The Destruction of PFM-1 Stockpiles in Ukraine

European Commission

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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
Reaction products of a component of the liquid explosive

1,5-dichloro-3,3-dimethoxy-2,2,4,4-tetranitropentane
Concentration of toxic substances in the atmosphere

Releases by explosions

Model developed under EU-ESPRIT

HITERM
High-Performance Computing and Networking for Technological and Environmental Risk Management

ESS
Environmental Software and Services GmbH
AUSTRIA

Weather Category A
Wind 2 m/s

HCN

85 ppm

concentration

100 boxes
7200 mines

MPC
25 ppm

Distance m
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?

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

STCU 1st project report
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

- OP/OB
- Contam.mat.
- Off gases
- Shallow ground
- Blast chamber
- Waste water
- Geological Disp.
- Other destr. methods
- Sol. waste
- Sec. waste
- Soil
- Groundwater
- Atmosphere

Open Pit/Open Burning

- OP/OB
- Contam.mat.
- Shallow ground
- Treatment e.g. thermal necessary
- Soil
- Groundwater
- Atmosphere
Test of mine in vacuum chamber
To separate the liquid explosive from the mine body

PFM-1 mine

Molten Salt Oxidation - MSO
Supercritical water oxidation

Fig. 4 Dependence of rate of conversion on the pressure

2nd research project
PFM-1 destruction

Mine ammunition

Transfer in destr. facility

Disassembling

Disassembled mines

Blast chamber

Thermal treatment

MSO

Oxid. Liqu. phase

SCF oxidation

Off-gas treatment

Treatment of liqu. waste

Secund. solid waste

Rel. clean off-gases

Rel. liquid effluents

Disposal of solid waste

Contaminated solid waste

Thermal treatment

MSO

Oxid. Liqu. phase

Environment
Solid waste

Supercritical Water Oxydation

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