EMERGING ENVIRONMENTAL APPLICATIONS OF ELECTRON ACCELERATORS

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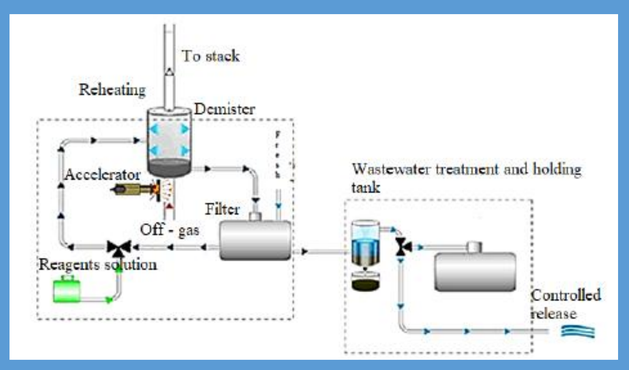
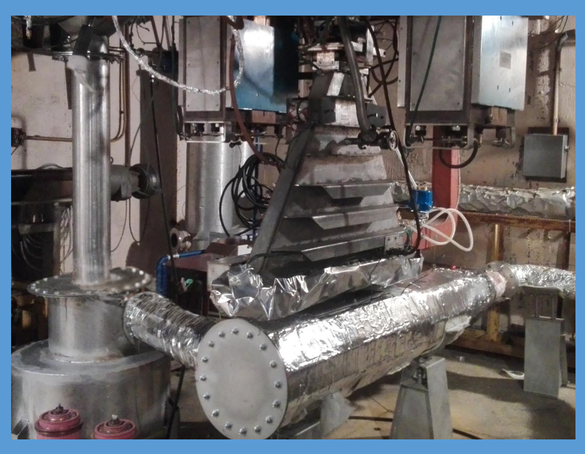
EB treatment of marine diesel flue gas

- Response for establishing of Emission Control Areas (ECA) - Removal of SO_2 and NO_x from marine diesel exhaust gases
- Hybrid technology using electron beam treatment and sea water scrubbing (with or without oxidant addition)



- Removal efficiencies for 5 kGy:
  - EB + sea water with oxidant (NaClO) scrubbing: 90% NO_x and 99 % SO_2 removal (inlet 1000 ppm NO_x and 700 ppm SO_2) – laboratory unit (below)

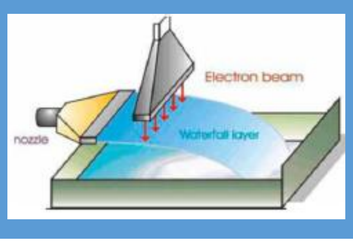


Residual balast water treatment

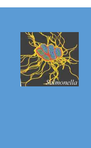
Electron Beam technology for:

- Dangerous pathogens removal: *Vibrio cholerae, Escherichia coli* and *Enterococci*
- Removal of invasive species which may displace native sealife thus harm local ecosystems

According to International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM)

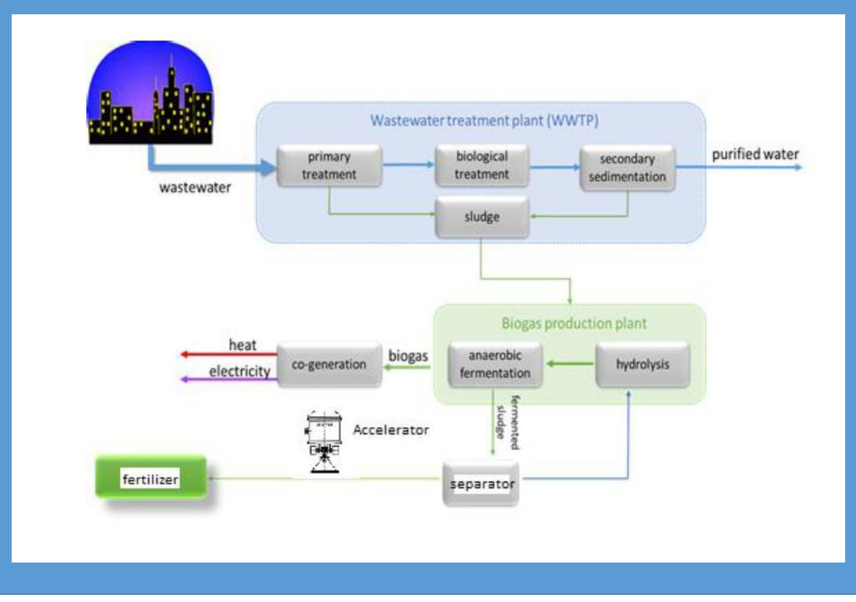


D_{10} dose [kGy] resulting in a tenfold reduction in the population is
- *Vibrio cholerae*, *Vibrio parahaemolyticus*, *Vibrio vulnificus*: 0.1 kGy;
- *Escherichia coli*: 0.5 kGy;
- *Enterococci*: 0.6 kGy.



„Zero Energy „ sewage sludge EB treatment

- Removal of pathogenic bacteria and parasite eggs from sewage sludge to make it usable as fertilizer
- Sludge disintegration by irradiation enhance biogas production in anaerobic fermentation proces
- Target- „Zero-Energy" biogas plant using electricity from methane to power the electron accelerator purposed for sludge treatment, product – biologically safe fermented sludge usable as fertilizer



Dose [kGy]	Nematodes			
	Adults	Eggs [pcs/kg s.m.]		
		Ascaris sp.	Trichuris sp.	Toxocara sp.
0	Many living	480	320	320
5.0	0	0	0	0
7.5	0	0	0	0
10.0	0	0	0	0

Acknowledgements. Reported works are carried out in the frame of NCBR and NCN project „**TANGO 2**". Agreement number TANGO2/341079/NCBR/2017, „Plasma technology to remove NO_x from off-gases", H2020 Aries project – "Accelerator Reasearch and Innovation for European Science and Society„ and IAEA RC , and two National Center for Research and Development projects co-finamced by REMONTOWA SA and Biopolinex SA

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 730871