

The Destruction of PFM-1 Stockpiles in Ukraine

Phase of preparation
Final report



European Commission

Geneva 0605
P. Krejsa

Preparation phase 2002 - 2005

EC offer to GoU of financing destruction of PFM-1 APL

- Assessment and evaluation of available information
- On the basis of the assessment, planning of research projects to obtain lacking information and data
- 1st STCU research project – condition of the mines
- 2nd STCU research project – destruction methods
- Starting ToR consultations concerning the obligations EC/ Ukraine
- EC Project Manager established at EC Delegation, Ukraine
- Preparing launching of tender
- Law of ratification signed
- Agreement of ToR
- Tender procedure
- Evaluation of bids
- Contract **must be signed before 31 December 2005**

Destruction



1 Assessment of the problem

Is sufficient information available to start destruction?

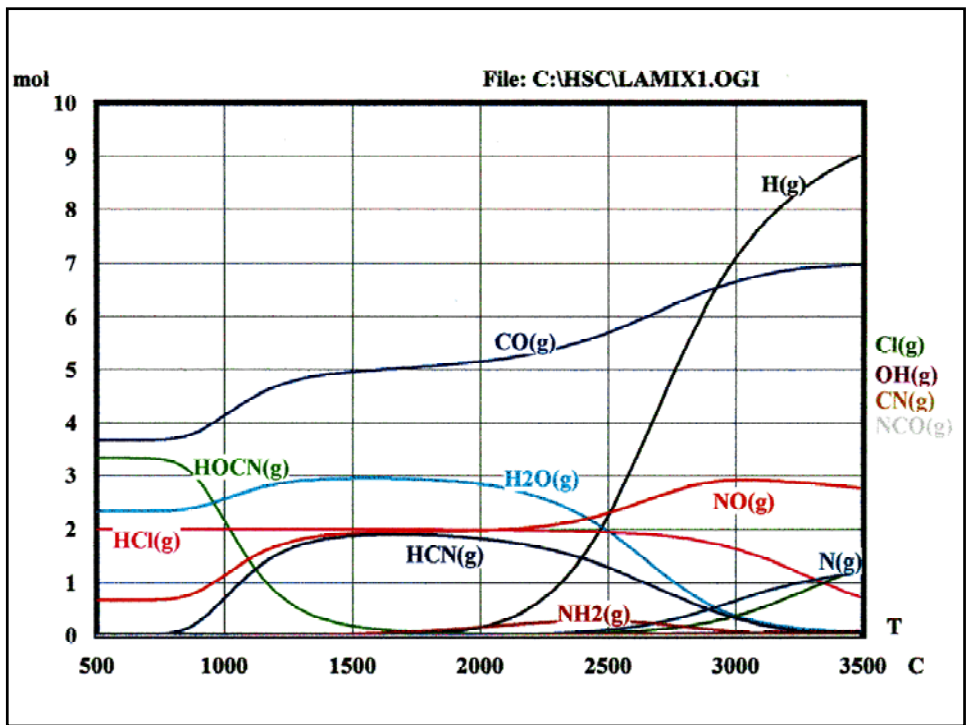
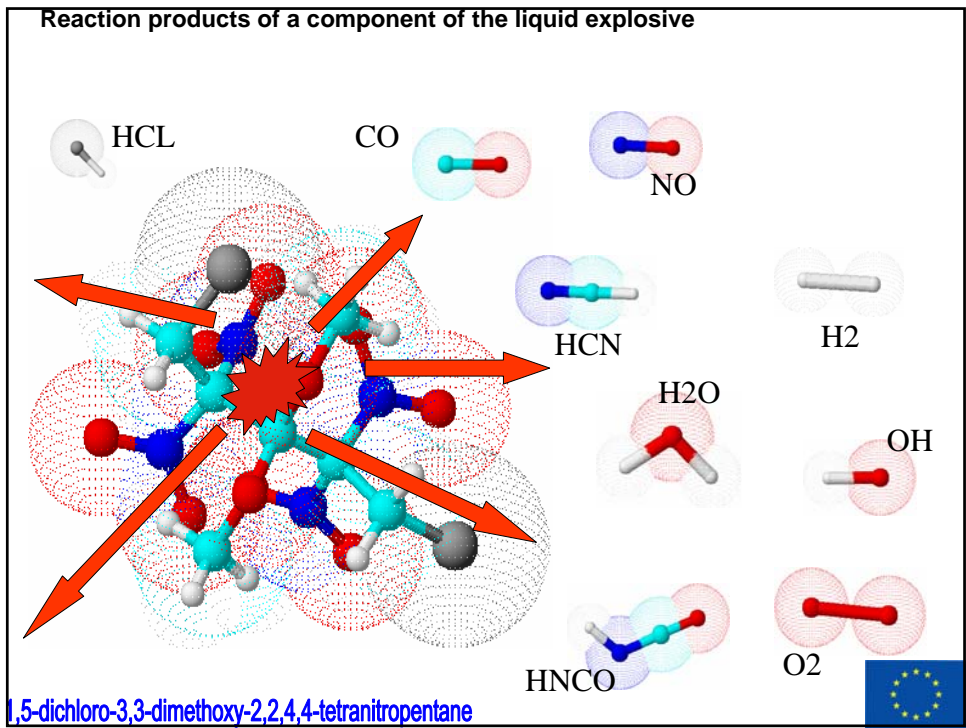
Can the destruction be performed with one of the usual methods –
destruction facility/OP/OB?

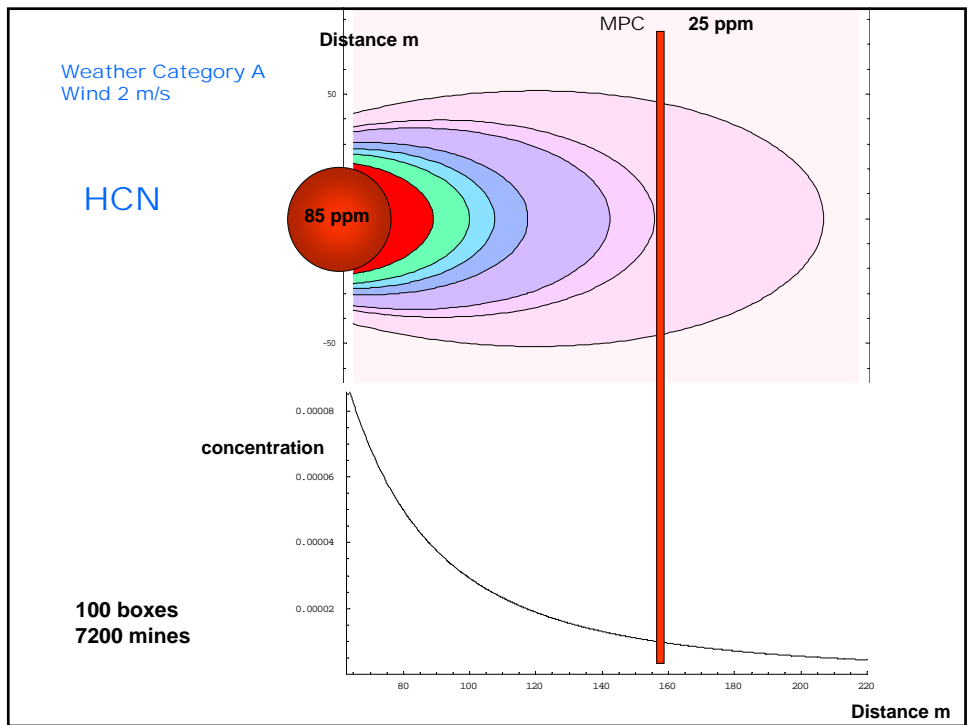
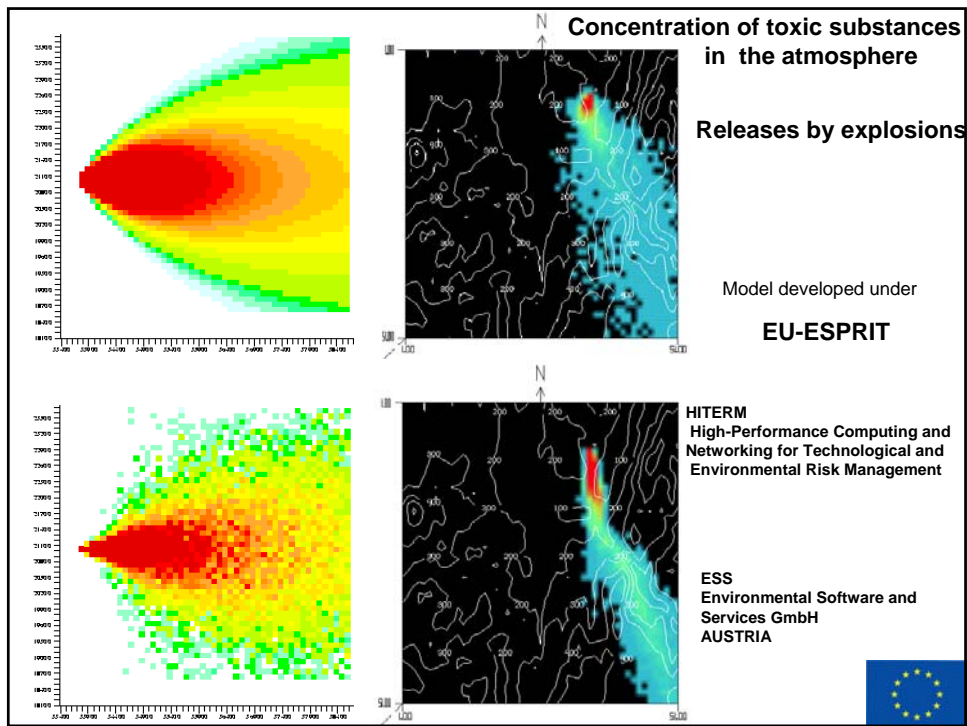
- Toxic and corrosive liquid explosives
- Toxic substances as reaction products
- Shelf life expired
- Autocatalytic reaction leading to undesired explosions



PFM-1 mine







From model and simulation to reality 2004 explosions in ammunition storage sites



From the beginning a major concern:
What is the condition of the mines? Must we expect while planning sophisticated
destruction processes and taking care of all possible impacts, explosions as seen
above?

2. Defining and performing a research project to fill the gaps
For the decision process were not sufficient data and information available

Condition of the mines





STCU – Science and Technology Center Ukraine

Intergovernmental organisation
Established in 1993
Canada, European Union, Ukraine, United States of America .

Research projects performed with Ukrainian scientists on the basis of the STCU program which offers **weapons scientists from CIS states** that are Parties to the STCU Agreement the opportunity to redirect their talents to **peaceful activities**.

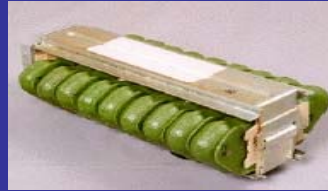


Stockpiled APM

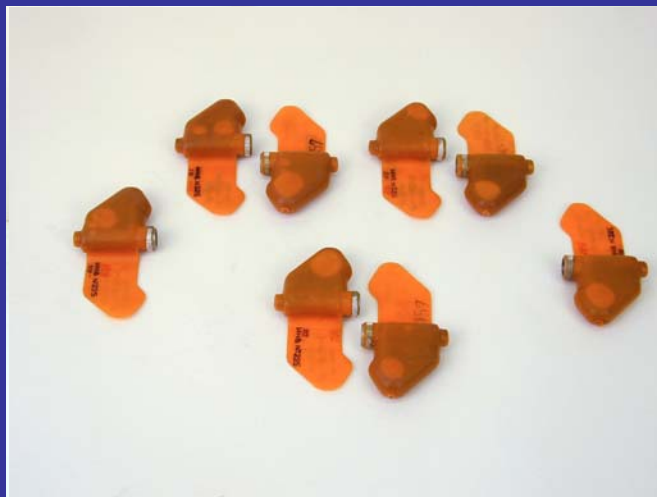
Originally 13 sites approx. 6 Mio. Mines
now (end of 2005) on 2 sites



PFM-1 Canister



Assembly of mine ammunition



STCU 1st project report

**Condition of mines : good
Risk assessment: triggered
from outside/population
density/ CIP**



Results

Condition of the mines good

Undesired explosions starting from the mines is unlikely but pose a risk if triggered by other undesired explosions.
Danger for inhabited zones and critical infrastructures nearby.

Considering typical industrial processes, destruction is not a problem of the toxicity of materials.

Open pit destruction/open burning should not take place because of toxic gaseous releases, and of not reacted explosives and reaction products to contaminate soil and groundwater bodies, leading to costly site remediation actions.



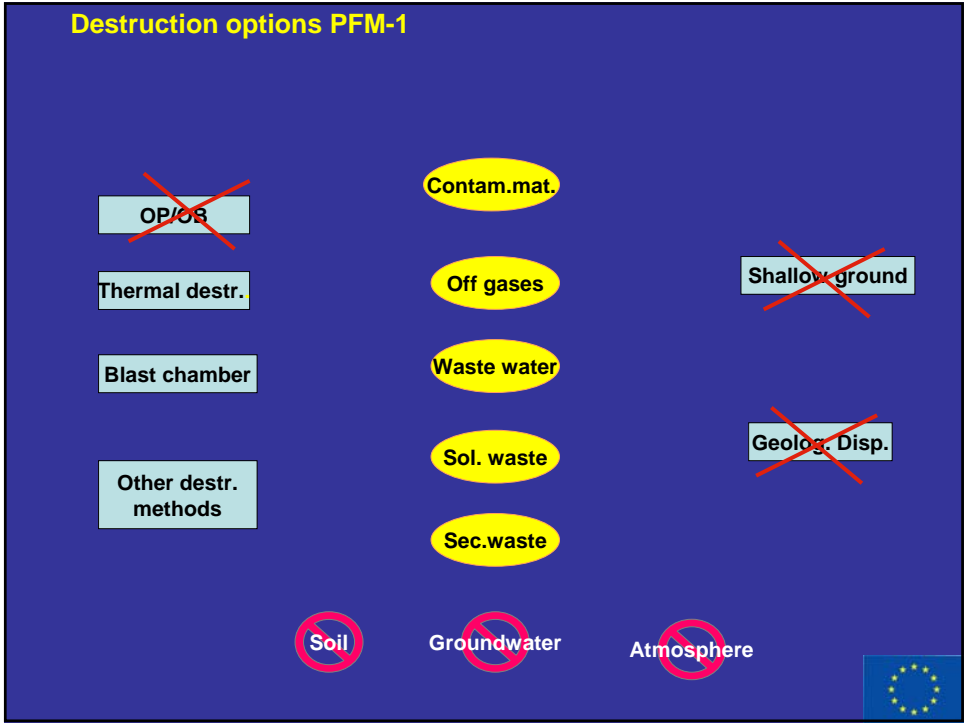
3 Approaching destruction

Based on the general assessment of destruction methods including industrial processes, a 2nd research project was performed

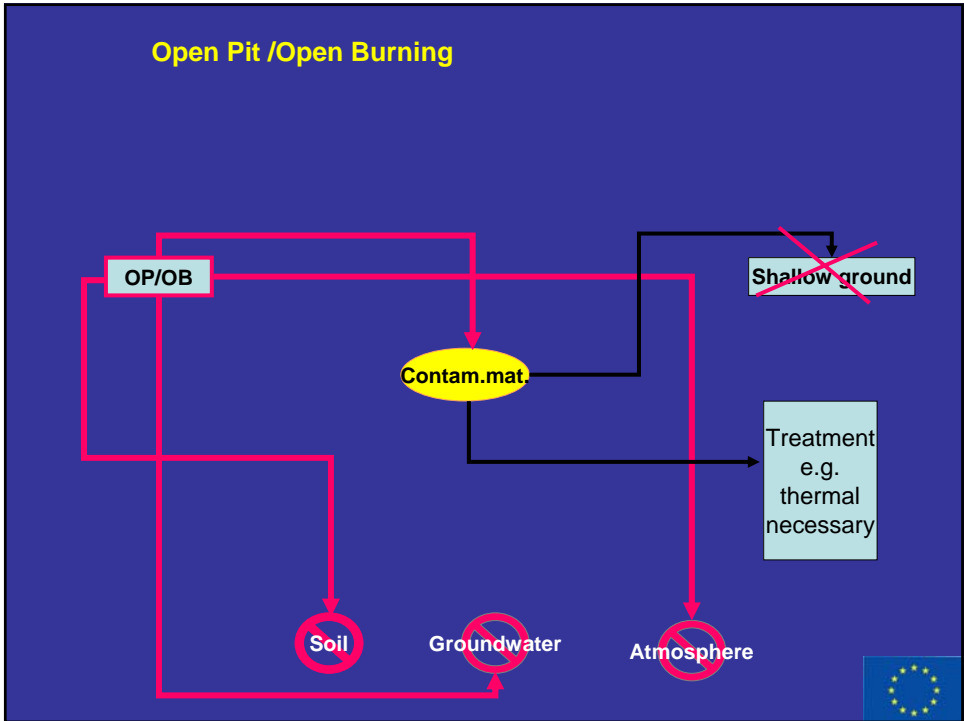
Methods to destroy the mines



Destruction options PFM-1



Open Pit / Open Burning



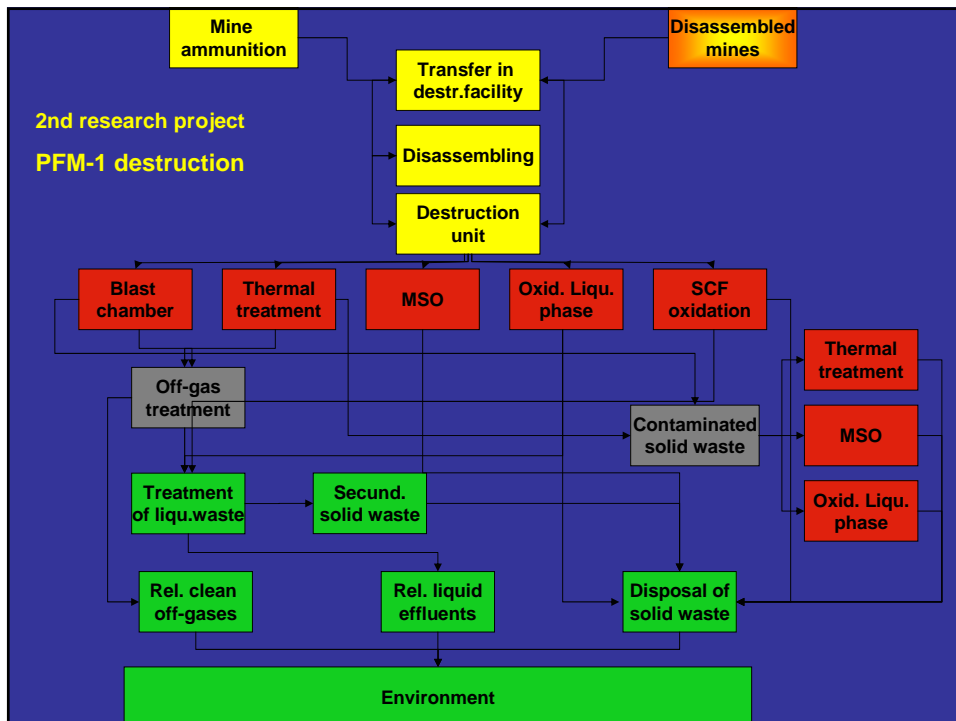
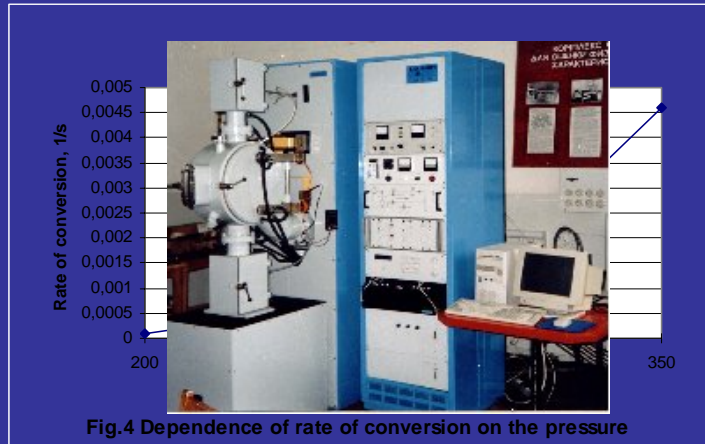
Test of mine in vacuum chamber
To separate the liquid explosive from the mine body



Molten Salt Oxidation - MSO



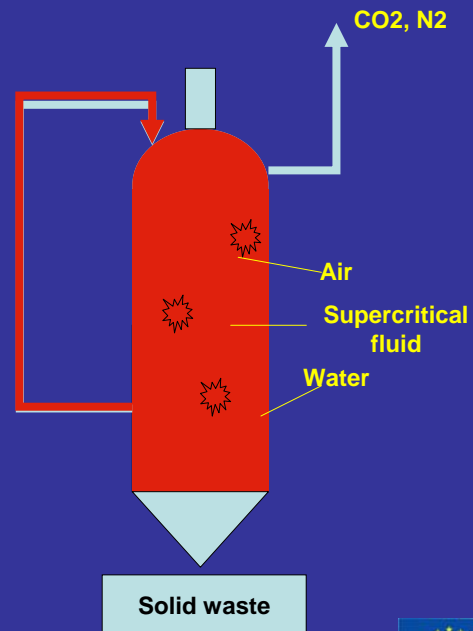
Supercritical water oxydation



Supercritical Water Oxidation

Released energy (p, T) of explosions is used to produce supercritical conditions

All organic material of the mines will be destroyed by SC water



Terms of Reference

Obligations of the EC contractor

- Facility, equipment and staff for the destruction
- Destruction of approx 6 mio. PFM-1 within 3 years
- Pre-treatment of waste, releases according to Ukrainian laws and regulations

Obligations of Ukraine

- Providing site and necessary infrastructure
- Providing licenses and permits
- Delivering the ammunitions into the destruction device
- Taking care of resulting wastes