

Ash and how to handle it

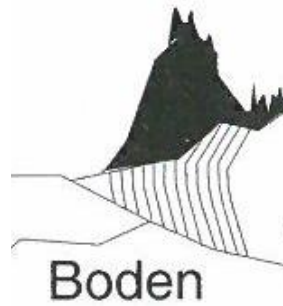
3rd ENTRAIN Train the trainer session:
Emissions, Air Quality, Fuel und Ash Logistic
Webinar, 02.12.2020

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AEE Intec



Luft



Composition of Fuels



Zusammensetzung
der Pflanzen-
substanz
in % der TM

C	40 - 47
H	6
O	40 - 44
N	1 - 5
P	0,05 - 0,8
K	0,3 - 5
Na	0,02 - 0,5
S	0,05 - 0,8
Ca	0,3 - 5
Si	0,05 - 3
Mg	0,05 - 1
B	0,005 - 0,01
Cl	0,02 - 1
Cu	0,0002 - 0,002
Fe	0,005 - 0,1
Mn	0,002 - 0,03
Zn	0,001 - 0,01

Major elements (> 1% resp. > 10.000 mg/kg)

- Carbon, C
- Oxygen, O
- Hydrogen, H
- Nitrogen, N

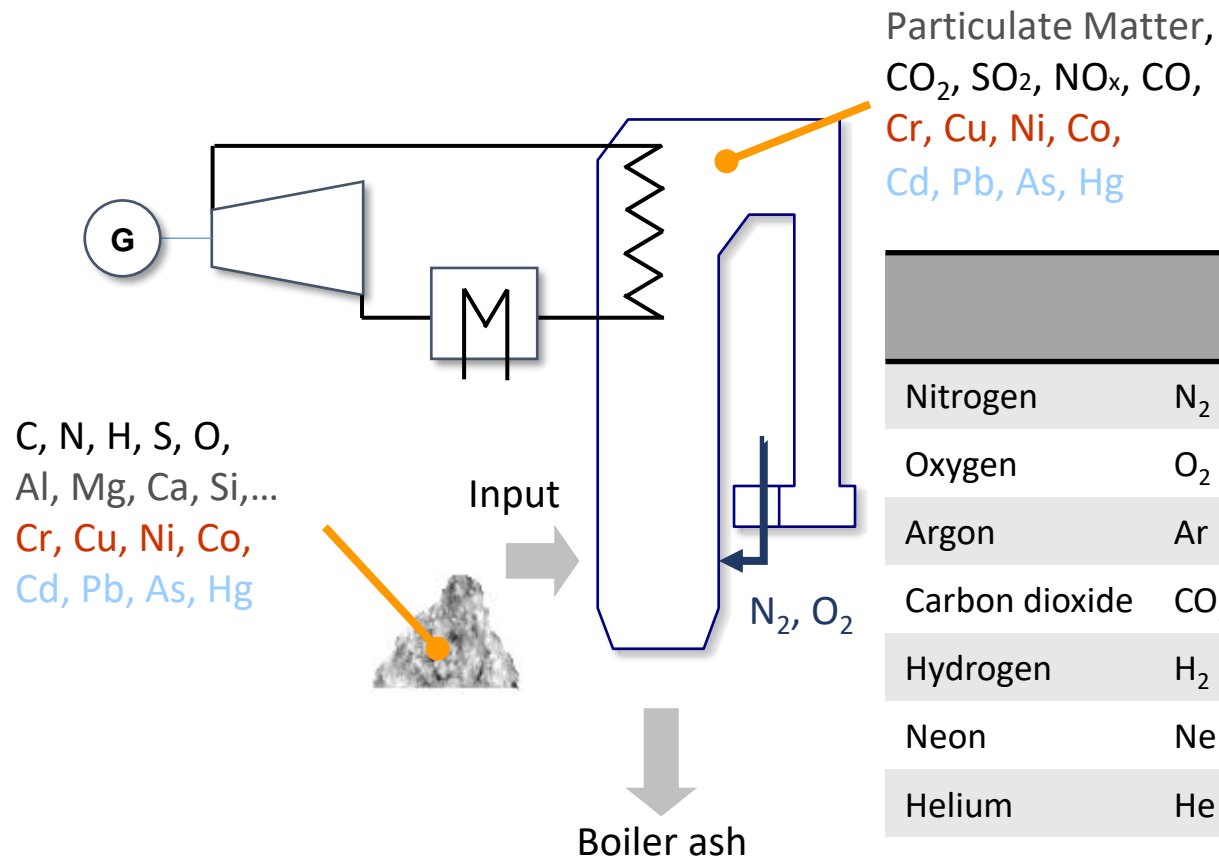
Minor elements (0,01 – 1 % resp. 100 – 10.000 mg/kg)

- Phosphorus, P
- Potassium, K
- Sodium, Na
- Sulfur, S
- Calcium, Ca
- Silicon, Si
- Magnesium, Mg
- Chlorine, Cl

Trace elements (< 0,01 % resp. < 100 mg/kg)

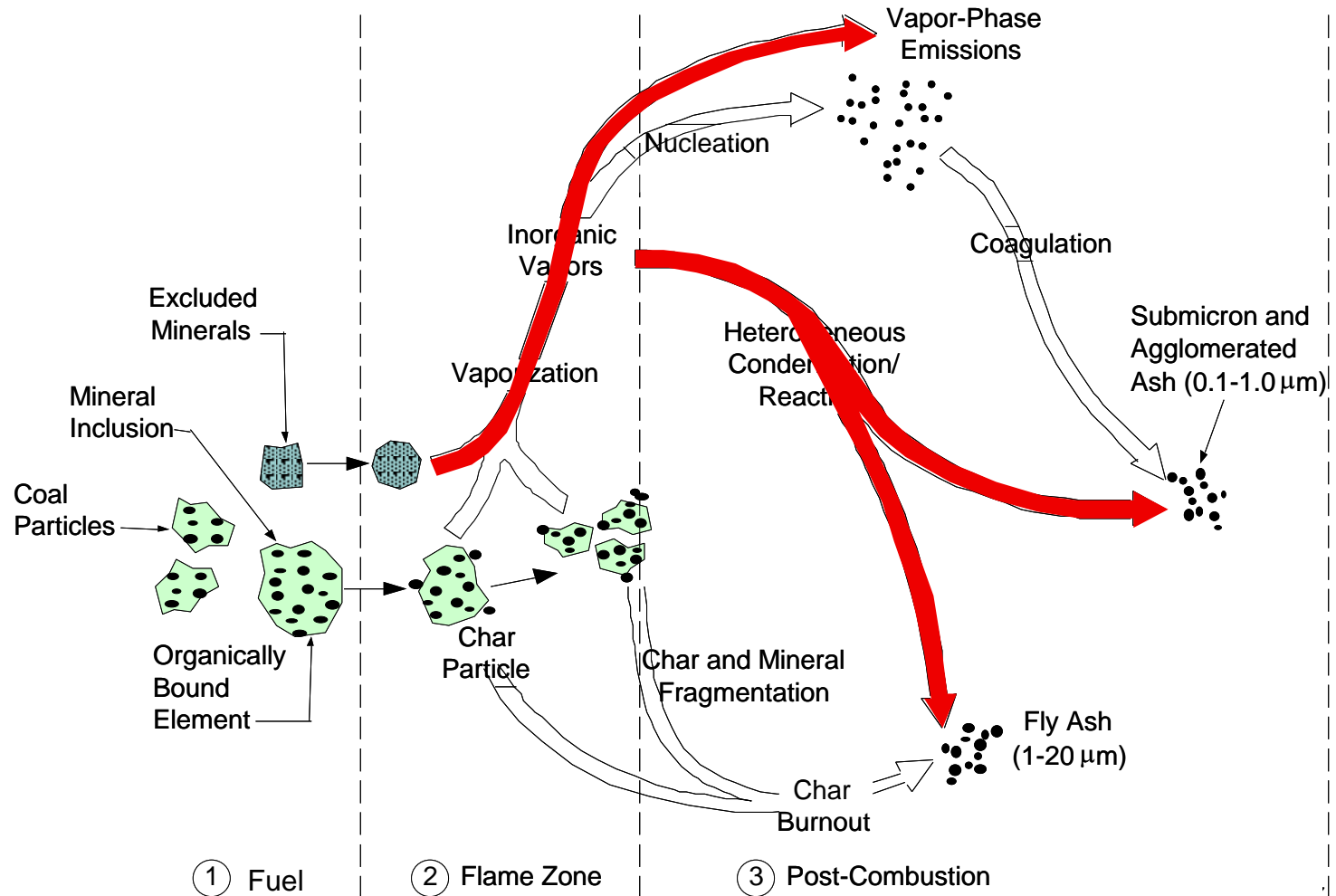
- Boron, B
- Copper, Cu
- Iron, Fe
- Manganese, Mn
- Zinc, Zn

Power plant process

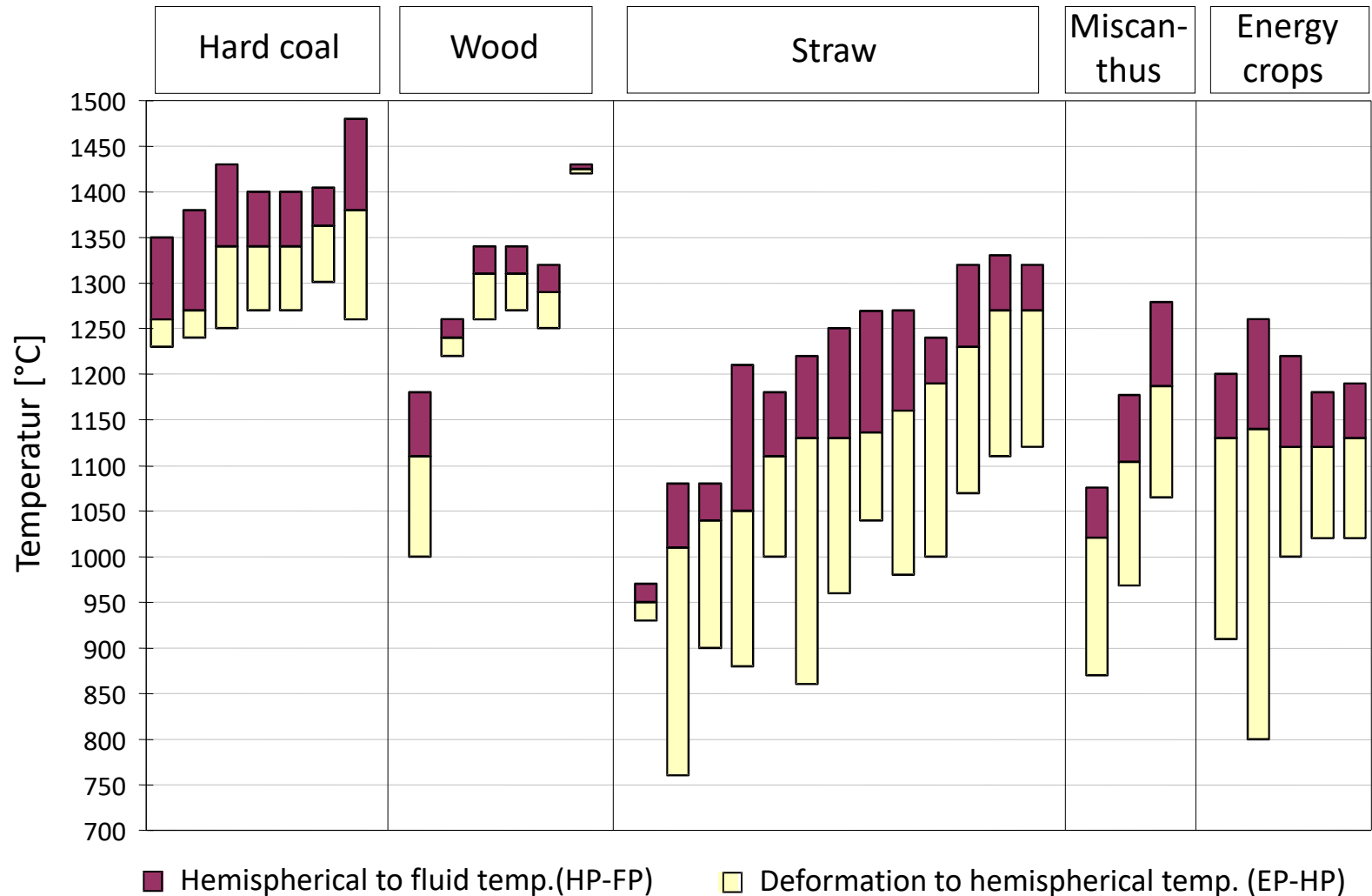


		Vol.-% (dry air)
Nitrogen	N ₂	78,10
Oxygen	O ₂	20,93
Argon	Ar	0,9325
Carbon dioxide	CO ₂	0,03 – 0,04
Hydrogen	H ₂	0,01
Neon	Ne	0,0018
Helium	He	0,0005
Krypton	Kr	0,0001
Xenon	Xe	0,000009

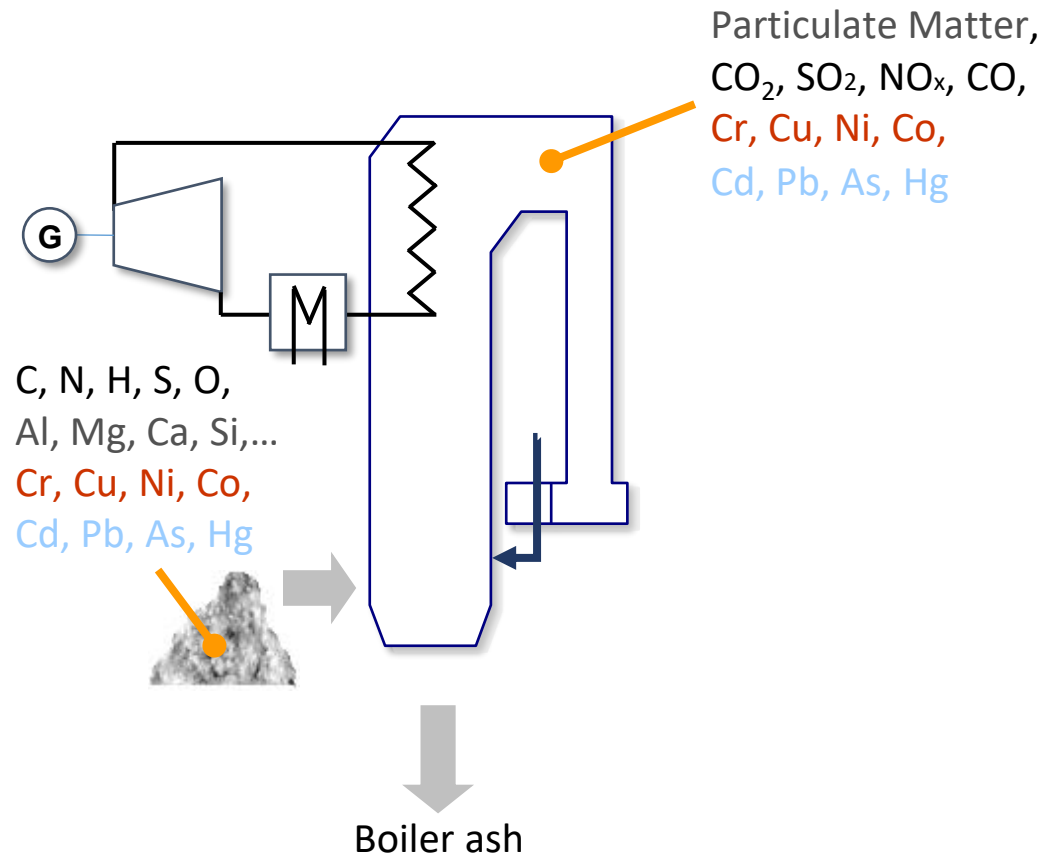
Combustion Process



Ash melting behavior of different combustibles

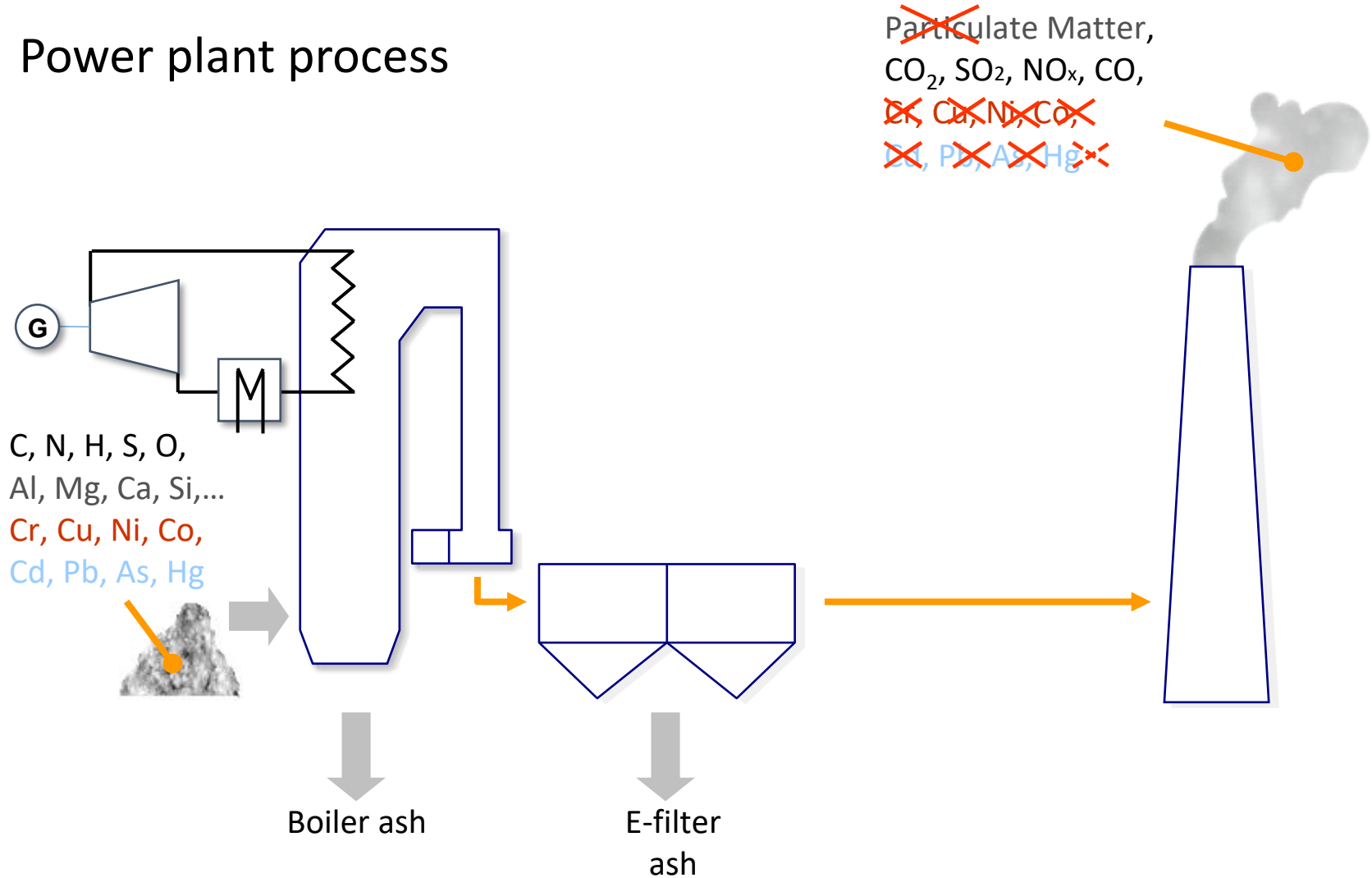


Power plant process



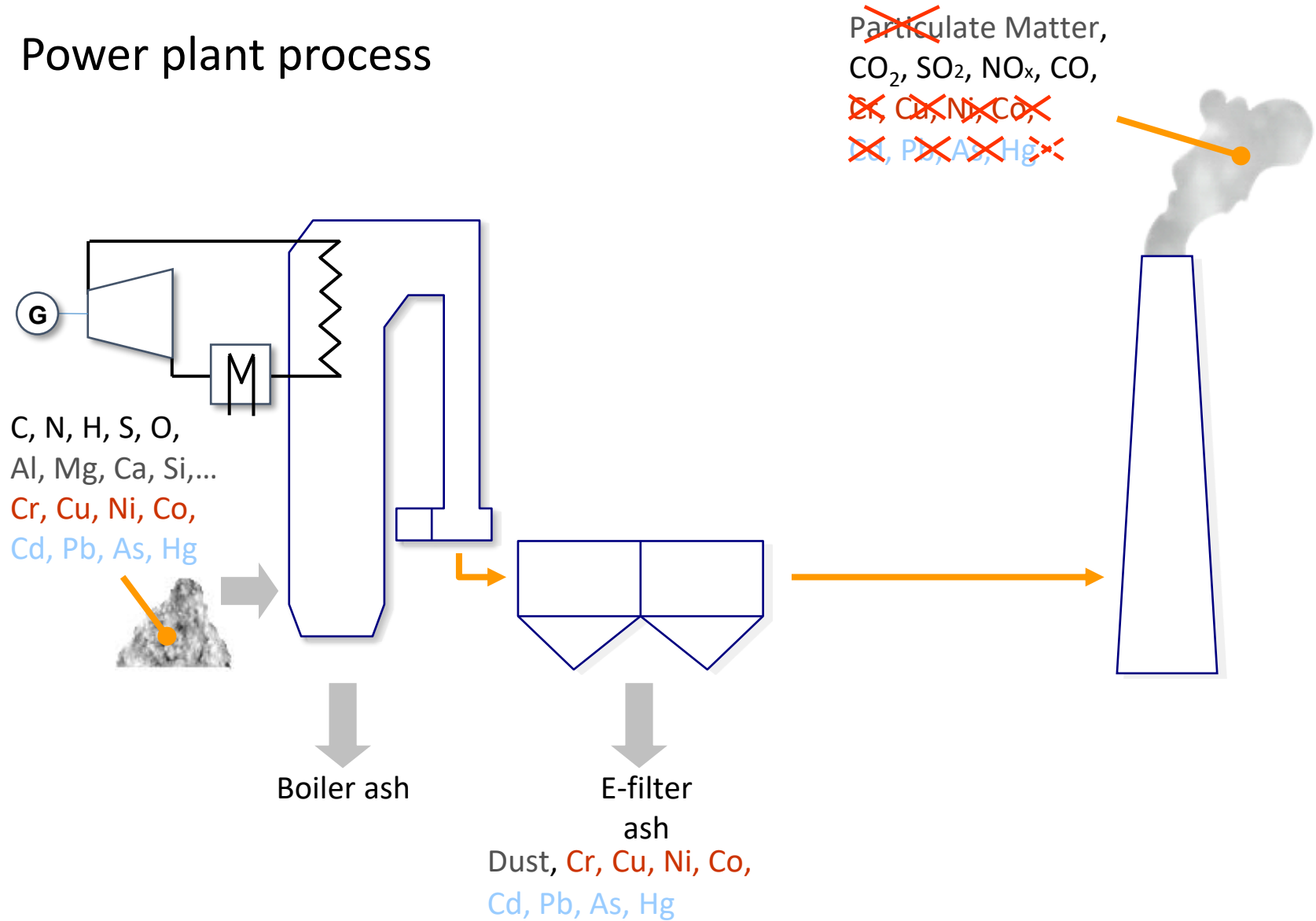
Flue Gas Cleaning

Power plant process



Flue Gas Cleaning

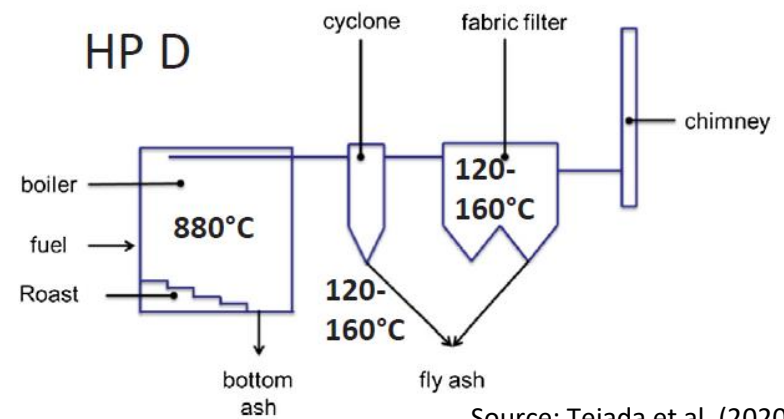
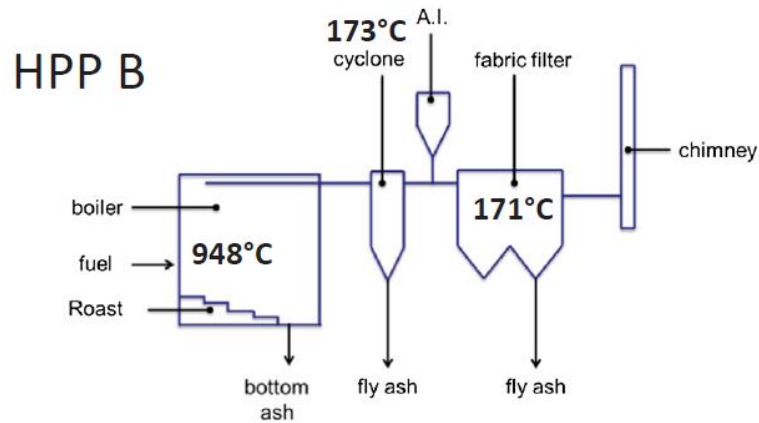
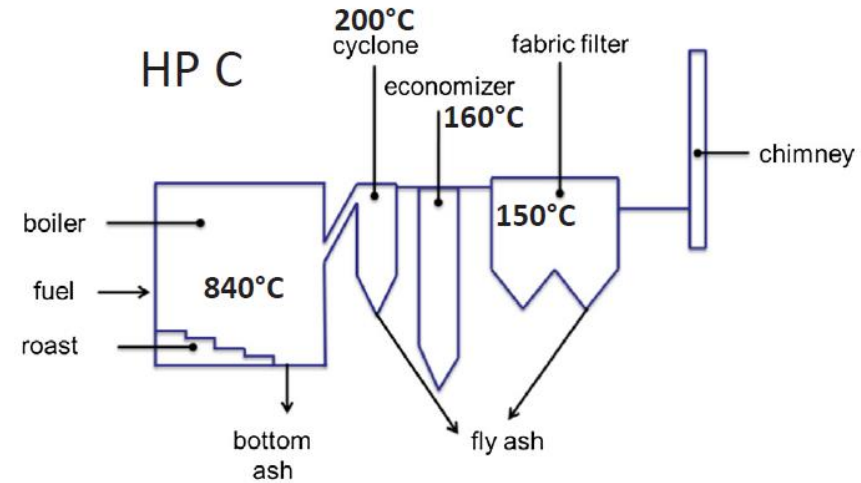
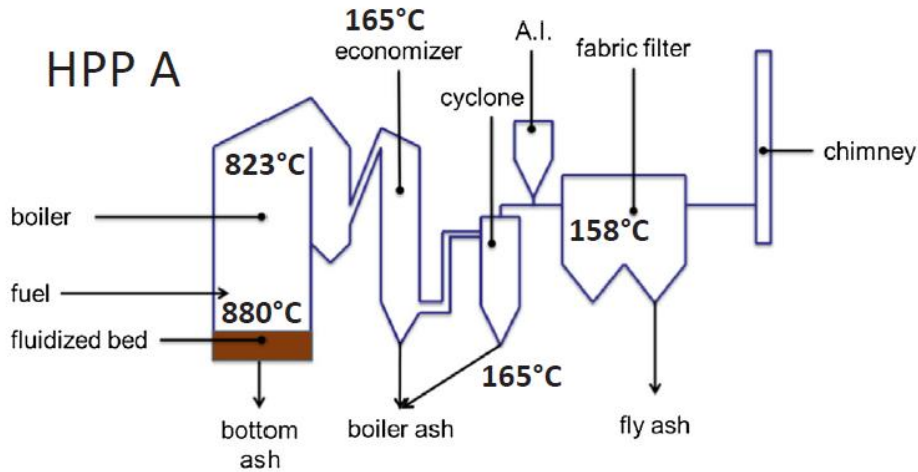
Power plant process



- Disposal
 - Cost intensive
 - Contradicts goals for a „circular economy“
- Utilization
 - Additive for construction materials
 - Recovery of valuable components
 - **Fertilizer / soil amendment**

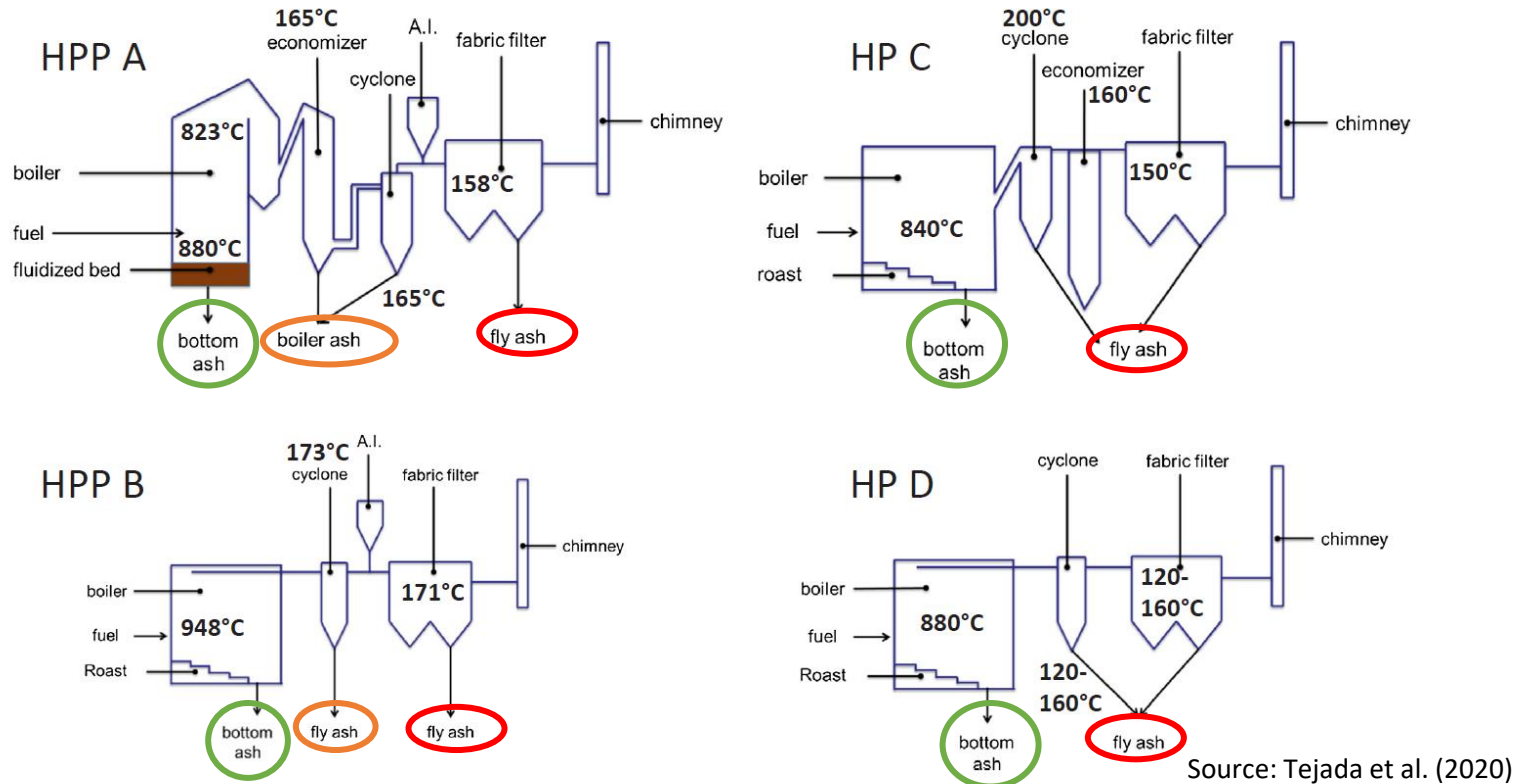
- Both utilization and disposal are regulated by national legislation, (e.g. Fertilizer Ordinance in Germany)

Screening of different ash fractions from wood-fueled HPPs



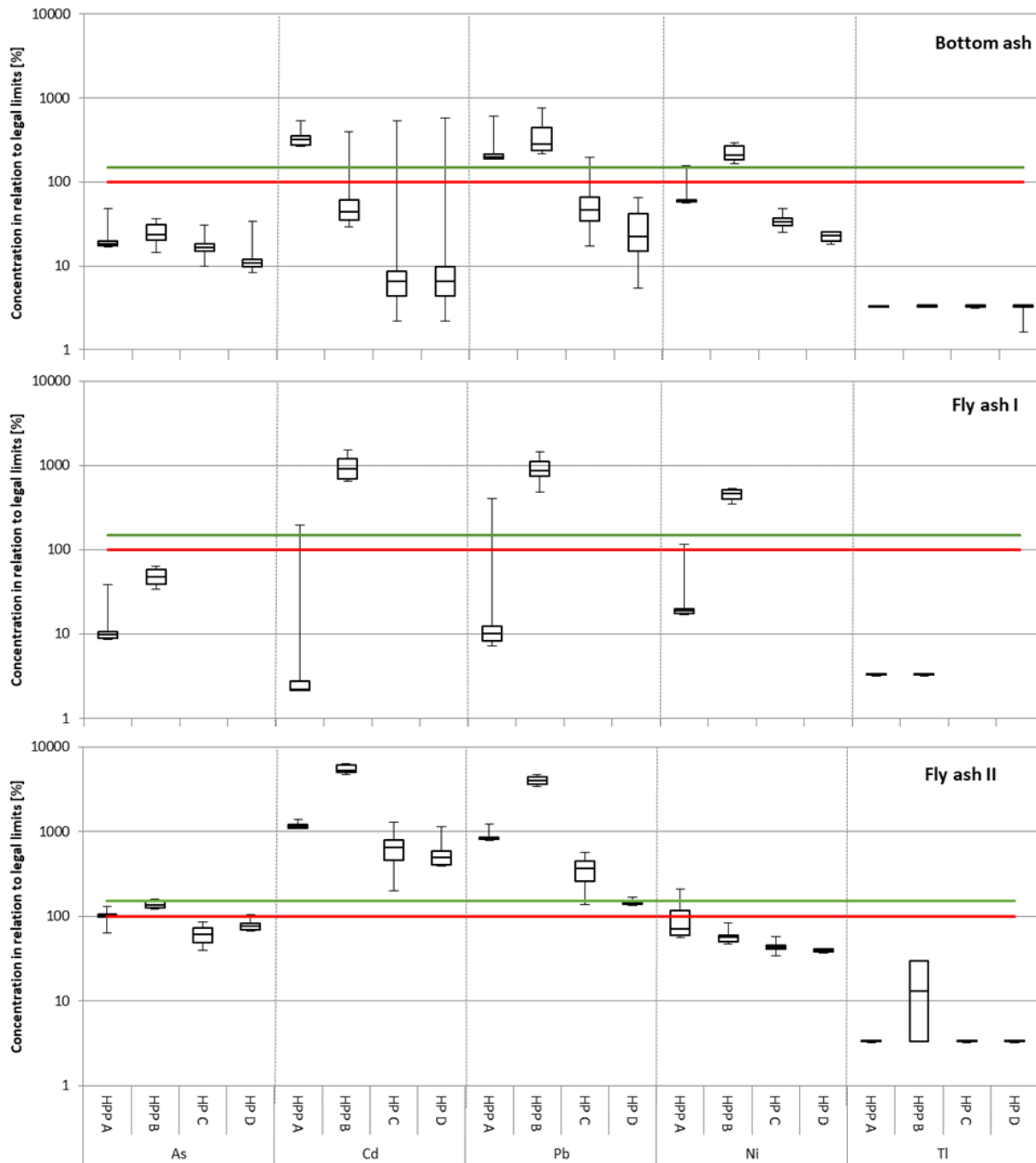
Source: Tejada et al. (2020)

Screening of different ash fractions from wood-fueled HPPs



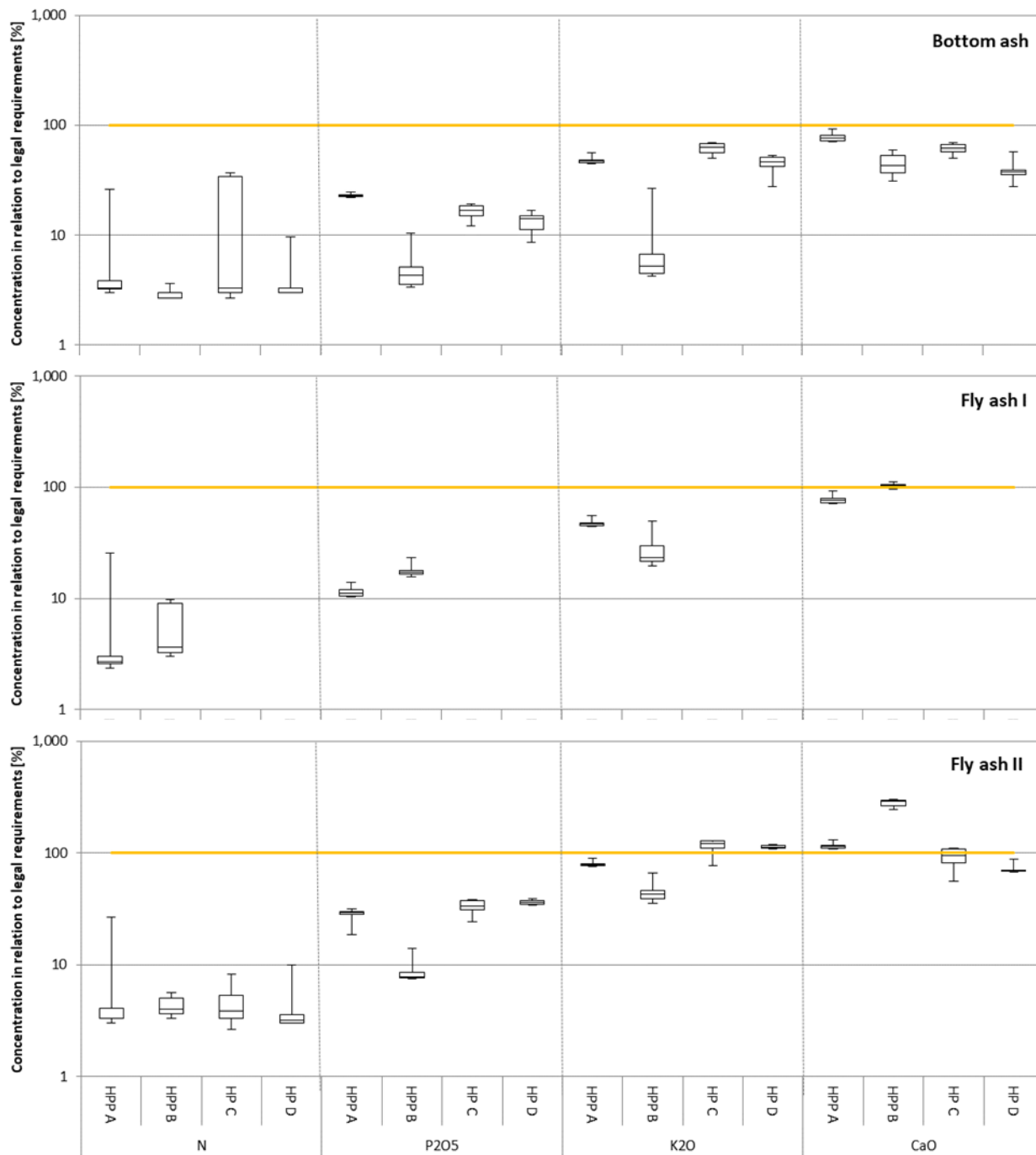
Potential application as a fertilizer is defined by the German fertilizer ordinance:

- Bottom ash: „Combustion chamber ash“ may be used
- Boiler/cyclone ash: Utilization possible
- Fly ash: Ash from „last filter unit“ is excluded from use



Assessment of different ash fractions with regard to legal limits for TE-concentrations

Nutrient concentrations in ash fractions compared to requirements for licensed multinutrient fertilizers



Thank you!



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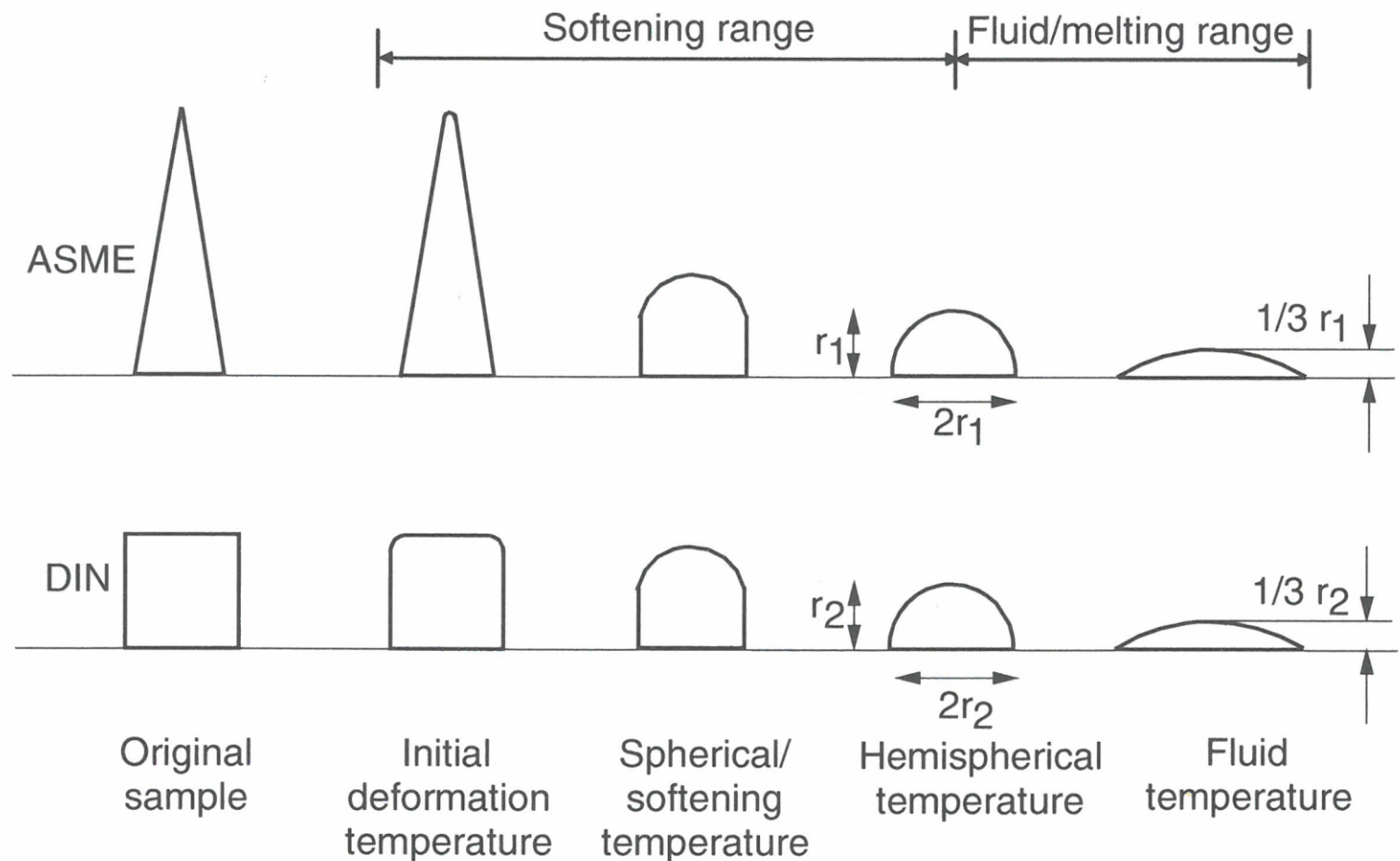
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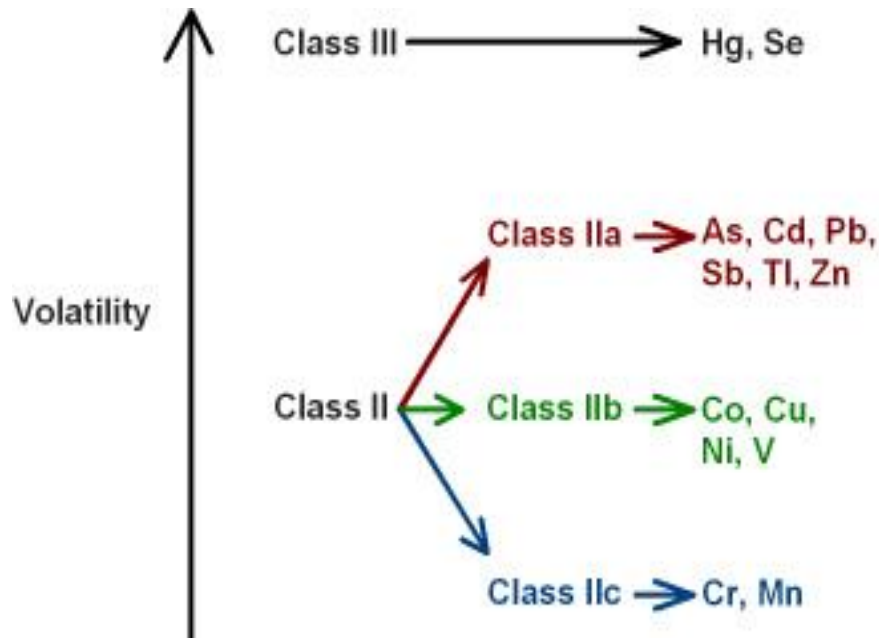
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Ash melting behavior of different combustibles



Deposition of trace elements



Classification according to [Meij]

