Part 1. Some thoughts on “Thermal Treatment Technologies” (T3)

Part 2. The Europlasma (T3) process for vitrifying WTE fly ash

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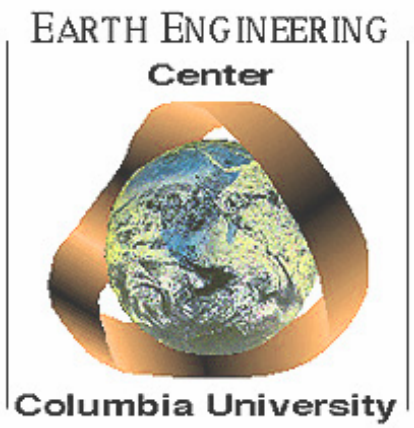
WTERT 2005 Meeting



The origins of this talk:

- The November/December issue of *Waste Management World* **(International Solid Wastes Association; ISWA) is dedicated to "Thermal Treatment Technologies" for MSW.**

- The invited papers for this issue were written by very prominent people in the international waste management scene.

- I was asked by *WMW* **to write a commentary as a preface to this T3 issue.**

“Thermal Treatment” Processes: A boon to humanity

- **Thanks to the discovery of controlled fire, humanity moved from the Stone Age to the Bronze and Iron Ages.**

- Copper metal was produced in smelters in the Negev industry as far back as 5000 BC.

- To this day, most of the metals and all the cement are produced by “Thermal Treatment” processes.

EUROPE

- **After reading this issue of *WMW*, readers will conclude that the dominant Thermal Treatment process for MSW is combustion combined with energy recovery, i.e., WTE. There are 400 WTEs in Europe alone.**

CHINA

- **The entry of China into the WTE nations must be a surprise to those in the U.S. who consider WTE to be a costly technology.**
- **It seems that the Chinese have figured out that the price of fuels will go up and up and have invested in nearly forty WTEs.**
- **China is using imported grate technologies like Martin and VonRoll and also home-grown fluidized bed technologies.**

JAPAN

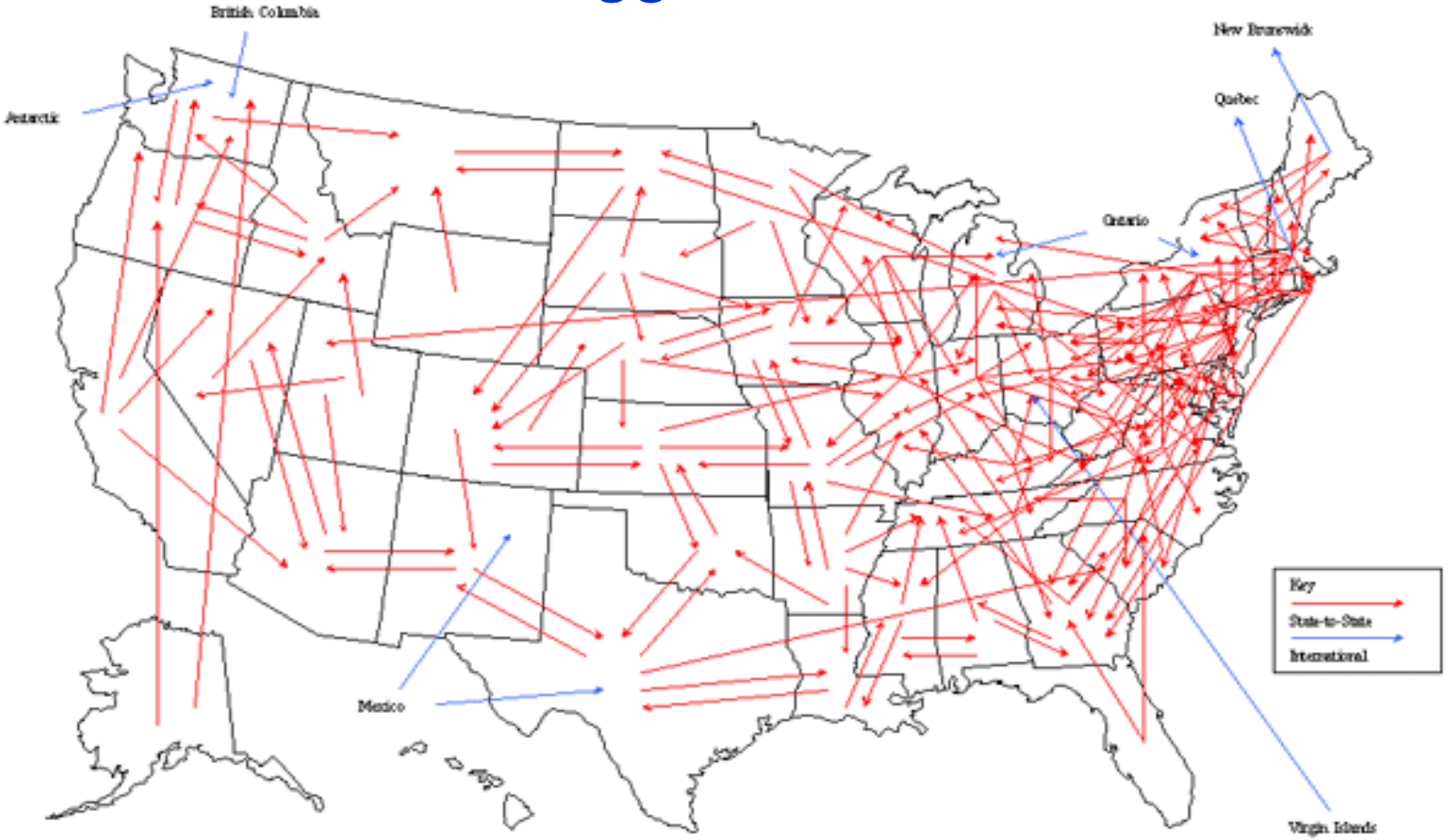
- Japan, after doing its utmost to increase recycling, combusts most of the rest in WTEs, uses the bottom ash, and vitrifies some of the WTE fly ash.
- The combination of WTE with vitrification combination has increased the overall cost of WTE to the point that some communities have opted for the alternative of high-temperature pyrolysis of the MSW to produce a syn-gas type of fuel and vitrified ash.

JAPAN

- Even so, the traditional combustion process remains dominant in Japan, as well as in every other country that practices “thermal treatment” of wastes.

- Japan remains one of the leaders in WTE technology, as we heard today from Prof. Nakamura who spoke about the oxygen enrichment WTE in Sendai.

U.S.A.: The largest user nation of WTE (29 M tons) but also the biggest user of landfills



Interstate Shipment of Municipal Solid Waste in 2002 (CRS, 2002)
Note: Map does not include transactions with the District of Columbia

Interstate movement of MSW for landfilling (CRS, 2002)

Novel processes need to pre-process the MSW feed

- Novel processes competing with combustion need to pre-process the “black bag” MSW, that is “particles” ranging in size from a coin to a suitcase and in hardness from cotton to glass, to a suitable feed for a gasification or other type of reactor.

- The difficulties in pre-processing the “black bag” MSW are indicated by the fact that “mass-burning” on a moving grate continues to be more attractive to new users than the Refuse-Derived-Fuel (RDF) process that requires pre-processing of the MSW.

When material is pre-processed (e.g. RDF) a larger fraction of the ash is in the form of fly ash

- RDF processes have to overcome another problem: When the MSW fuel consists of smaller and lighter particles, a larger fraction of fine particles are carried over to the gas control equipment and are collected as fly ash in the baghouse.

- Fly ash contains the volatile heavy metals in the MSW and the minute amount of dioxins formed during cooling of the combustion gases.

Novel processes claim to produce entirely different products (e.g. alcohol, syngas, synthetic oils) from the same feedstock: The black bag MSW

Having collaborated on a dozen graduate theses on all types of MSW processing, visited many WM facilities and read numerous papers on this subject, it appears to me that the only all-forgiving process that will accept the lowly “black bag” feed is combustion. Also, at this time, the most accommodating of the existing types of combustion processes seems to be mass burning.

However, there is room for other "Thermal Treatment Technologies"

a) to process sorted fractions of the MSW (e.g. gasification of plastics; aerobic digestion of food wastes, etc.)

b) To process the by- products of combustion…such as the Europlasma process discussed in the 2nd part of my presentation……..

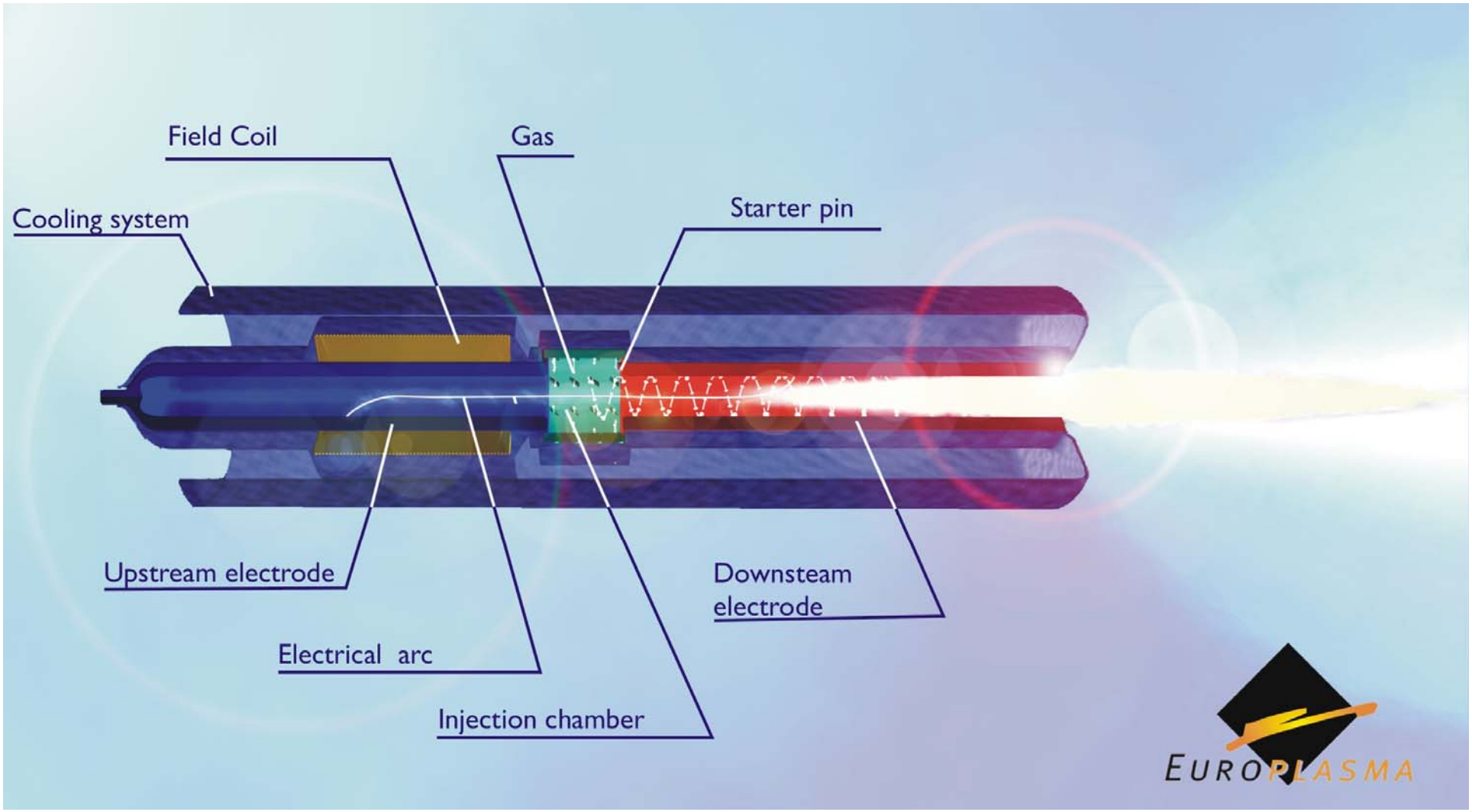
The Thermal Plasma Torch: An alternative way for dealing with hazardous wastes

EUROPLASMA

NOTRE AVENIR DÉPEND DE NOUS

Plasma Torch

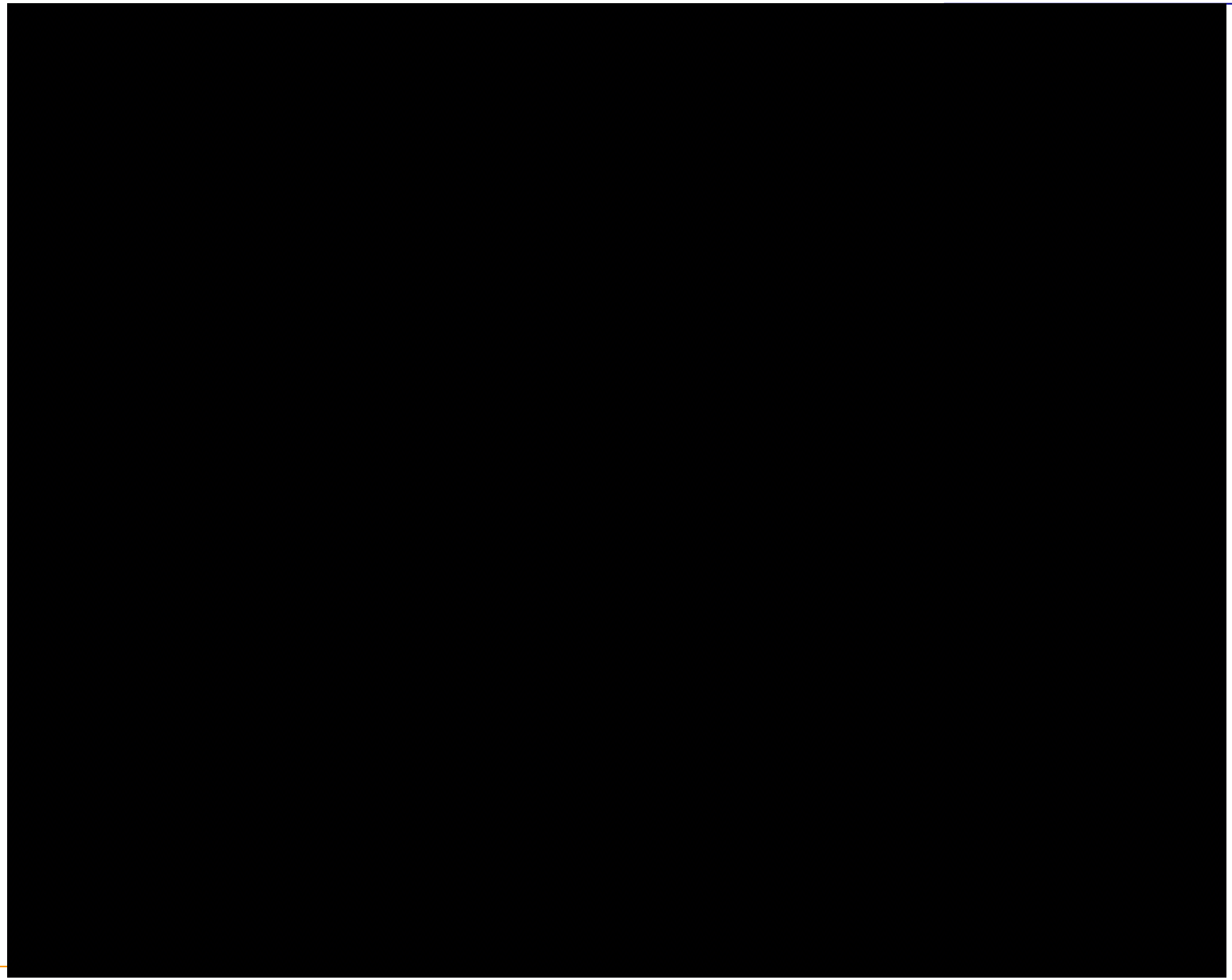
How it works ?



A short film illustrating how the plasma torch works

(film by Europlasma)

Plasma Torch



Europlasma

Company Profile

- Founded: 1992
  Capital: 45 % public - 22 % private - 33 % Financial .
  Head Office: Bordeaux - FRANCE

- Engineering company : EUROPLASMA
  Team : 10 employees

- Subsidiaries: INERTAM-COFAL, Destruction of asbestos
  destruction
  Team : 43 employees

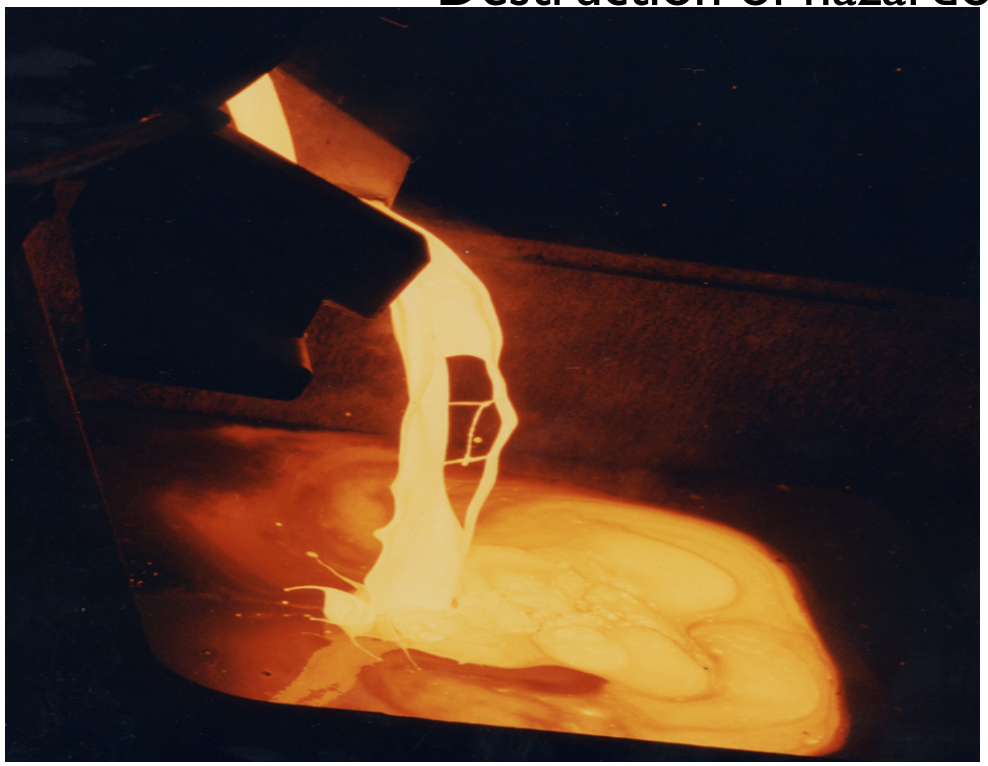
- Turnover en 2004 : 9,2 M Euros

www.europlasma.com
www.inertam.fr

Plasma torch applications:

Environmental quality:

- Fly ash from MSW incineration in WTEs
  Destruction of asbestos
- Destruction of hazardous wastes



Heavy industry process

Heating iron blast furnace
Heating of melting cuppola

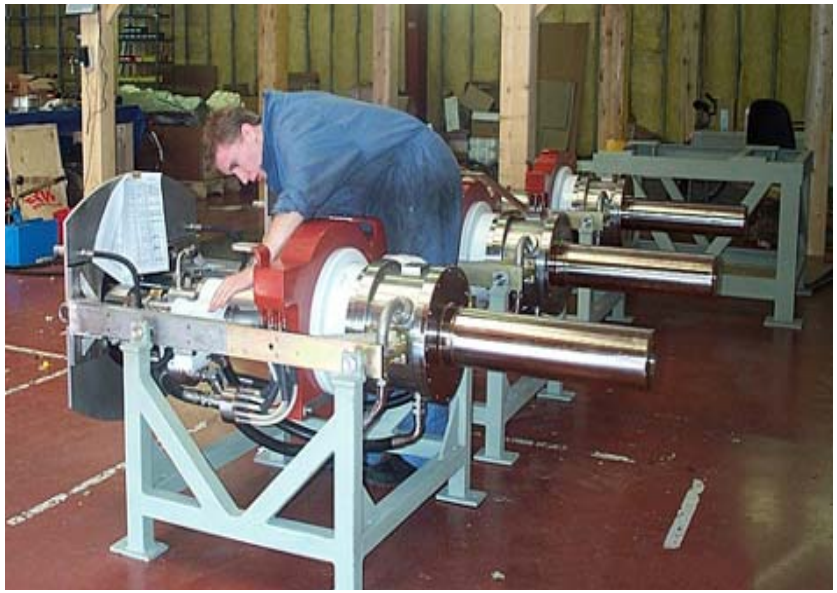
Partnerships with laboratories

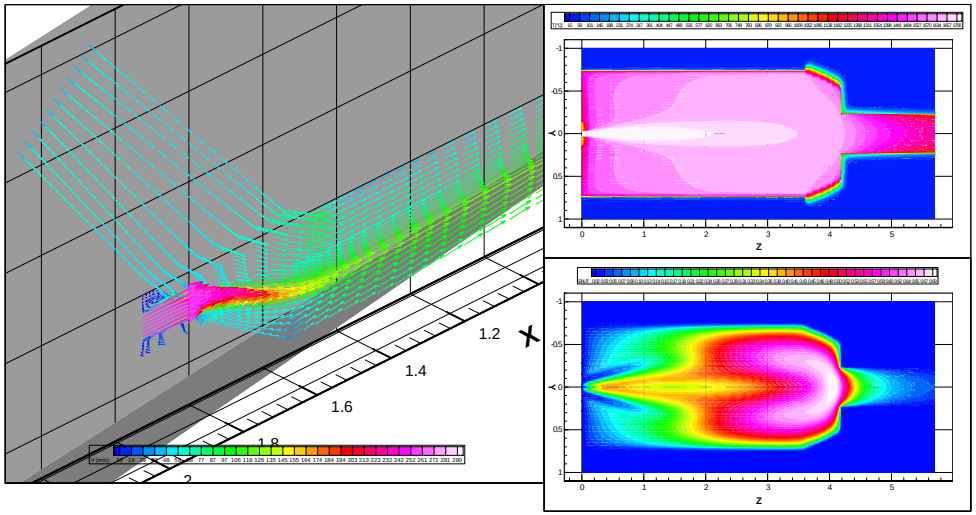
Low radioactivity wastes (CEA)
Plasma Post Combustion (CEA)
Destruction of chemical weapons

Europlasma skills

Engineering skills

Manufacturing and marketing of Melting units using a plasma torch
Manufacturing and marketing of Plasma Heating Systems
Commissioning, Training, Maintenance
New thermal application research





Europlasma skills

Owner and Operator of INERTAM (100 km south of Bordeau, France)

Authorized capacity:
8,000 T per year

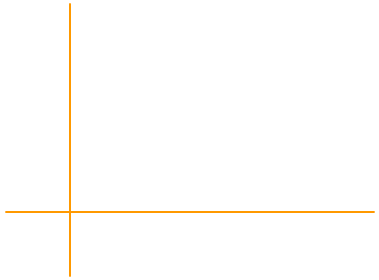
Dedicated installation classified for Environmental Quality :
Asbestos et Industrial Toxic Waste

Investment of 12 M euros in 2002 for the erection of a new production line started in 2004

Vitrification by thermal plasma

Vitrification of hazardous wastes by the plasma torch is an alternative to landfilling and results in:

- Massive **reduction** of waste volume
- **Conversion** of toxic waste into an inert glass that can be re-used in construction and architecture

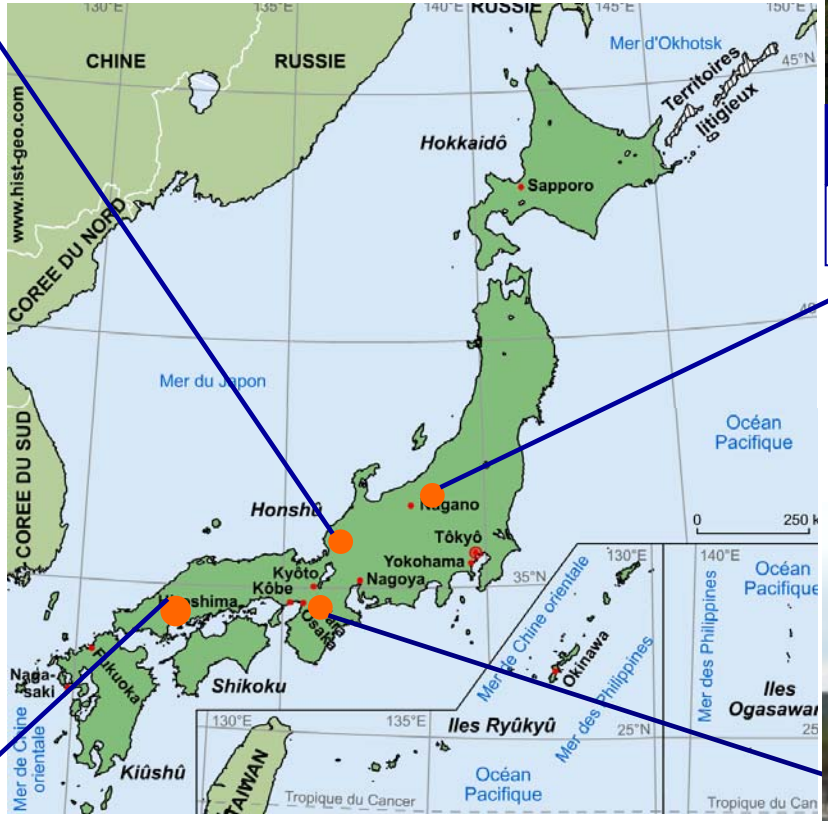


Industrial sites using EUROPLASMA technology

EUROPLASMA in JAPAN

MAIZURU

Fly Ash & Bottom Ash (6 t/d)



IMIZU

Fly Ash (12 t/d)

SHIMONOSEKI

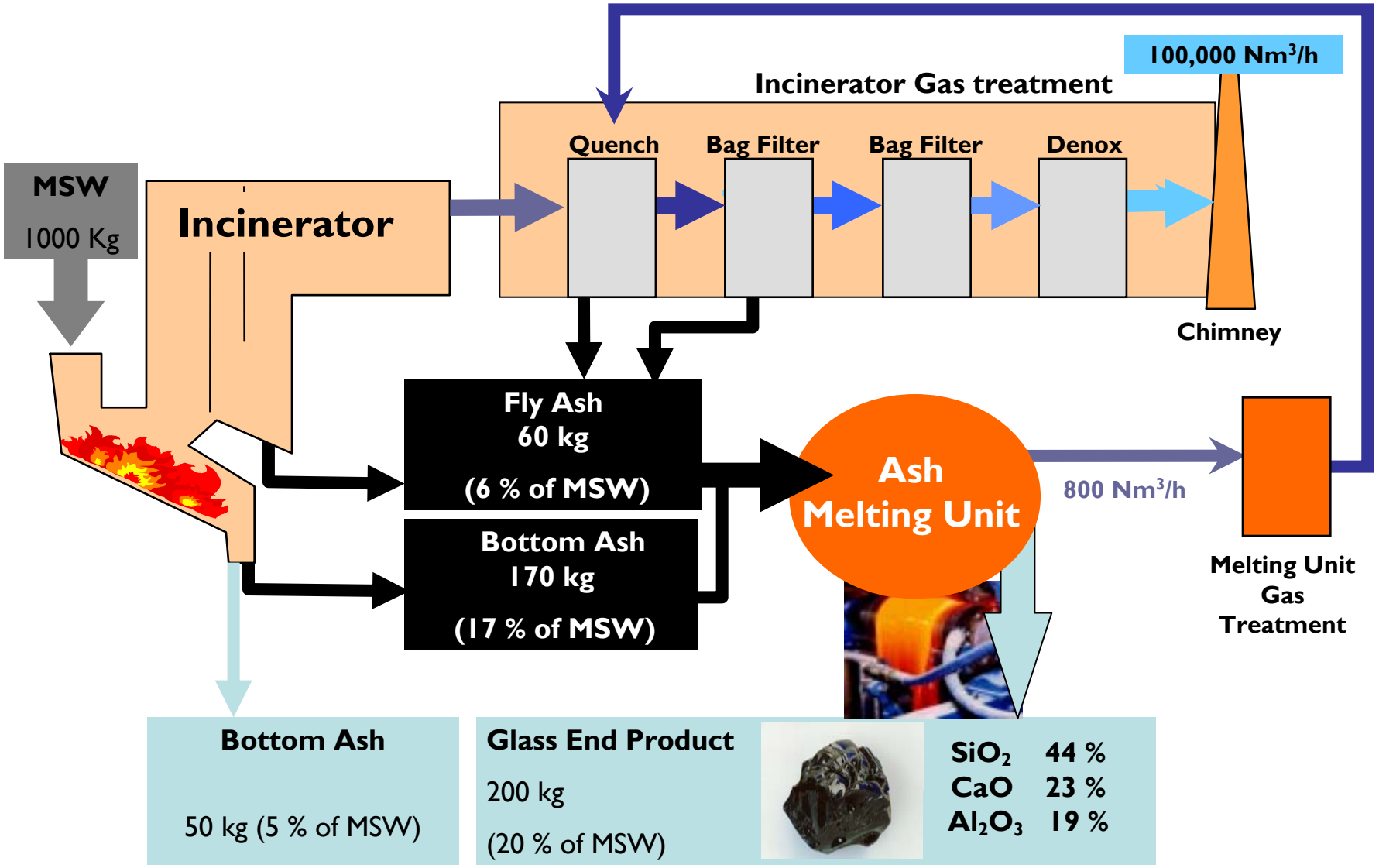
Fly Ash & Bottom Ash (42 t/d)

KAKOGAWA

Fly Ash (20 t/d)

Shimonoseki (Japan)

MSW capacity : 185,000 t/year (incinerator)
Ash melting unit : 42 t/day



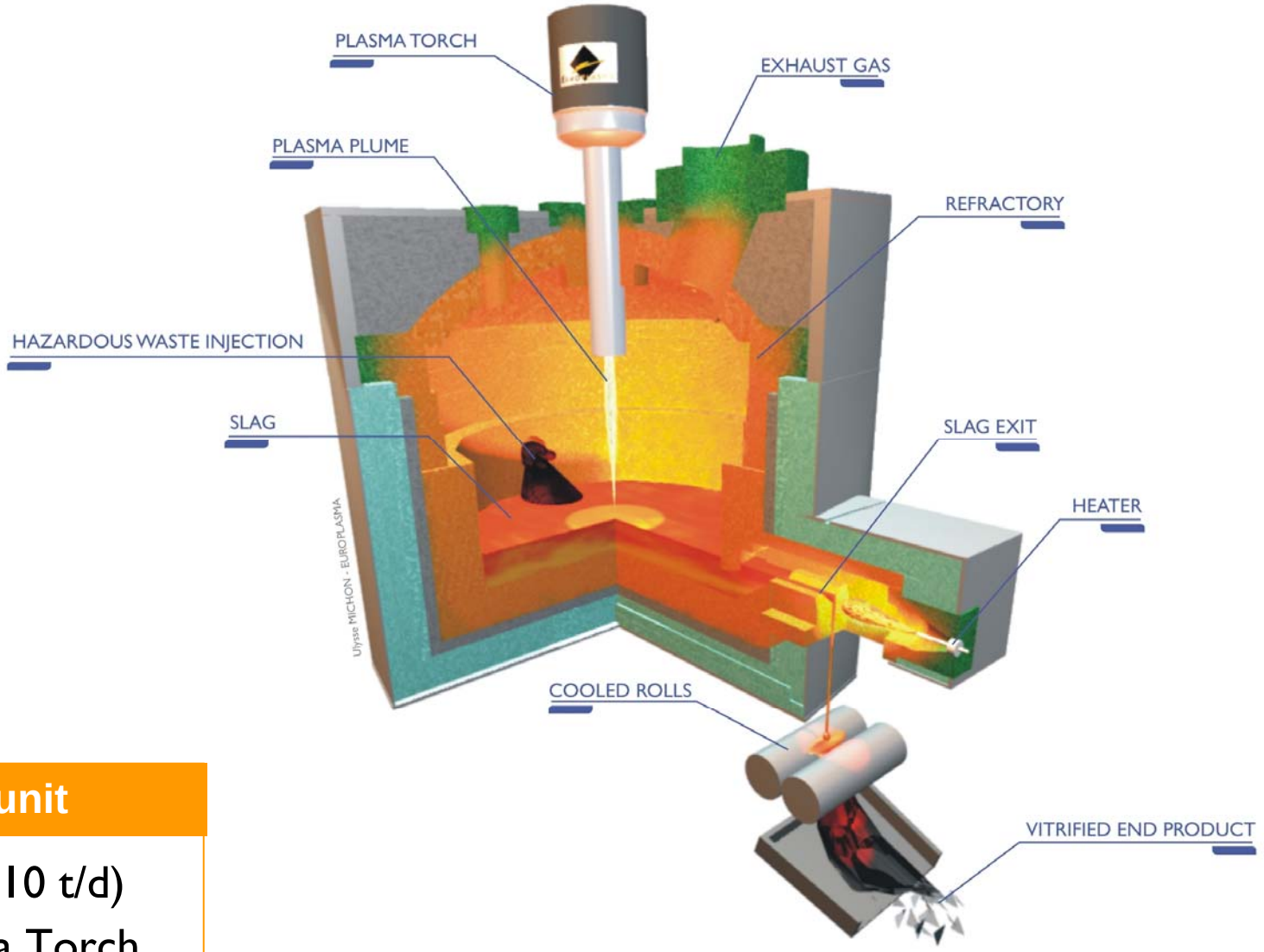
Cenon WTE (France)

OWNER

Communauté
Urbaine de
Bordeaux

OPERATOR

Novergie (SUEZ)



Ash Melting unit

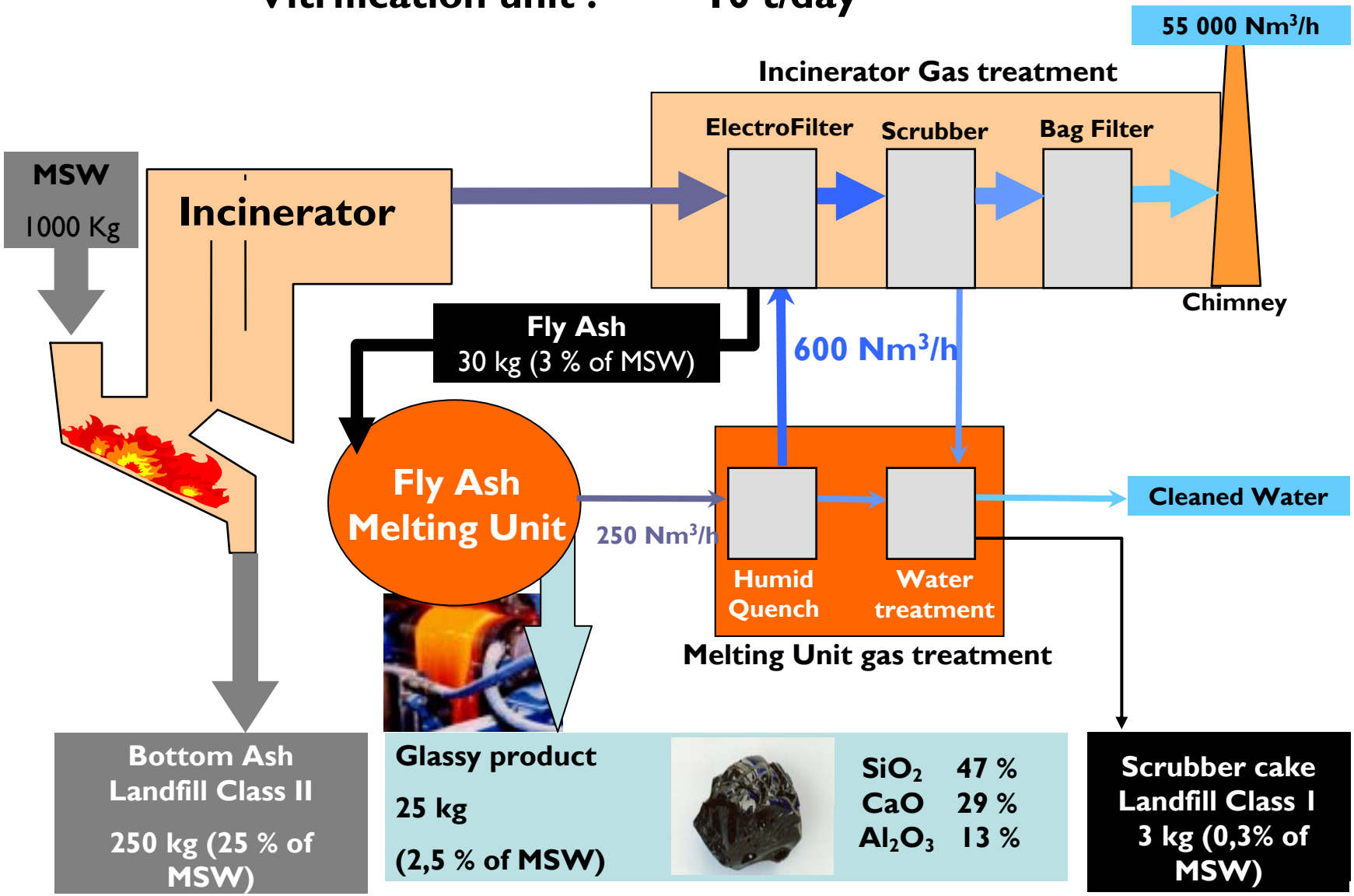
2 000 t/year (or 10 t/d)
1x500 kW Plasma Torch

A short film of the thermal plasma facility at Maizuru, Japan, for vitrifying fly ash

(film by Europlasma)

Fly Ash Melting Unit: CENON (Bordeau) WTE

MSW capacity : **120,000 t/year Fly Ash Melting**
Vitrification unit : **10 t/day**



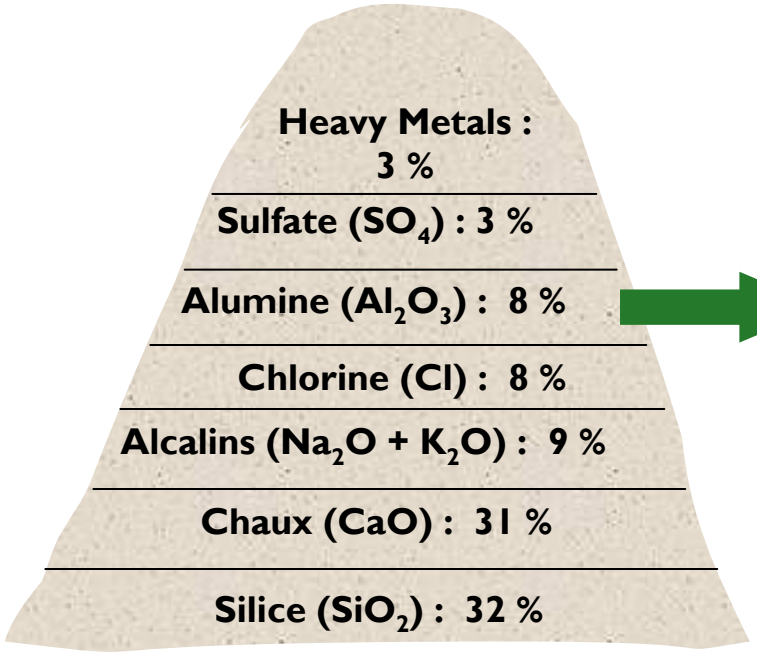
Fly Ash Melting Unit: CENON (Bordeau) WTE

From 1997 - 2005

- Energy consumption: 1.3 kWh/kg of fly ash
  (43 kWh/ton MSW)
- Torch maintenance: 1 h every 300 h
- Furnace maintenance: 1 month every 6 months
- Availability of facility: 90 %
- No need to modify the WTE gas control system
- Fly ash is vitrified within the WTE facility

Fly Ash Melting Unit: CENON (Bordeau) WTE

Fly Ash



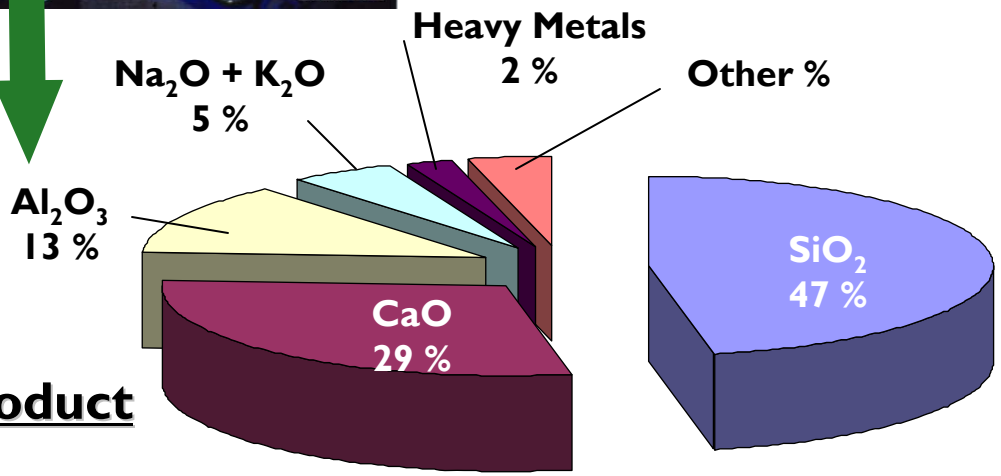
Analysis by IEEB (independent eng. firm)
February 2003

1 400°C

Gas from furnace

Nitrogen
Oxygen
Water
Salt
Acid
Heavy metal dust

Glass End Product



Fly Ash Melting Unit: CENON (Bordeau) WTE Operating experience:

- Dioxin destruction : 99,9%
- Element Absorption in the glass product:

	Absorption in glass product[1] %
SiO_2	98
CaO	98
Al_2O_3	100
Na_2O	63
K_2O	25
Cl	7

Métal	Absorption in glass product[1] e%
Fe	98
Ni	90.0
Zn	61.1
Cu	40.5
Pb	30.9
Cd	21.7
Hg	< 3.6

1: **Measurements of facility emissions by INERIS, July 1999.**

With many thanks to

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Prof. Themelis is authorized to present these slides on behalf of Europlasma at the WTERT 2005 Meeting