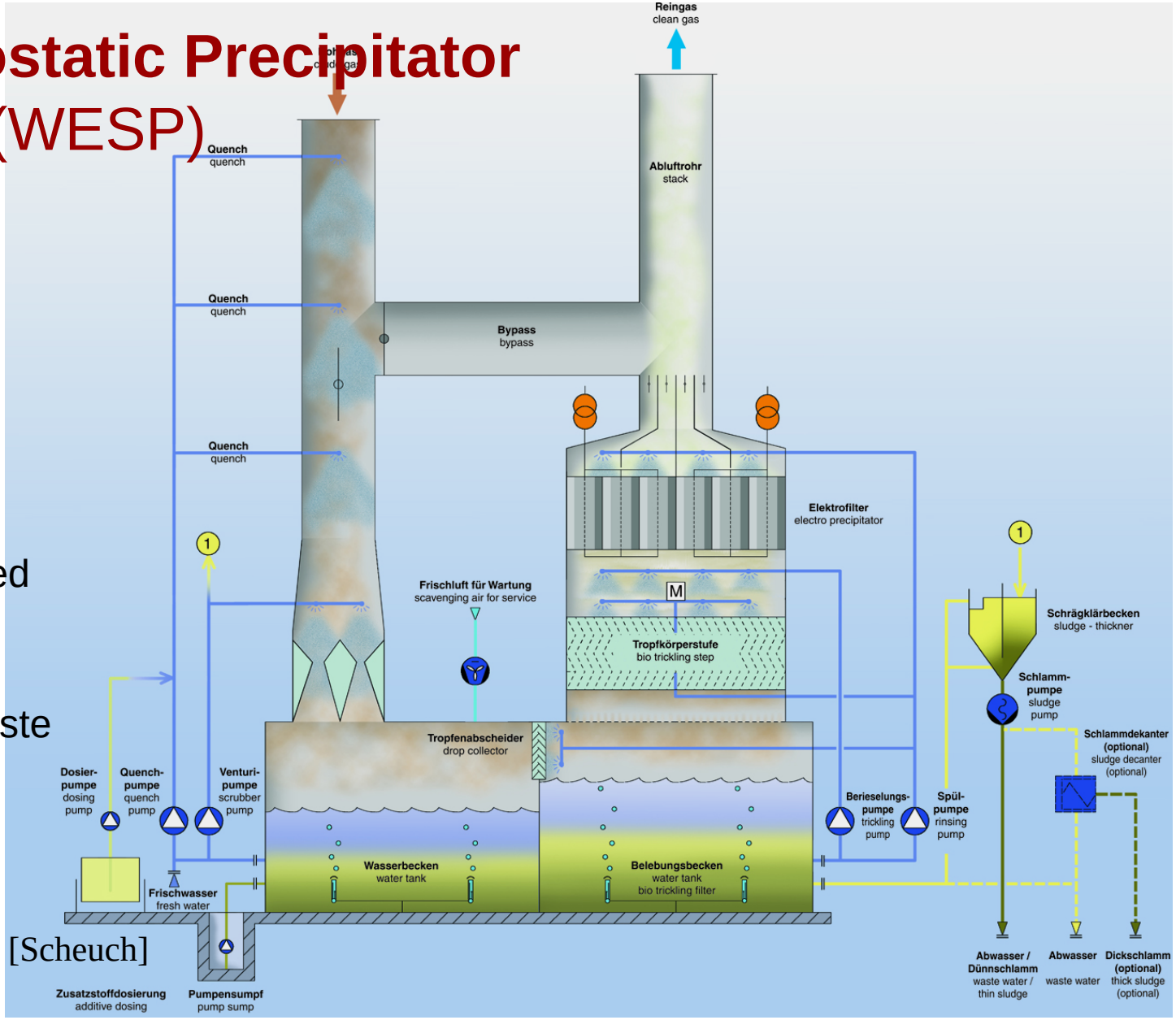
# Wet Electrostatic Precipitator (WESP)

**3 steps treatment**:

- spraying system
- bio-scrubber
- WESP

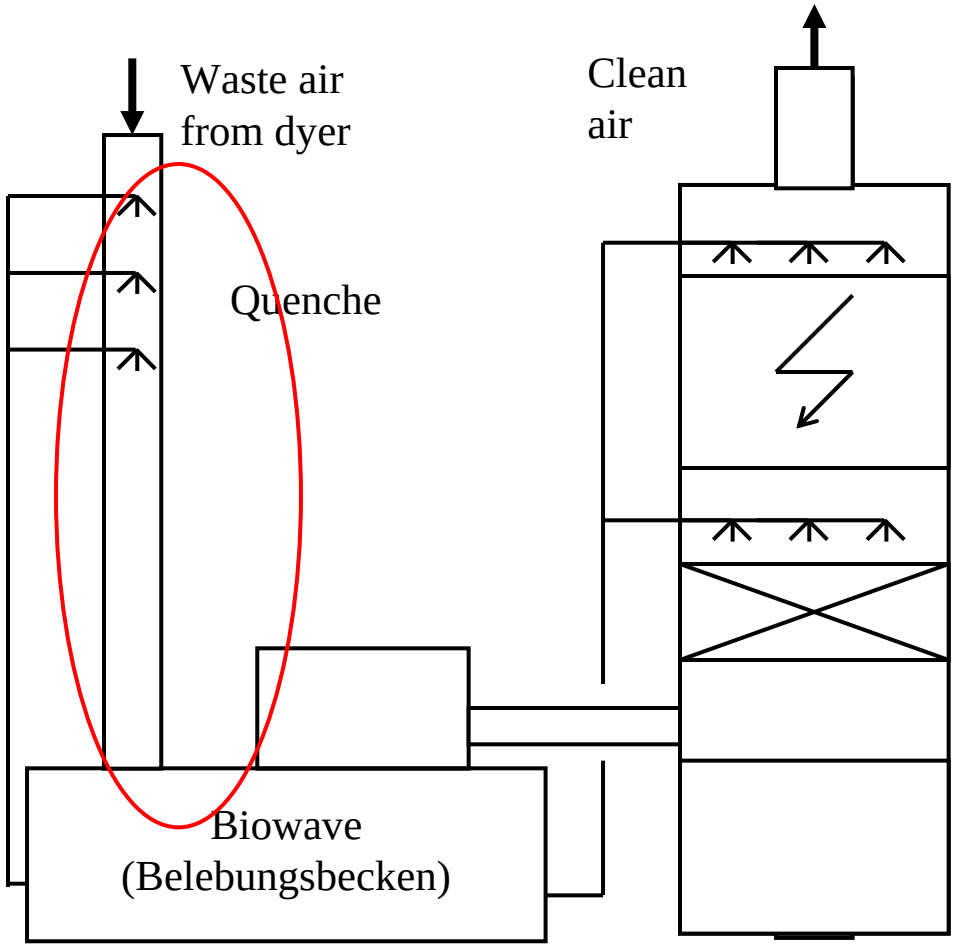
Thermophilic activated sludge population (45-60°C)

Combination with waste water treatment (100.000 pax. unit)




[Scheuch]

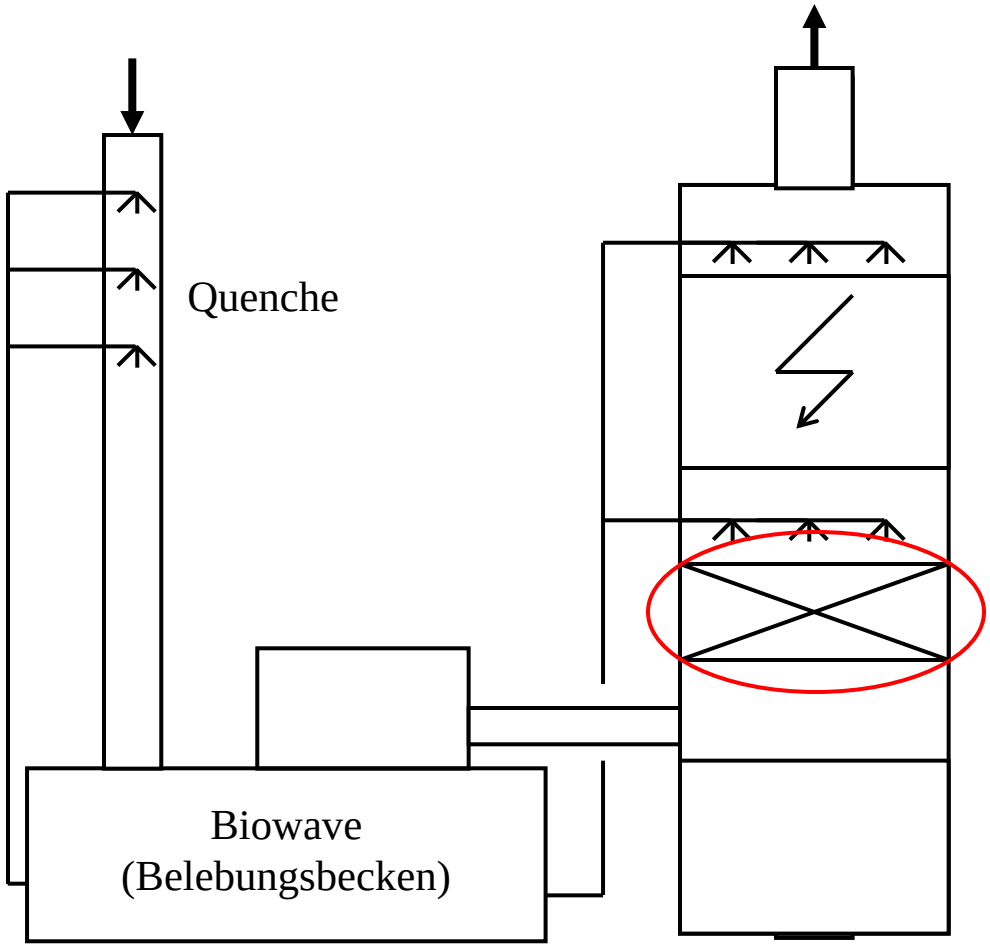
# Construction of Quenche



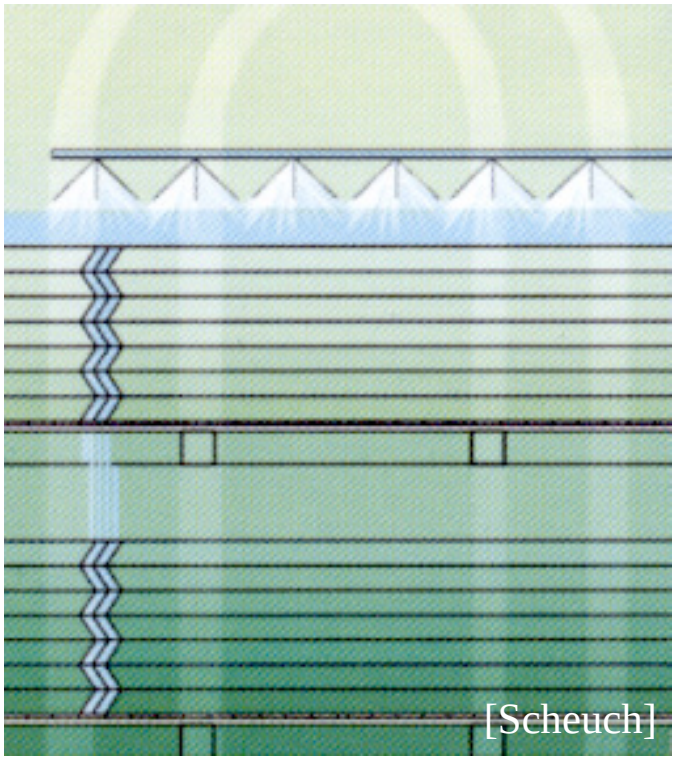

**Nozzels fields and waste air pipe**

# Treatment equipment

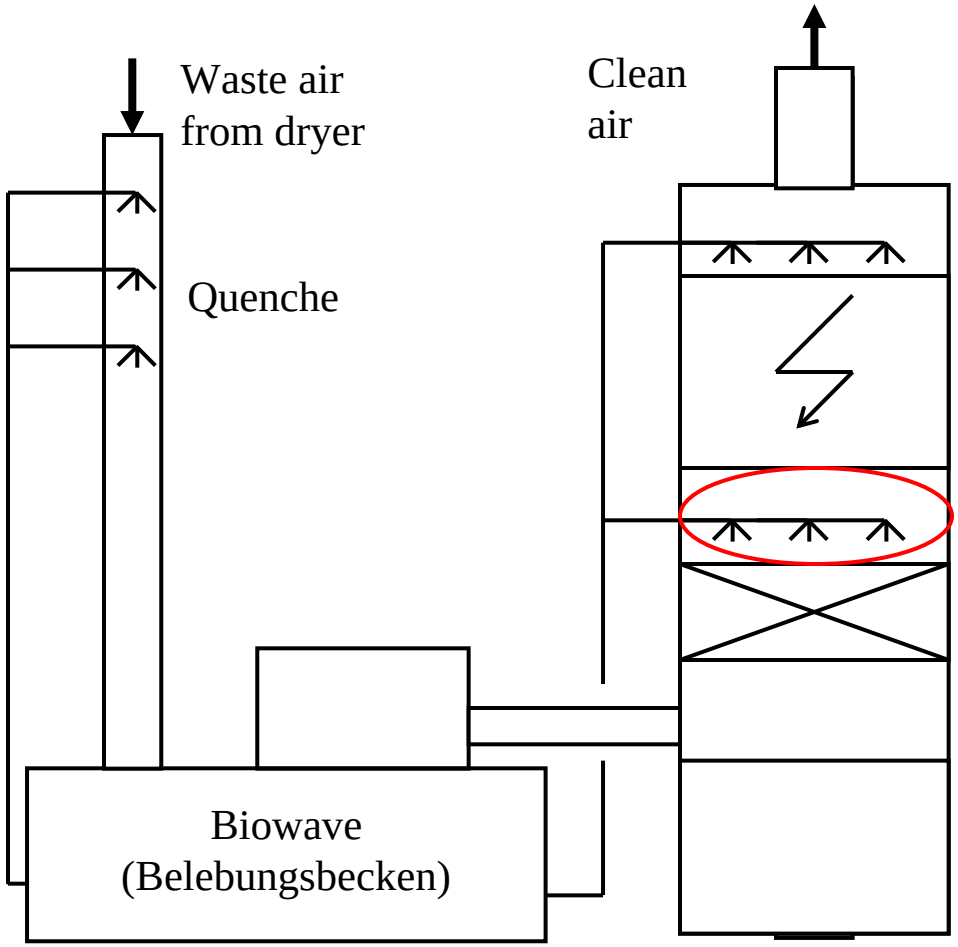
# Construction of BioScrubber




**Bioscrubber**

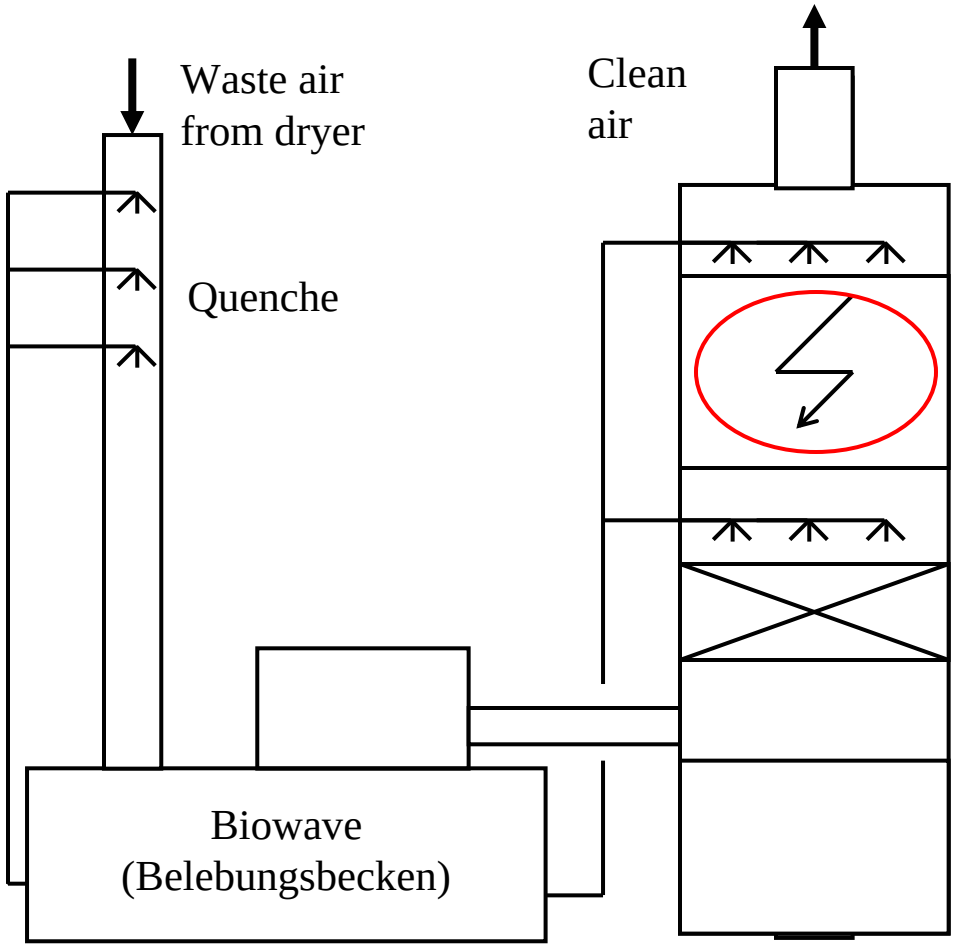


# Construction of BioScrubber



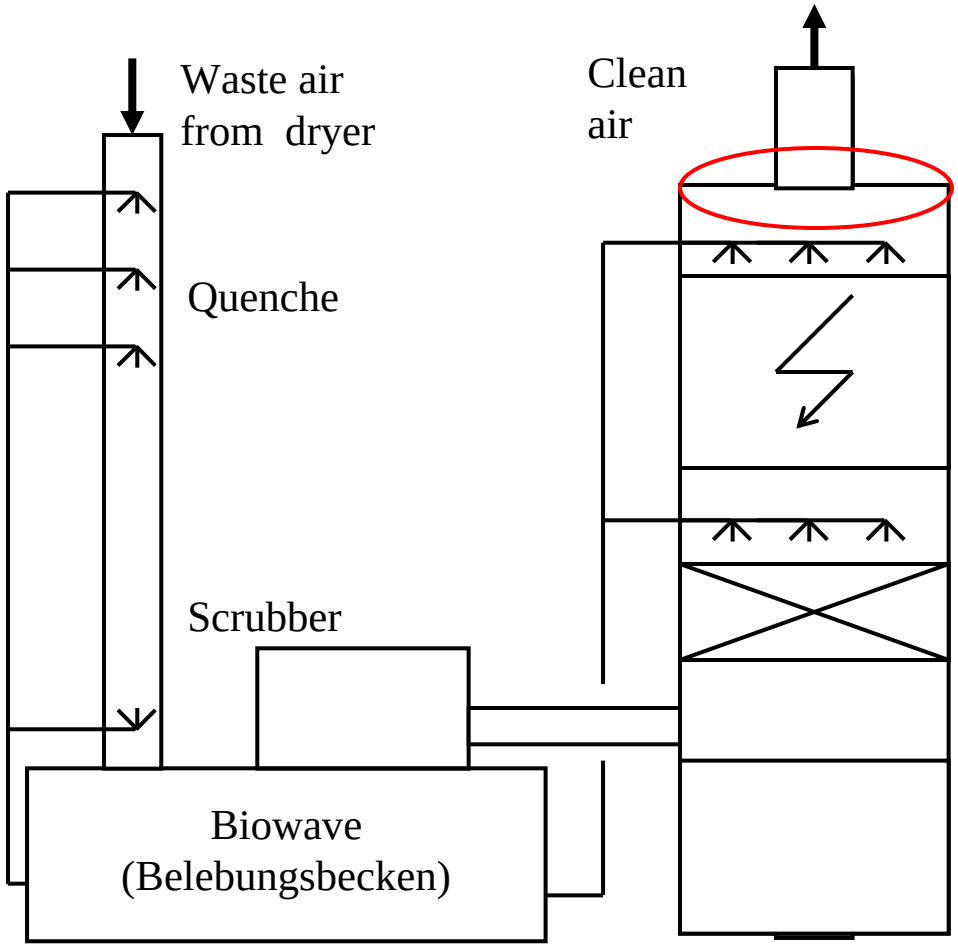

**Rotational blaster**

# Construction of WESP



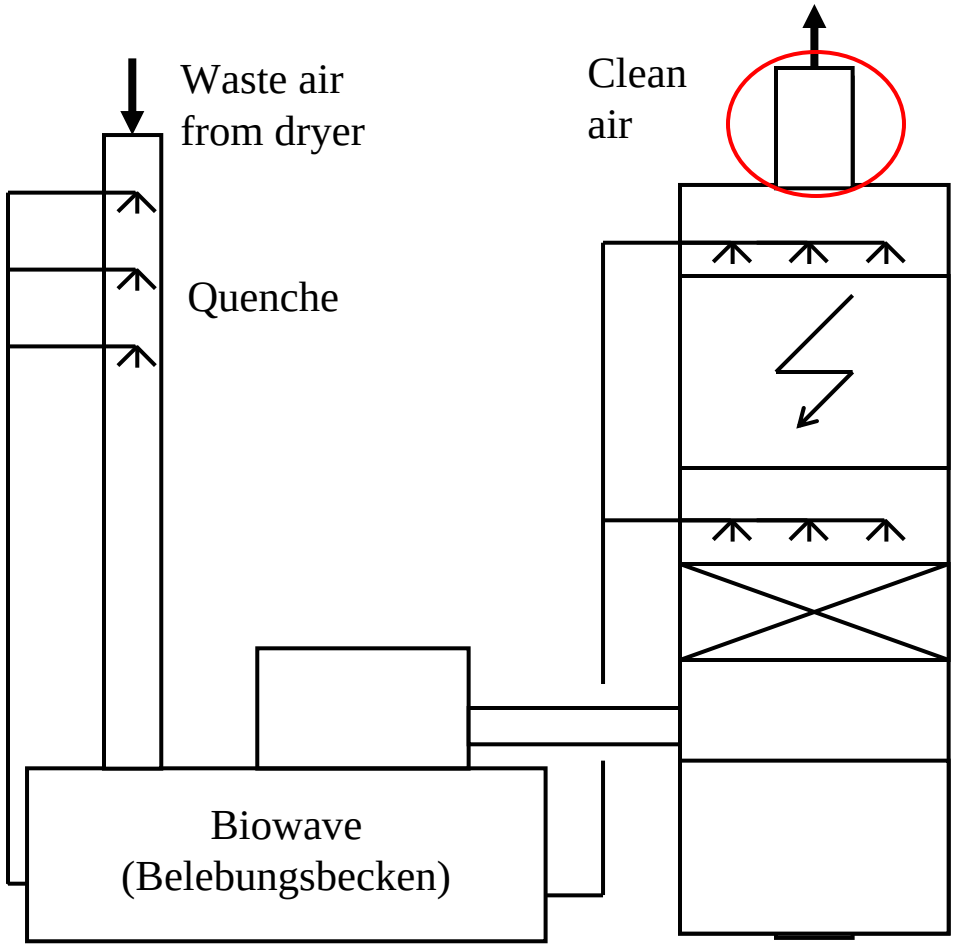

**Wet electrostatic precipitator**

# Construction of WESP




**High voltage unit**

# Construction of WESP





[Portenkirchner]

# Results of waste water treatment

| Parameter | Waste water | Output active sludge | Output flotation | Output RO |
|---|---|---|---|---|
| COD [mg/l] | 7000 | 3000 | 1000 | 30 |
| HCHO [mg/l] | < 1 | < 1 | < 1 | < 1 |
| $N\text{-}NH_4$ | 2 | 8 | 6 | 0 |
| Conductivity [µS/cm] | 1400 | 2400 | 2800 | 80 |
| pH | 5,5 | 6,9 | 4,5 | 4,5 |

# Benefits for waste water treatment

- adaptation of bio-sludge on environment
- increase COD reduction (60%)
- low excess sludge
- increased foaming and bulking tendencies
- high rate of living organisms
- high resistance against variation of T, pH, conductivity
- high stability from biological point of view
- no need of continuous chemical dosage (except anti-foaming agent)

# Results of waste air treatment

| Parameter | Clean air [mg/m³] | Reduction [%] |
|---|---|---|
| Formaldehyde | 5 | 82 % |
| Dust | 3 | 91 % |
| Organic acids | 0,9 | 97 % |
| Organic C | 15 | 65 % |
| Blue haze | invisible | |

- Proven application at industrial scale
- Process innovations:
  - Combination waste water & air treatment
  - Combination activated sludge & reverse osmosis, and use of thermophile aerobe biology
  - closed waste water cycle
- Emission level reduced
- Further modification for other application


[MDF Hallein]

# Optical effect of WESP
(bluehaze reduction)