

GlidArc-assisted cleaning of flue gas from destruction of conventional or chemical weapons

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***presently with Ceramatec, Utah**

Huge amount of various explosives is stored ... and waiting for destruction.

Their "open burning" is rather simple and the destruction cost is minimal, but huge quantities of dangerous products are released to atmosphere.

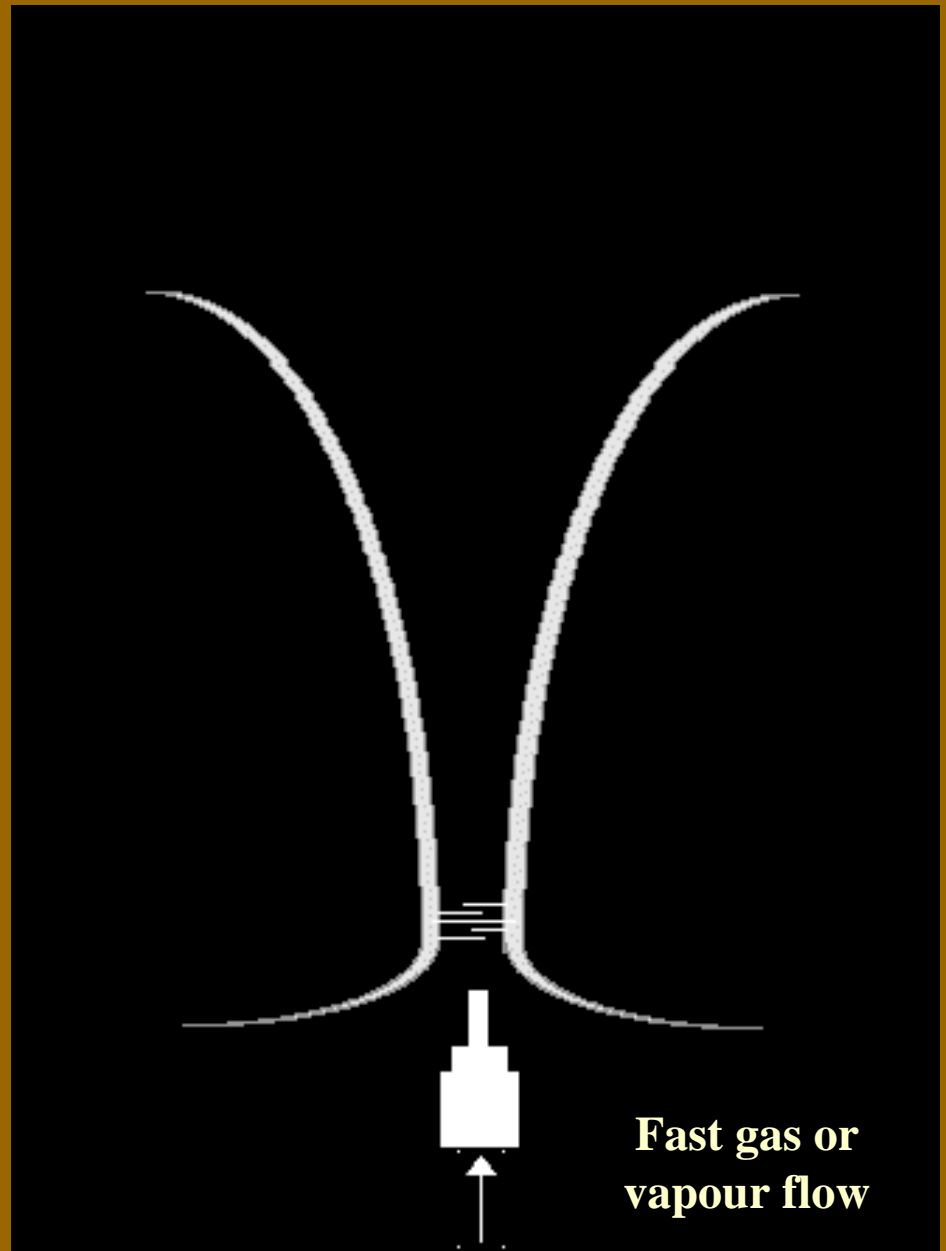
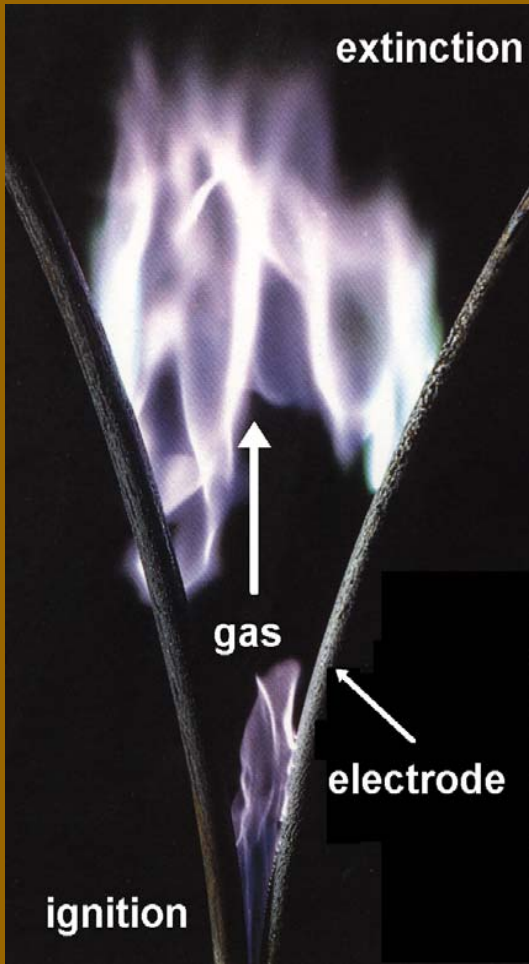
The simplest elimination - their detonation in atmosphere, under the water, or under the ground - provides a large part of toxic materials dispersed into the soil and the flue-gas problems remain.

Since 1993 we are involved in a **GlidArc™**-assisted cleaning of flue gas from combustion of conventional munitions.

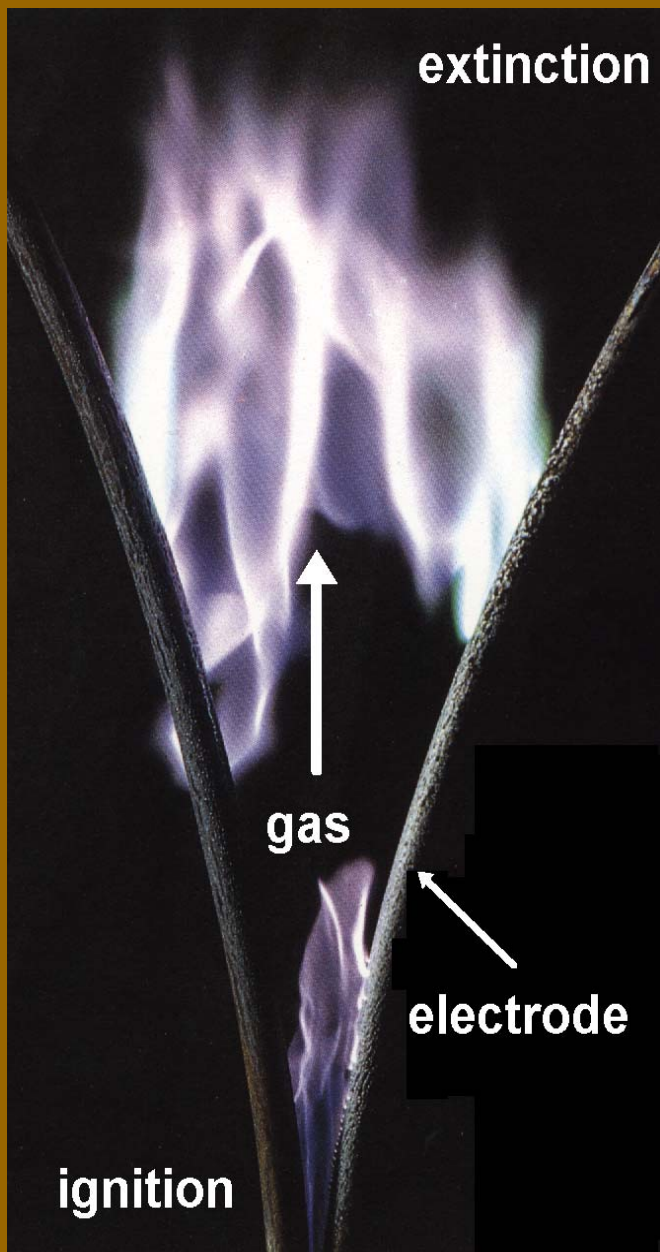
Additionally, thousands tons of extremely dangerous chemical weapons are stored throughout the World and become very unstable with age.

Nowadays, ECP has been associated in even more ambitious program of Kobe Steel Ltd. (Japan) and Ceramatec Inc. (Utah) related to the chemical weapons destruction (again **GlidArc™**-assisted) in a Japanese port Kanda as well as in Belgium site of Poelkapelle (close to famous WW-I chemical battlefield Ypres).

Next destructions sites are under construction...



How GlidArc I operates:



GlidArc features

cold electric discharge, 5 – 15 kV, < 5 A,
0.05 to 50 kW

0.03 - 12 bar

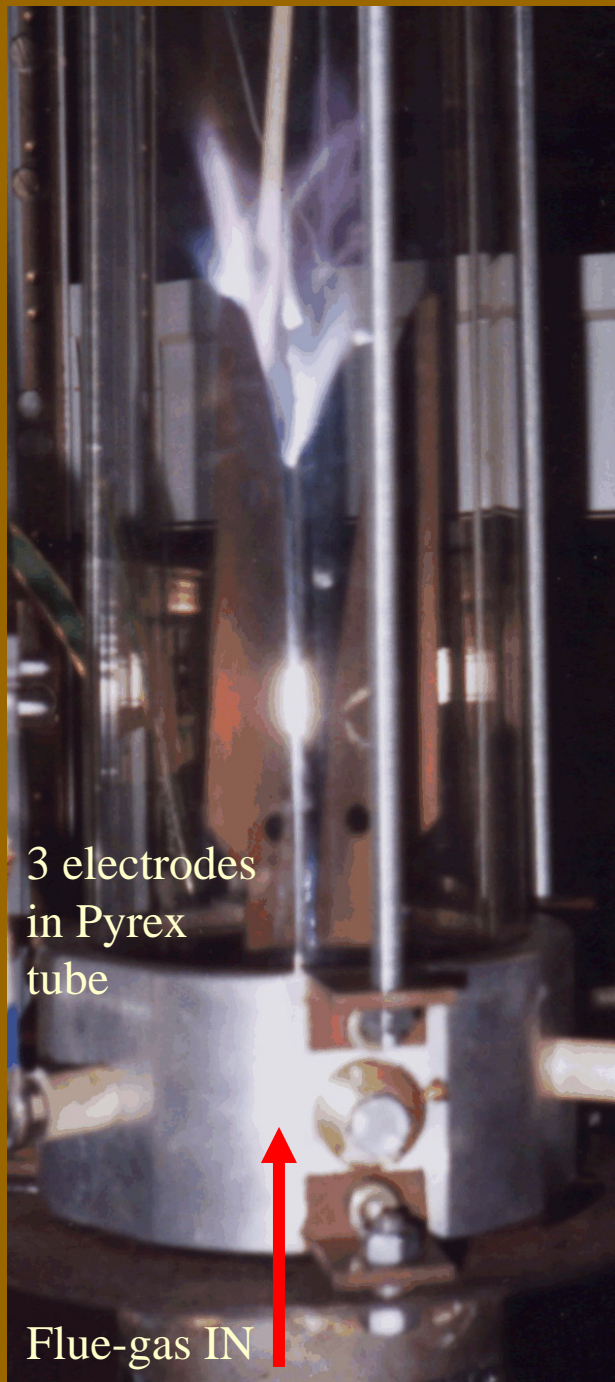
enhances and stabilizes exothermic
processes *via* active catalytic species

not cooled electrodes

any gas, vapor, droplets or dust accepted

any initial feed temperature accepted

multiple-discharge/electrode system can
be installed for a large scale



Bench-scale cleaning of flue gas from nitrobenzene burning:

Hot flame core that consumes all available O₂

μ-sponge soot with absorbed polyaromatic hydrocarbons



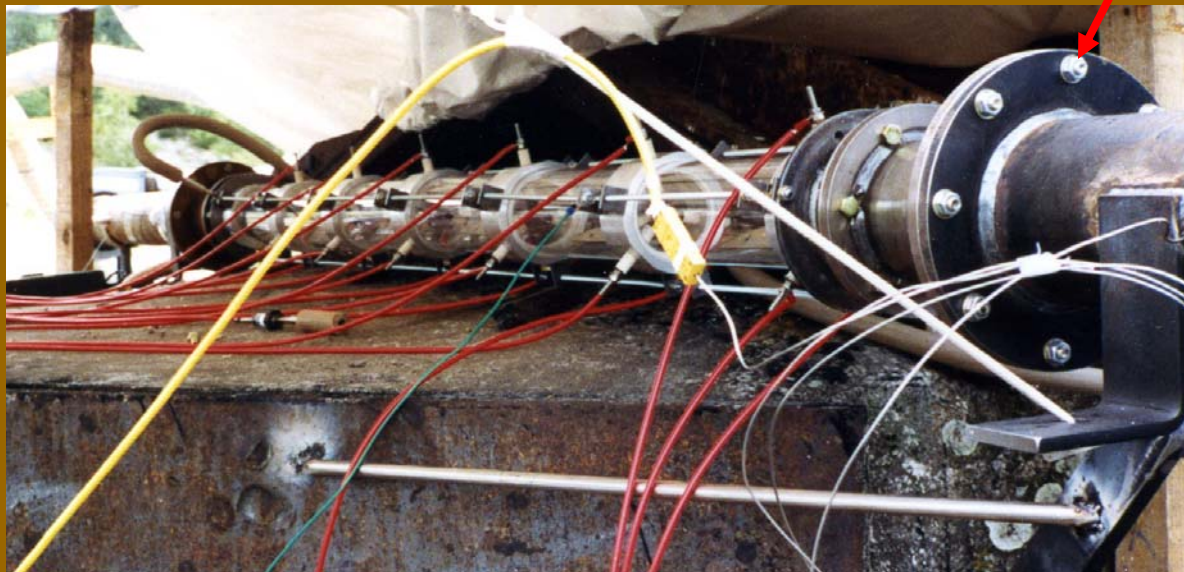
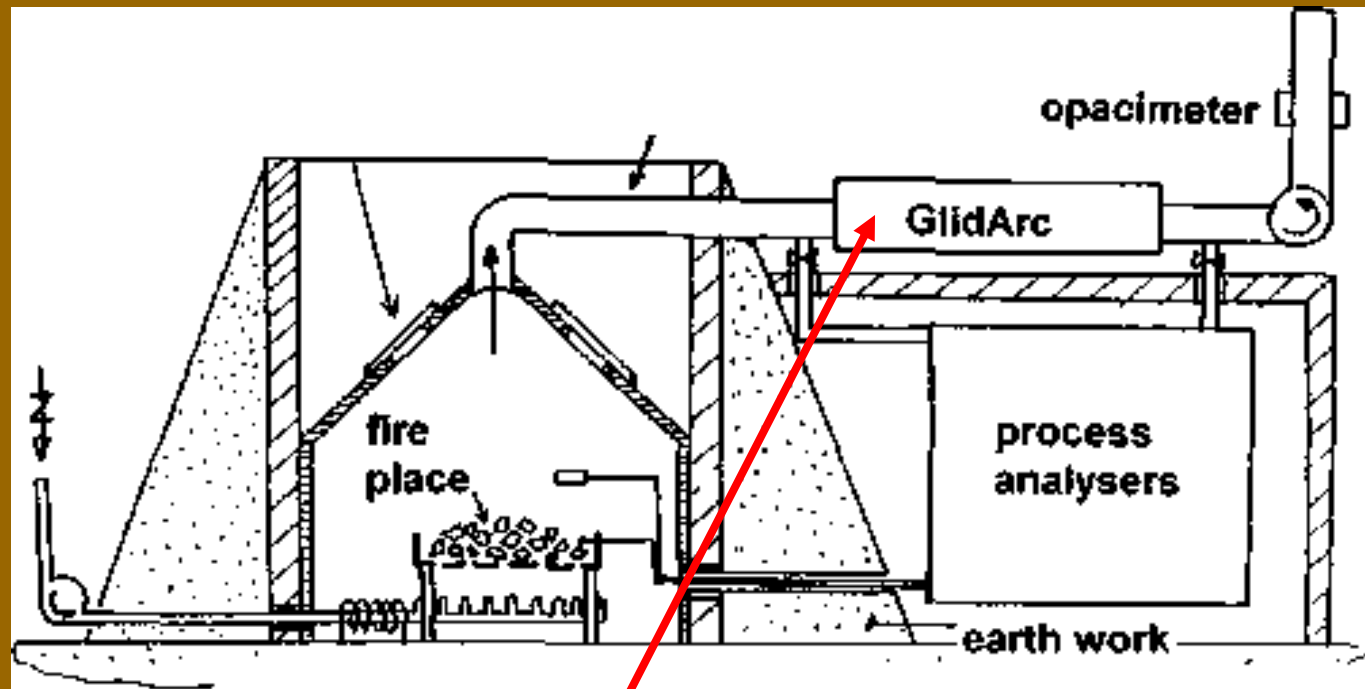
Nitrobenzene combustion rate	0.9 - 4.4 g/min
Air flow-rate	32 – 110 L(n)/min
Temperature at the reactor inlet	70 – 280°C
Temperature at the reactor exit	85 – 282°C

Result: up to 94% destruction rate of organic Carbon

so?

Going to burn a real explosive:

Tri-Nitro-Toluene (TNT) on a military firing ground



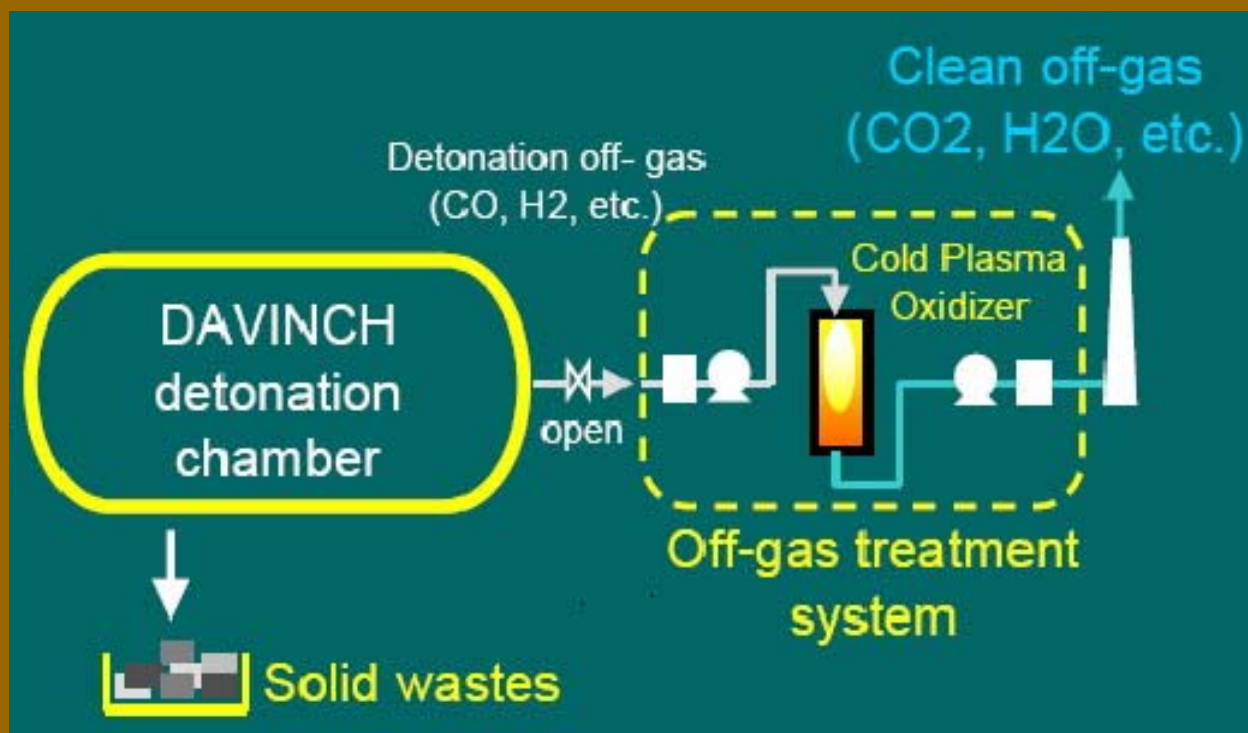
Pilot plant for TNT burning and Flue Gas GlidArc™ - assisted cleanup

Results of full-scale tests of GlidArc-assisted cleaning of flue gas issued from TNT burning in air for the Flue Gas flow rate of 50 m³/h and 3.2 kW electric power dissipated in GlidArc

FG composition	IN	OUT
CO (ppm)	760	515
NO _x (ppm)	1180	406
NO ₂ (ppm)	206	158
CO ₂ (%)	3.4	14.8
O ₂ (%)	17.6	13.0
Soot	abundant	very little

Chemical weapons

A controlled detonation system DAVINCH™ of Kobe Steel destroys explosives containing a chemical agent and **without previous dismantling**, but by a single detonation in a soft-vacuum chamber. At close to 3000 K and 10 GPa conditions most of chemical agent is destroyed.

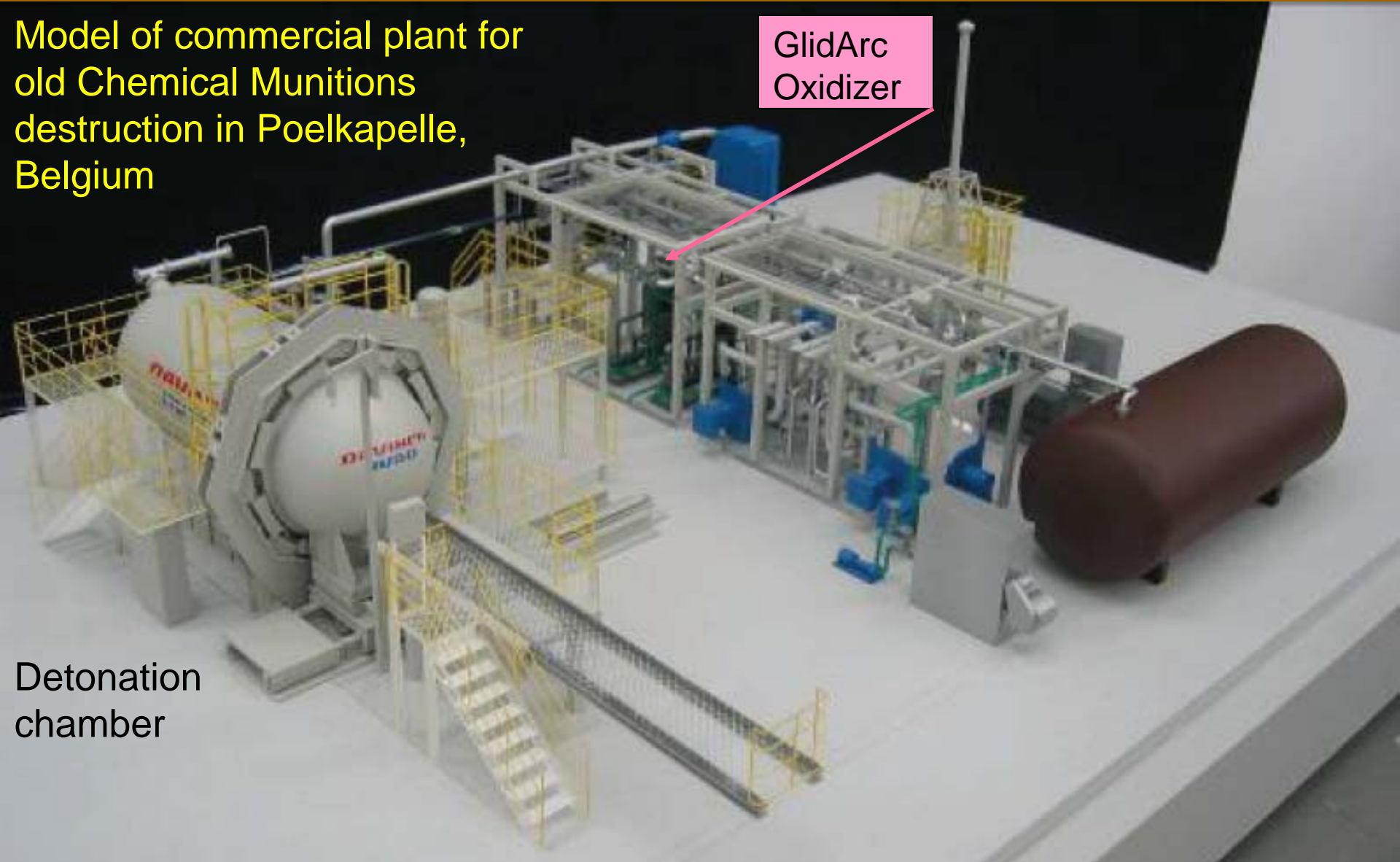


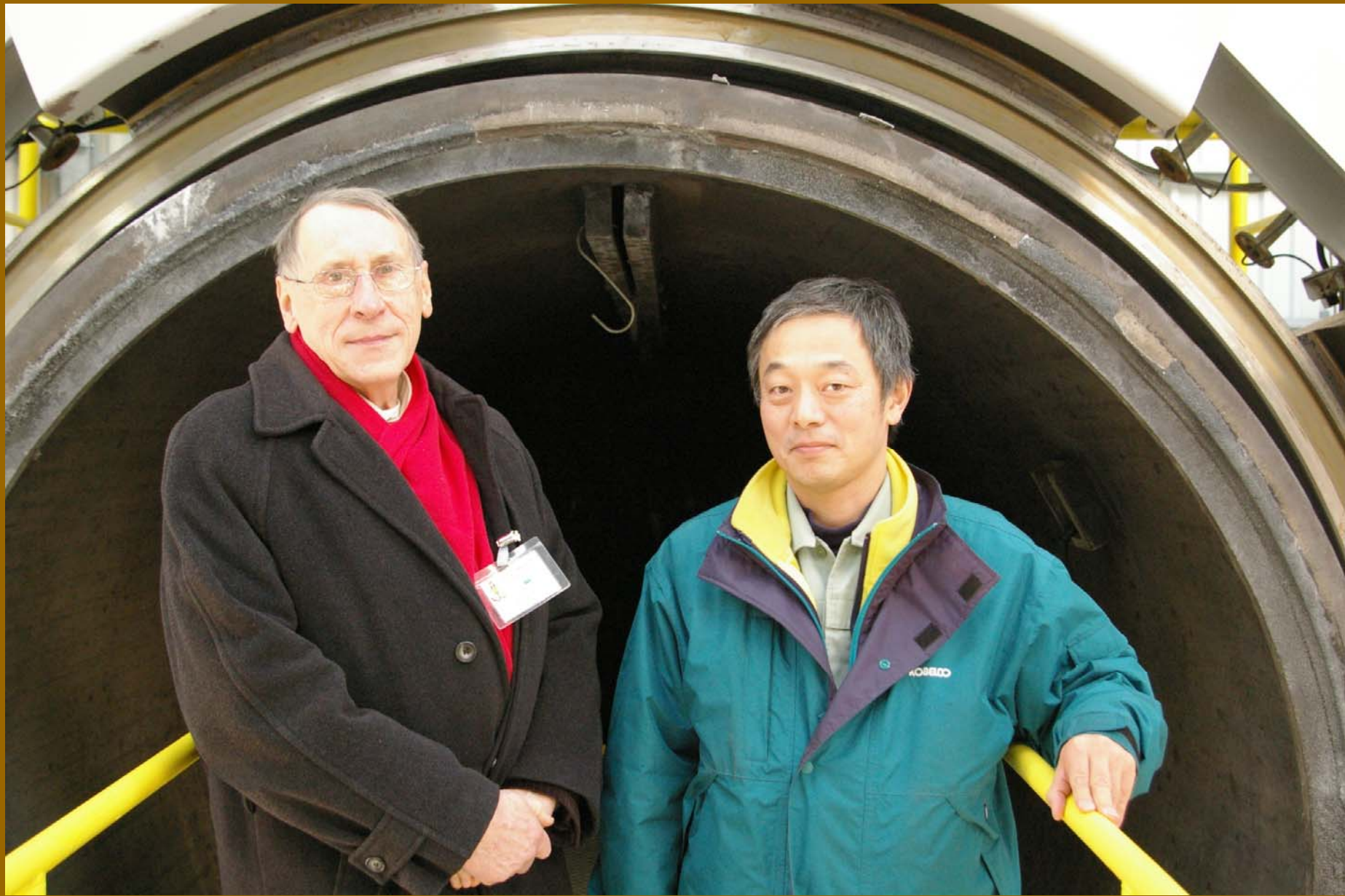
Remaining pollutants are then completely neutralized in ECP's **GlidArc™** Oxidizer

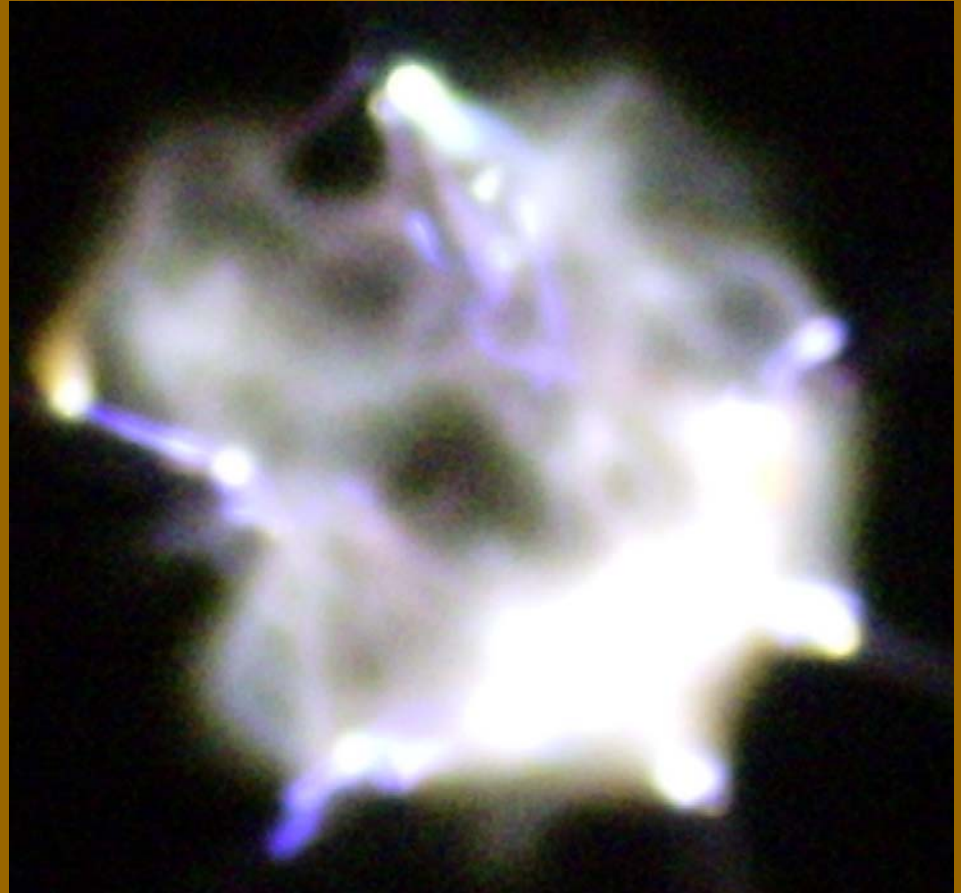
Model of commercial plant for
old Chemical Munitions
destruction in Poelkapelle,
Belgium

GlidArc
Oxidizer

Detonation
chamber







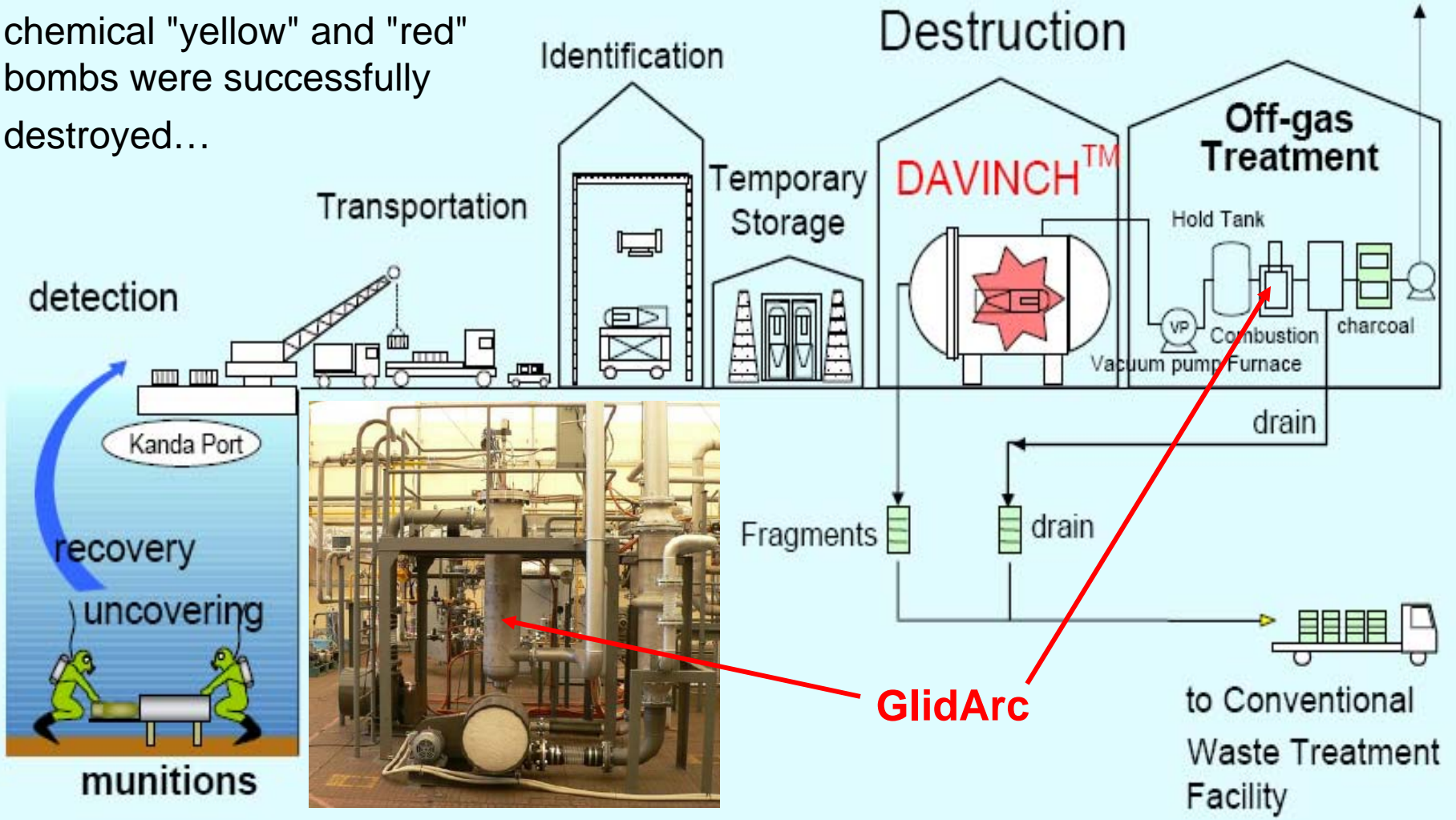




The Northern European Gas Pipeline will take supplies from Russia across the Baltic Sea to Germany.

How this problem is solved in Kobe, Japan:

Since 2004 more than 1400 chemical "yellow" and "red" bombs were successfully destroyed...



A test with **Sarin** (a nerve agent) surrogate shows its still dangerous 1.38 ng/m^3 content in the chamber off-gas - so 99.999998% destruction efficiency.

While crossing then the GlidArc Oxidizer its concentration lowers to **0.04 ng/m^3** (for allowed 0.1 ng/m^3). Residual CO concentration of 200 ppm in the detonation off-gas lowers to **zero** at the exit of the **GlidArc Oxidizer**.

New Flexible Mobile DAVINCH system is under development; it includes an independent **GlidArc Oxidizer** module for the off-gas **deep cleaning**.

Other very dangerous substances (pesticides, bacteria, viruses, etc. can be destroyed this way...

Thank
you!

