GLIDARC-ASSISTED CLEANING of FLUE GAS from CONVENTIONAL or CHEMICAL WEAPONS DESTRUCTION

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Since 1993 a very simple process based on GlidArc plasma reduces the nuisances of waste explosives combustion processes in which soot, VOC, PAH, NO_x, CO, and other toxics are emitted. Similar GlidArc Oxidizers are commercially used to completely decontaminate the gas issued from a controlled detonation of old chemical weapons in Japan and in Belgium.

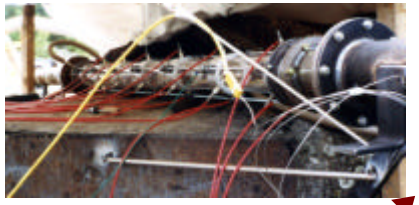
Classical explosives

Laboratory setup for plasma assisted cleaning of the Flue Gas (FG) issued from an open burning of nitrobenzene; covered ranges:

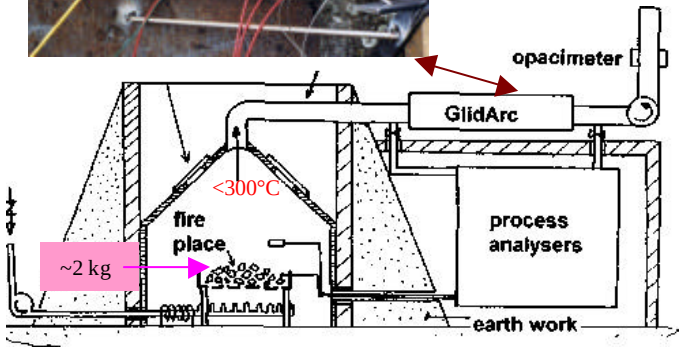
Nitrobenzene combustion rate	0.9 - 4.4 g/min
Air flow-rate	32 – 110 L(n)/min
Temperature at the plasma reactor inlet	70 - 280°C
exit	85 - 282°C
Ratio of the FID signal from the non-treated FG over the signal from the FG when plasma reactor was operating	3 – 17

Conclusions: work at the highest possible FG inlet temperature and the highest possible VOC initial concentration. In such a way the plasma reactor works as an igniter of practically self-combustion of VOC. A visual observation of the plasma action clearly indicated a spectacular diminution of the smoke darkness.

Pilot Experiment: Controlled open-air combustion of the TNT $CH_3C_6H_2(NO_2)_3$



6 serial GlidArc-I (3 electrodes) discharges in 80-mm tube (0.25-m long each); 50 Hz, 3-phase, 1–9 kW, 200 m^3/h FG



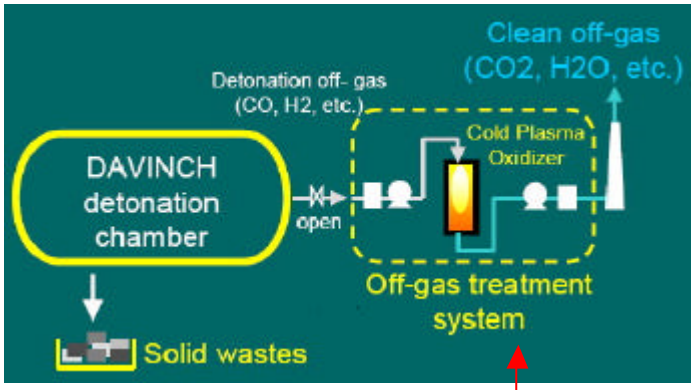
A typical result:

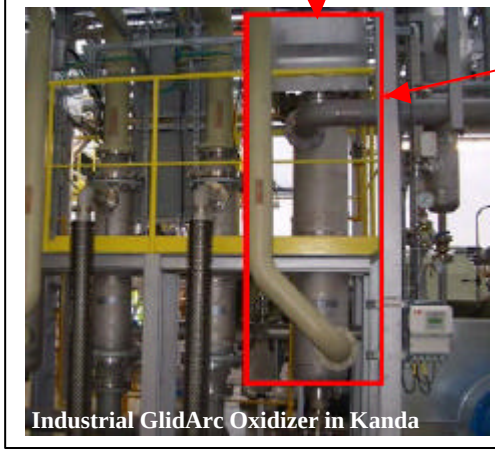
FG flow rate	50 m3/h	
GlidArc power	3.2 kW	
FG composition	before	after
CO (ppm)	760	515
NOx (ppm)	1180	406
NO2 (ppm)	206	158
CO2 (%)	3.4	14.8
O2 (%)	17.6	13.0
Soot	abundant	very little

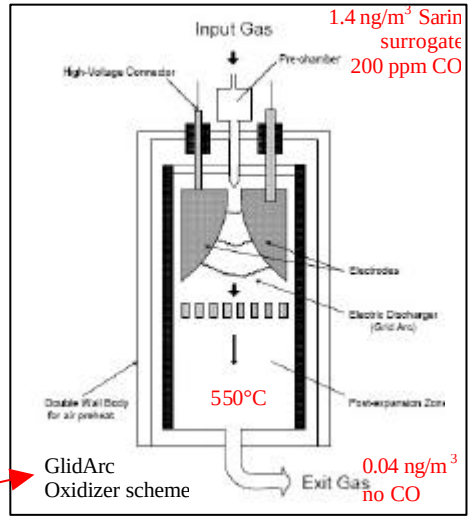
Low energy cost of 0.06 kWh/m^3 of the treated FG

Chemical weapons

A system developed by Kobe Steel (Japan) destroys various chemical agents and explosives (without previous dismantling) by a single detonation in a soft-vacuum chamber. At close to 3000 K and 10 GPa most of chemical agent is destroyed. Remaining pollutants are then completely neutralized in a second step Plasma Oxidizer based on GlidArc-I discharges.







Since 2004 more than 1300 chemical "yellow" and "red" bombs were successfully destroyed in Kanda (Japan) plant.
A second commercial plant in Poelkapelle (Belgium) works properly since April 2008.

Routine operation:
20 kg TNT-equivalent per explosion, corresponding to ~ 100 chemical shells per

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