SESSION 1: IMPROVING QUALITY of LIFE

PANEL 1.1A: Essential elements of well-being

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Ahmed Basfar established the Radiation Technology Centre at King Abdulaziz City for Science and Technology (KACST) consisting of three major research activities in the areas of radiation processing of polymers, high dose dosimetry and environmental applications of radiation in addition to ten supporting laboratories

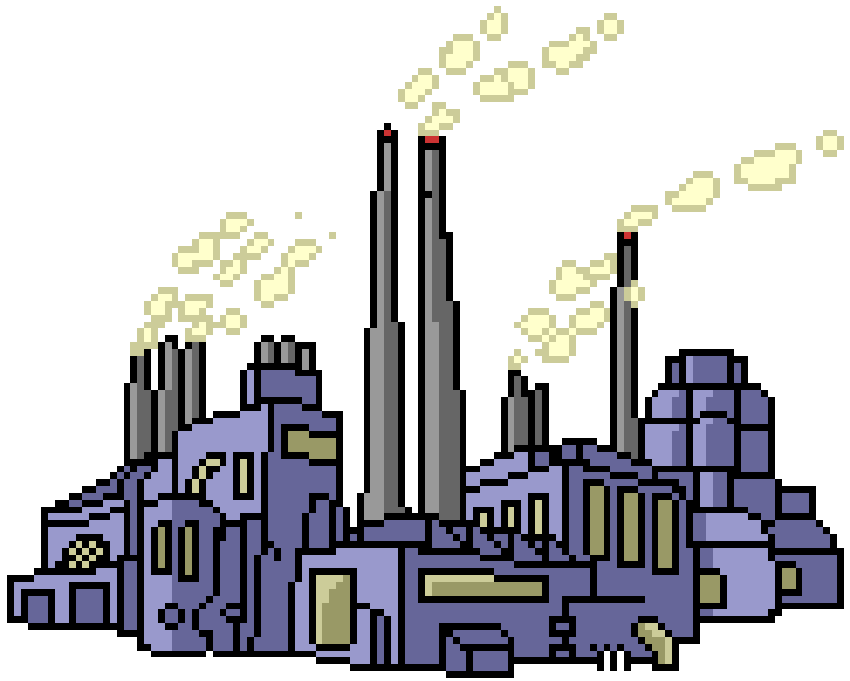
مدينة الملك عبد الله للطاقة
الذرية والمتجددة K•A•CARE

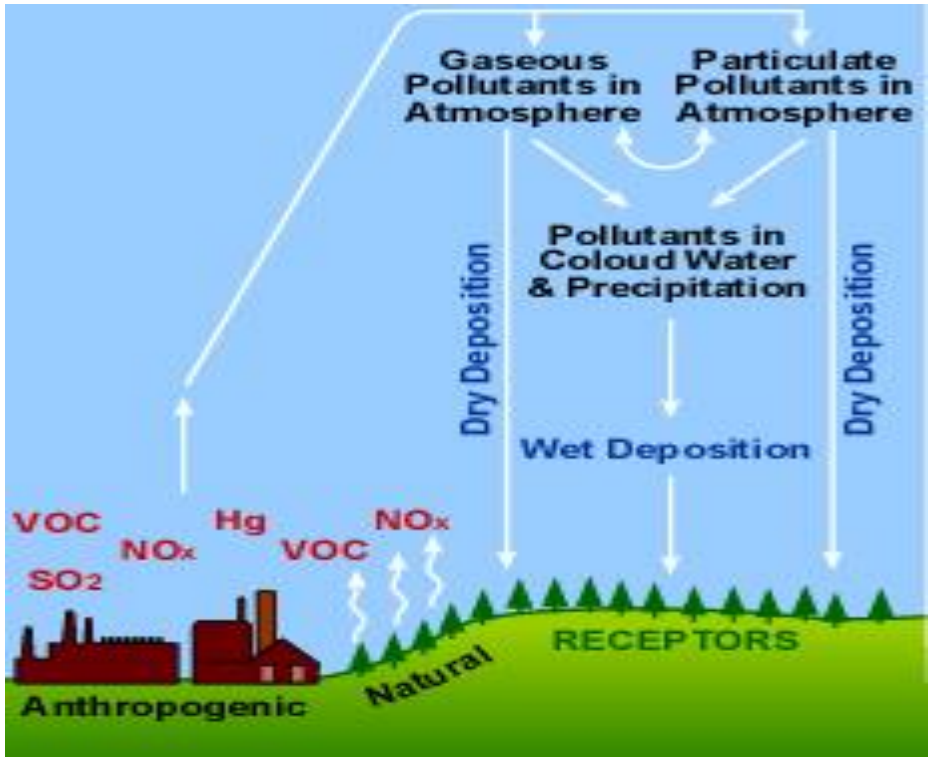
Application of Ionizing Radiation in Environment Protection

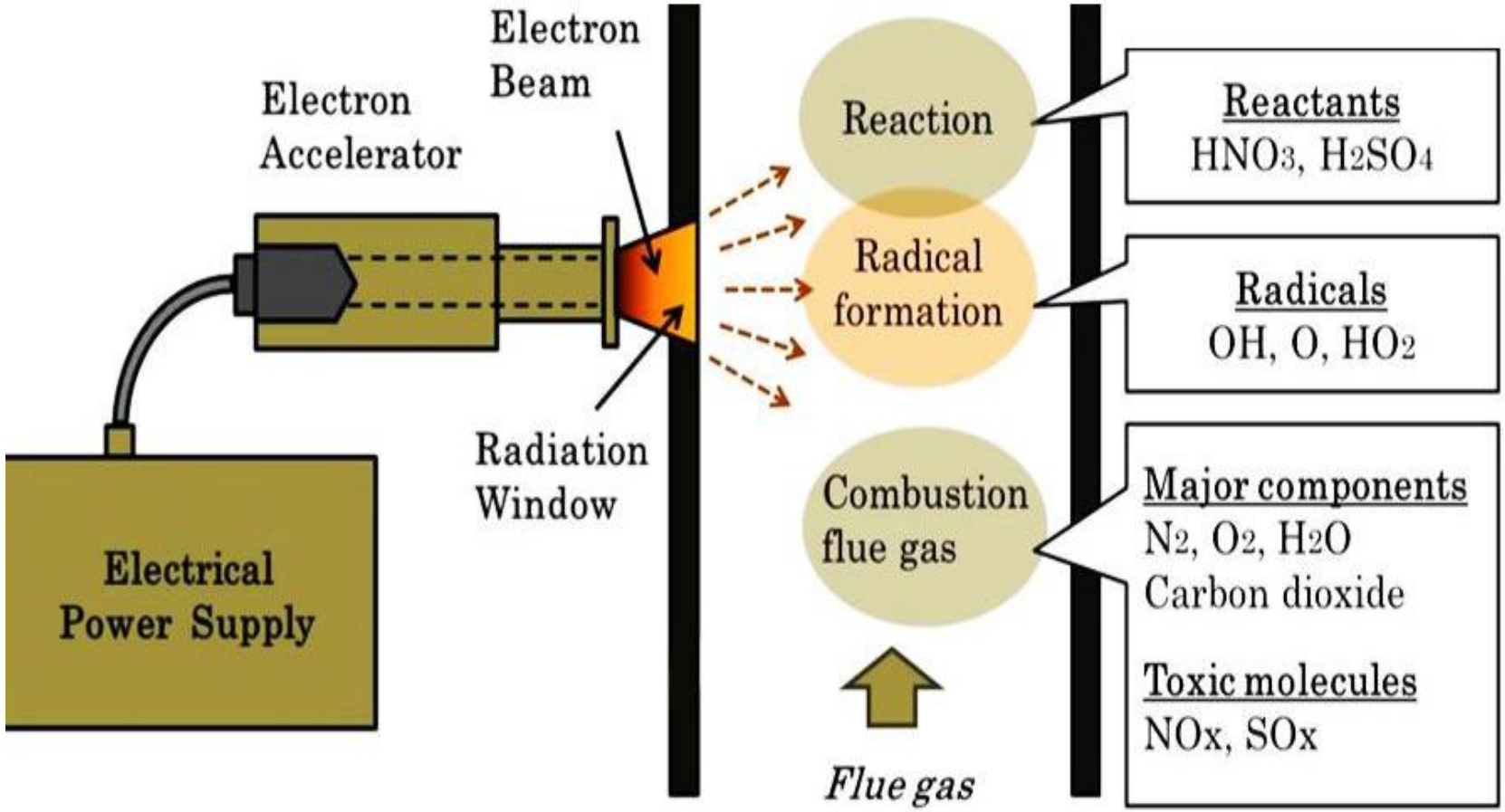
Prof. Dr. Ahmed Basfar
King Abdullah City for Atomic and Renewable Energy (KACARE)
Riyadh Saudi Arabia

IAEA Ministerial Conference on Nuclear Science and Technology, Vienna
28-30 November, 2018

Emission of Pollutants and Acidic Rain







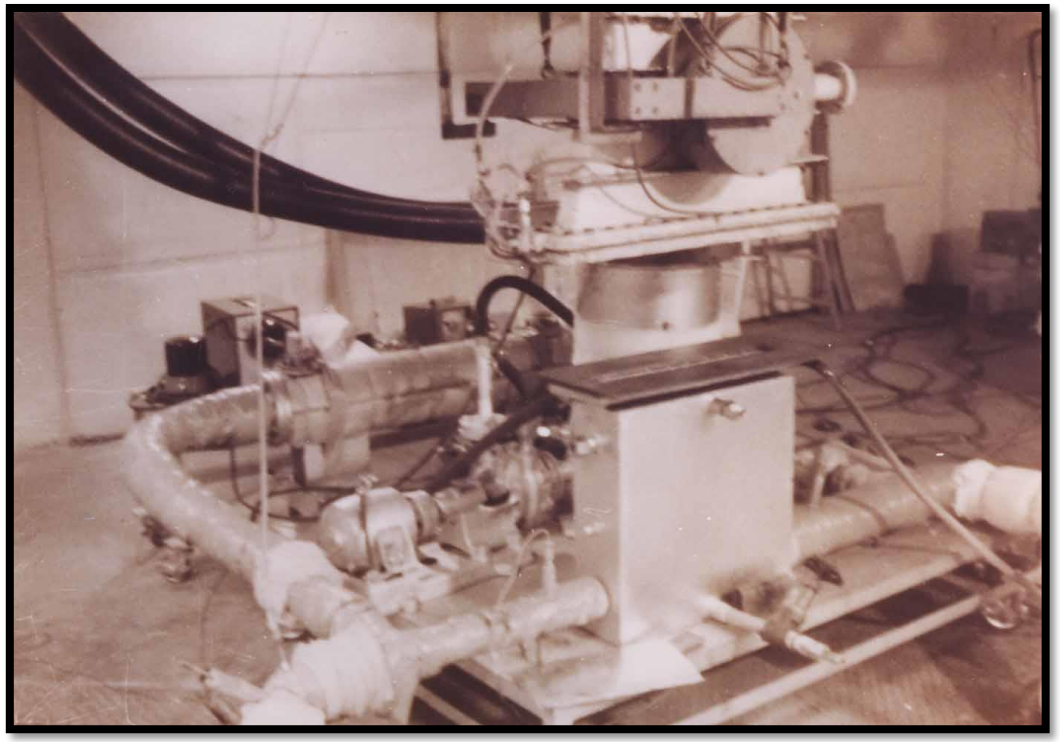
General Scheme of the Electron Beam Interaction with the Flue Gas

Japanese Experience of EBFGT Technology Development

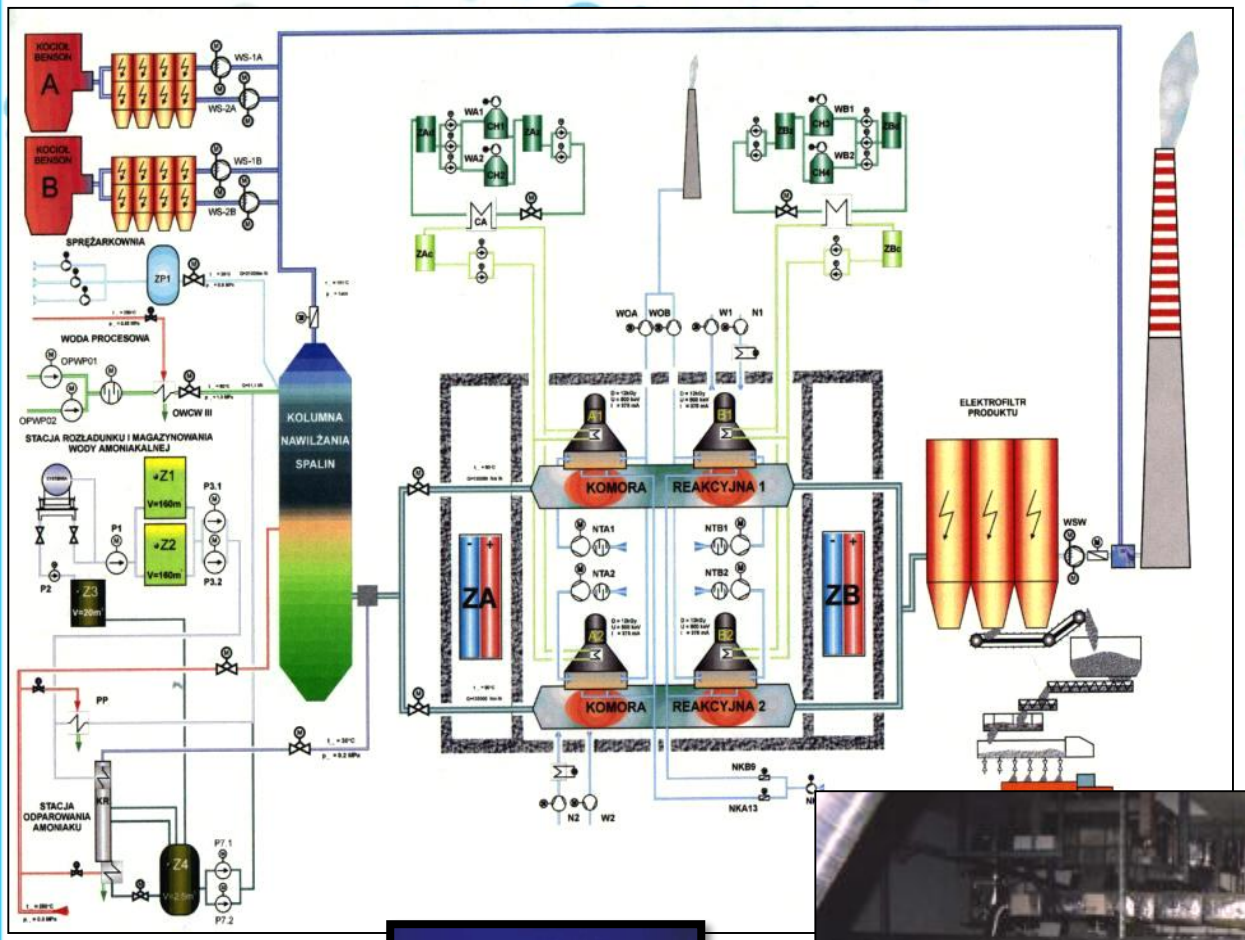
JAERI / Takasaki RCRE and Ebara Co. in 1972

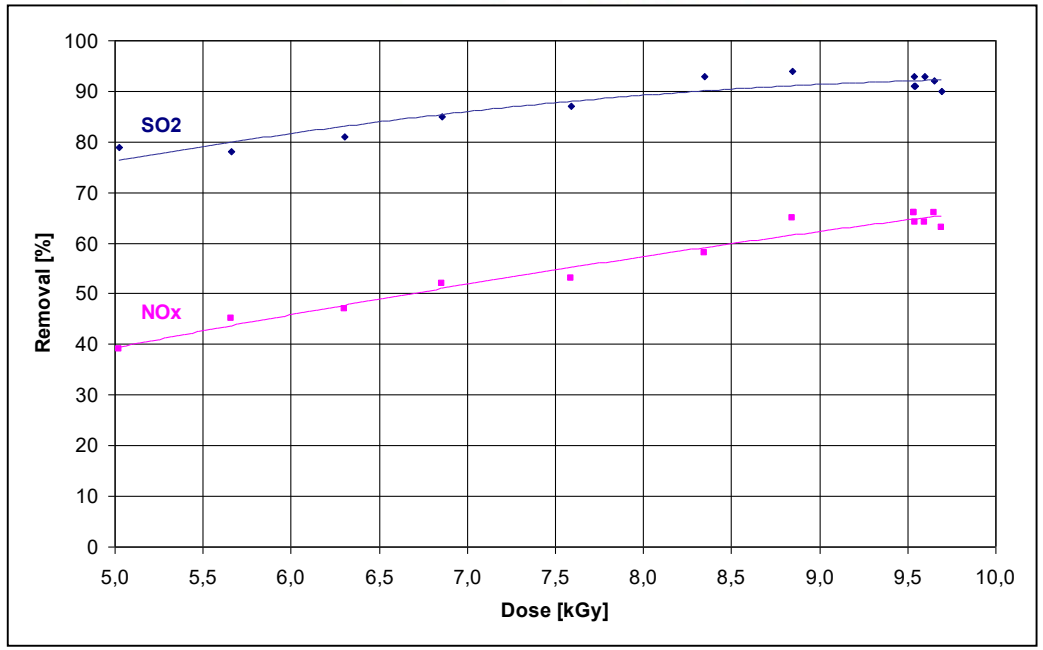
Small flow type plant (60Nm3/h)

Removal:SO_2 80%;NO_x 90%



Dependence of SO_2 and NO_x Removal Efficiency on Dose





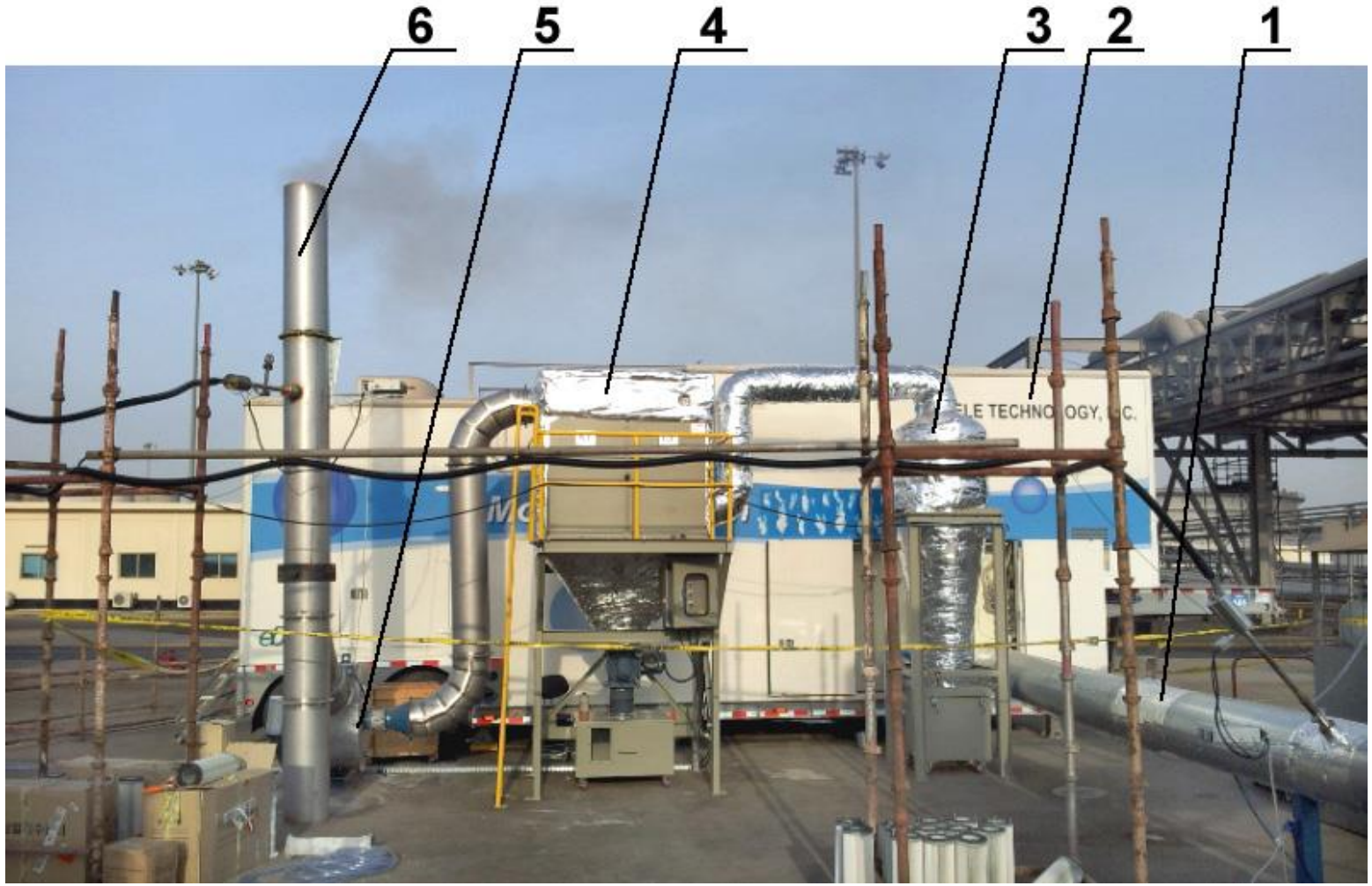
Pomorzany, Poland (IAEA/EPS/INCT)	1999
Flow gas flow (coal-fired)	270,000Nm³/h(130MW)
Flue gas temperature	130-150℃
SO2/NOx Conc.	1000~1500/400~600mg/Nm³
SO2/NOx Removal Eff.	90%/70%
By-product production	200~300kg/h
NH3 consumption	100~150kg/h
Electron beam accelerator	800keV/4×300mA
Total power consumption	1MW

General View of the Pilot Plant in Saudi Arabia

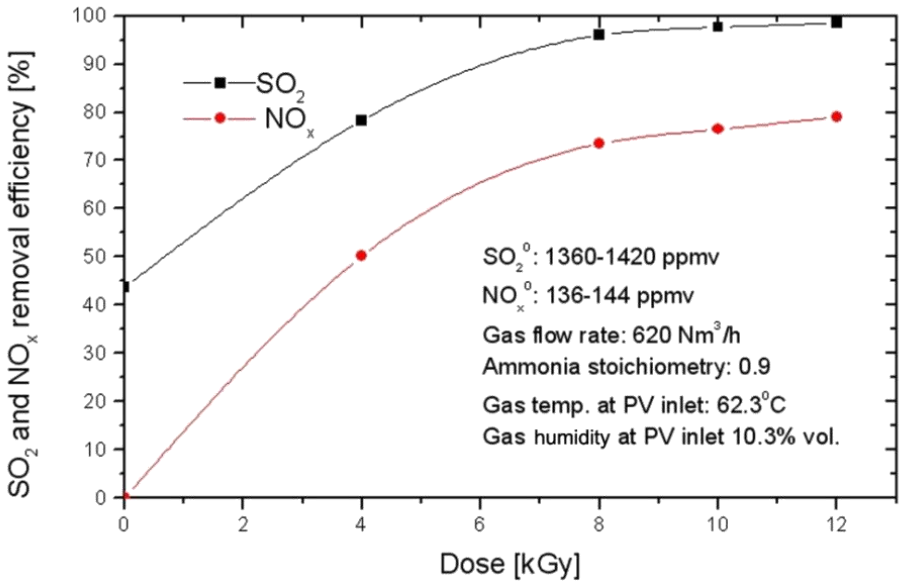
1. Stack of F 1001 boiler
2. Boiler F1001
3. Flue gas duct
4. Control room
5. Humidification unit
6. Pilot plant stack
7. Bag filter
8. Insulated duct part
9. Cyclone
10. Ammonia storage and injection unit
11. EB mobile unit

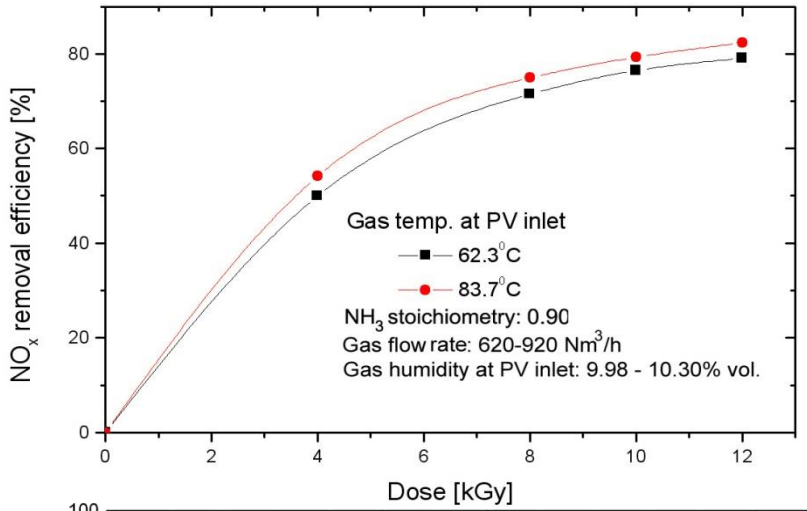
Pilot Plant Process Units

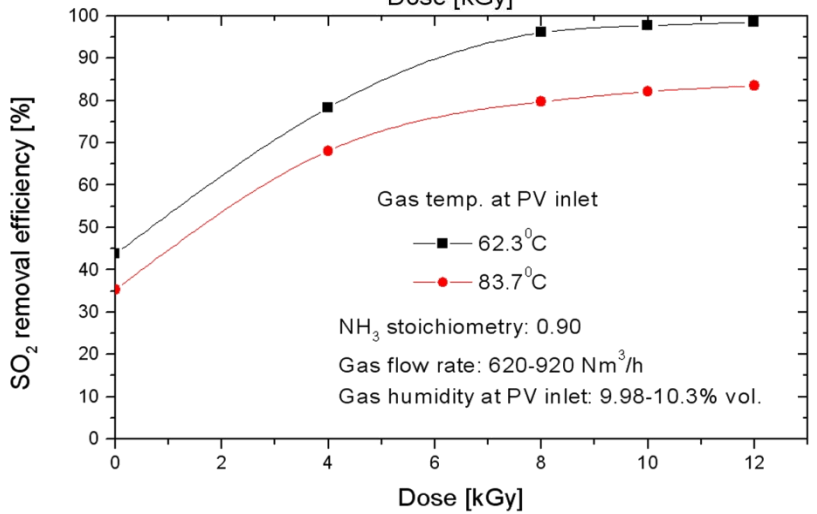
1. Inlet to process vessel,
2. EB-TECH mobile unit,
3. Cyclone,
4. Cartridge filter
5. ID fan
6. Stack



SO_2 and NO_x Removal Efficiency







Radiation Technology for Wastewater Treatment

High contamination

Textile dyeing wastewater
Leachate from landfill area
From petrochemical plant
From paper mills
From mines (coal, metals)
From chemical plants

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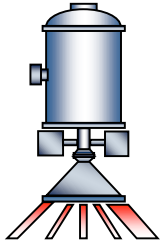


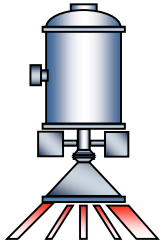
Removal of impurities
(COD, BOD, S/S etc.)

→ **Discharge**

Low or less contamination

Underground water
Water from lakes or marshes
Effluent of municipal plants

→



Disinfection
Removal of Color,
Odor, Residuals

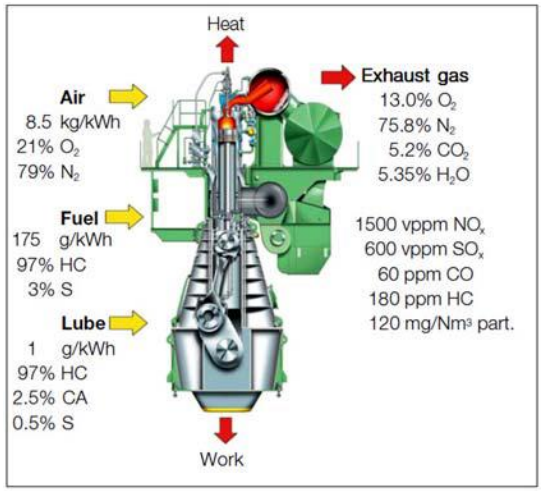
→ **Re-use**

Textile Dyeing Wastewater Treatment Plant in Korea

Full-scale application of electron beam wastewater treatment plant for 10,000 m^3/d of textile dyeing waste water with 1 MeV, 400 kW accelerator.

Marine Transportation

EMISSION



- Two stroke Diesel up to 81 MW
- 6 to 14 pistons (each 1820 dm^3)
- Heavy oil
- Consumption 250 ton fuel/day
- Typical off-gases – 13 % O_2, 5.2% CO_2, 5.35% H_2O,
- 1500ppmv NOx, 600ppmv SOx,

  60 ppmv CO, 180 ppm VOC

„Green" dock

Vibrio cholerae
Enterococci
Escherichia coli

Conclusions

- EBFGT is the most advanced technology for simultaneous SOx and NOx removal
- Feasibility of the technology has been demonstrated for coal fired plant in the full industrial scale
- Feasibility of the technology has been demonstrated for oil fired boiler in pilot industrial scale
- The process can be applied for diesel engine flue gas treatment at cargo ships (laboratory tests)
- The process can be applied for VOC and PAH treatment (laboratory and industrial pilot tests)
- The process can be applied for mercury emission control (laboratory tests)
- New developments needed in accelerator technology

Challenges and Opportunities for Application

1. Public Acceptance.
2. Regulatory works from Authorities.
3. Engineering Problems ? (Research to Business).
4. Penetration in water and sludge.
5. Laboratory to Commercial Plant.
6. Economics (competitions with conventional technology).
7. Socio-Economical aspects.

THANK YOU