Liquid Rocket Fuel in the OSCE Area: Overview of Disposal Aspects

Prepared within the scope of implementing the
OSCE Document on Stockpiles of Conventional Ammunition

Organization for Security and
Co-operation in Europe

Table of Contents

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1 Purpose

Following the OSCE Document on Stockpiles of Conventional Ammunition agreed by the OSCE Forum for Security Cooperation on 19 November 2003, FSC.DOC/1/03 the purpose of this Overview is to:

- consolidate the most suitable practices of liquid rocket fuel components' elimination experienced in the last 15 years to provide the OSCE participating States with information and analyses for developing policies and for designing general guidelines and procedures for the elimination of their unusable or surplus liquid rocket fuel components – mainly melange and samin – and to
- encourage concerned participating States to apply for OSCE international financial and/or technical support for the elimination of their rocket fuel components.

2 Scope

Based on experience gained from manifold projects listed in Chap. 3 "Background" this Overview describes the humanitarian and environmental risks posed by melange and samin; notes appropriate storage and handling aspects; highlights various elimination methodologies; provides a suggested project template for planning purposes; and includes a format for OSCE support request (annex 1).

3 Background

Throughout the development of rocket and missile systems there have been two competitive options for thrust-gaining – **solid** or **liquid** propellant and oxidizer. After successful developments in Peenemünde/Germany 1937-1945 with liquid components such as:

- alcohol and liquid oxygen (Fi 103 - V1and A4 - V2) and
- isobutylether and nitric acid (anti-aircraft rocket "Wasserfall") the post-war Soviet rocket industry further pursued the "liquid" option for development of military surface-to-surface and surface-to-air missile systems became well known. Some of the liquid systems additionally were equipped with solid propellant (first stage) boosters.

Table 1: Summary of weapon systems using liquid propellants

Weapon system		Use	Remarks
Type	NATO designation		
Volga-2 S-75	SA-2 'Guideline'	Surface-to-Air	China - HQ-2 Version Iran - Sayyed-1 Version North Korea - Own version
Angara/Vega S-200	SA-5 'Gammon'	Surface-to-Air	
R-1	SS-1a 'Scunner'	Surface-to-Surface	Initial design that led to 'Scud'. Iraq - Al-Hussein 1 and 2.
R-11 (8K11), R-17 (8K14), R-300 Elbrus	SS-1b/c 'Scud'	Surface-to-Surface	There were a range of further theatre ballistic missile derivatives, including SS-4 'Scandal' (8K53) etc.
P-15, P-20, P-21, P-22, P27 Termit	SS-N-2 'Styx' SSC-3 'Styx'	Ship-to-Ship Surface-to-Ship	Also produced in India, North Korea and possibly Egypt.
R-13 (4K50)	SS-N-4 'Sark'	Ship-to-Surface	SS-N-5 also referred to as 'Sark'
R-21 (4K55)	SS-N-5 'Sark'		Submarine-Launched Ballistic Missile (SLBM)
R-27 (4K10)	SS-N-6 'Serb'		
R-29 (4K75)	SS-N-8 'Sawfly'		
R-29K (4K75D)	SS-N-18 'Stingray'		
R-29RM (4K75RM)	SS-N-23 'Skif'		
C-201 SY-1/HY-1	CSS-N-1 'Scrubbrush'	Ship-to-Ship Surface-to-Ship	
C-201 HY-2/FL-1/FL-3A	CSS-N-2 'Silkworm' CSS-N-3 'Seersucker'		Also produced in Iran

The high energetic liquid fuel samin and the oxidizer melange had both to be pumped into separate internal missile tanks and set under pressure prior to launching. Ignition was initiated by jetting the two components into the missile combustion chamber. At firing unit level both components were separately stored in special storage containers. Special tank vehicles were used for filling the missiles prior to firing. Non-fired missiles

Fig. 1: Melange storage site in Kazakhstan

Fig. 2: Melange storage site in Armenia

had to be removed from the launcher, emptied, cleaned, and both components – the propellant and the oxidizer – had to be returned to the appropriate containers. As a result of the collapse of the Soviet Union large quantities of melange became obsolete in the territory of former Republics of the USSR, its allies and partners, many of them now OSCE participating States. Due to the long time of storage of melange (beginning in 1961) without proper maintenance most of it is in poor condition and unusable. The storage sites are deteriorated; the containers are corroded, partly leaking with the risk of bursting.

Although samin was left behind as well it has served in most countries as a substitute fuel mixed with diesel and/or kerosene. There are only minor deposits left. During the last 15 years most OSCE participating States have undertaken measures to eliminate their melange and accumulated significant practical experience in this discipline:

State	Quantity	Status
Albania	34 tonnes	Completed. OSCE
Armenia	872 tonnes	Completed. OSCE
Azerbaijan	1,400 tonnes	Completed. NATO
Belarus	10,000 tonnes 400 tonnes	Completed. Export to the Russian Federation Subject to disposal
Bosnia and Herzegovina	45.6 tonnes	Completed. UNDP
Czech Republic	220 tonnes	Completed. Export to Germany
Finland	40 tonnes	Completed. Export to Germany
Georgia	450 tonnes	Completed. OSCE

State	Quantity	Status
Germany	4,500 tonnes	Completed. National effort
Hungary	approx. 800 tonnes	Planned.
Kazakhstan	638 tonnes 410 tonnes	Completed. Bilateral US-Kazakhstan Planned. Kazakhstan-OSCE
Kyrgyzstan	approx. 10 tonnes	Subject to disposal
Moldova	350 tonnes	Completed. NATO
Montenegro	128 tonnes	Completed. UNDP-OSCE
Poland	approx. 1,000 tonnes	Planned. National effort
Russia	over 53,000 tonnes	Completed. National effort
Slovakia	100 tonnes	Completed. Export to Germany
Ukraine	16,200 tonnes 215 tonnes	Ongoing. OSCE Completed. Poland
Uzbekistan	1,100 tonnes	Ongoing. NATO

During the Joint OSCE-NATO Technical Workshop on Rocket Fuel Component (RFC) Melange Disposal organized in Kiev on the 6-8 July 2005, participants to the workshop agreed on the urgent need to prepare a common approach to assist affected countries to safely dispose of their stockpiles of unusable and/or excess melange and samin.

4 General information on rocket fuel components

4.1. Oxidizer Melange

Melange, also known as IRFNA (**I**nhibited **R**ed **F**uming **N**itric **A**cid), is a complex mixture of extremely active chemical substances, easily evaporating and highly toxic, hygroscopic, including concentrated nitric acid, saturated with nitrogen tetroxide and various additives:

HNO_3	≥ 70%	Nitric acid
N_2O_4	18-27%	
Others	approx. 3%	(H_3PO_4, I_2, Al_2O_3, HF)
H2O	≤ 4%	

The compound of the most common types of melange is shown at annex 2.

Due to the extensive period of storage of melange and its hygroscopic nature, the H2O share has strongly increased and as a result of shrinkage and corrosion, the effectiveness of the inhibitors has decreased, thus leading to destabilization and active decomposition of the melange itself which can therefore not longer be used as rocket fuel component. In the event of disaster it will prove hazardous to human health and the environment.

Nitric Acid (HNO_3)

Nitric acid evaporates as a reddish-brown fume with pungent smell. It is not combustible, but reacts with water or steam to produce heat. Contact of concentrated nitric acid with combustible materials may increase the hazard of fire and lead to an explosion.

Contact with nitric acid or inhalation of nitric gases will result in severe cauterization of skin, mucous membranes, the respiratory system (pulmonary oedema) and eyes.

Nitrogen Tetroxide (N_2O_4)

An instable reddish-brown gas, it does not burn itself but supports combustion as a strong oxidising agent. May ignite combustible materials (wood, paper, oil, clothing, etc.), containers may explode when heated, ruptured cylinders may 'take off'.

Inhalation of nitric gases will result in lungs evolving slowly and their becoming progressively inflamed. It is dangerous for the skin mucous membranes, the respiratory system (pulmonary oedema) and eyes.

4.2. Propellants Samin and Isonit

Samin is a highly efficient propellant consisting of triethylamine and xylidine = 1:1.

Triethylamine ($(C_2H_5)_3N$)

– is a toxic, transparent and slightly yellowish fluid having a pungent objectionable smell. It is a flammable/combustible compound that may be ignited by heat, sparks or flames. Vapours are heavier than air and form explosive mixtures with air. Vigorous reaction happens in contact with strong acids.

Contact with triethylamine mainly results in local effects. Eye contact causes severe burns. Clothing wet with triethylamine will cause skin burns. Carcinogenic (skin), temporary blue hazy vision, vapours irritate nose, throat, lung, causing coughing, choking and difficult breathing.

Xylidine ($C_8H_{11}N$ – six isomers)

Xylidines are flammable/combustible substances that may burn but do not ignite readily. When heated, vapours may form explosive mixtures with air.

All six isomers are poisonous, creating headache and dizziness and are carcinogenic. Formerly, during the Soviet period, excess or unusable samin used to be incinerated in open-type furnaces, a method which promotes environmental pollution.

Isonit was used as propellant for rocket on-board mechanisms like gas generators. Isonit stands for

Isopropyl Nitrate (2-Propyl Nitrate, $C_3H_7NO_3$)

and is easily inflammable. Self-ignition is possible when getting in contact with organic material.

5 Environmental and Health Risk Analyses

5.1. Melange

The effects of direct contact with melange are described in chap. 4.1. Beyond that the local environmental and public health risk results from the status of the individual storage sites. Major leaks or bursting of containers would lead to toxic clouds of melange vapours. It is calculated by military and civilian institutions that melange spillages cause the creation of acute or deadly poisoning zones as follows:

Melange spillage. Acute and Deadly Poisoning Zones (Wind 1 m/sec)

Radius, m	Quantity of melange spillage m^3				
	0.01	0.1	1.0	10	100
Acute poisoning concentration $NO_2 \geq 20$ mg/m²	40	160	500	1600	5000
Deadly poisoning concentration $NO_2 \geq 200$ mg/m²	12	40	160	500	1600

The public tends to more frequently appeal to the authorities and people's deputies with a request to disband melange storage sites. Such appeals have been registered in all regions, and that confirms the fact that social tensions are on the rise with negative attitude towards melange storage sites.

Potential serious consequences may be aggravated by the fact that in close proximity to melange storage there are residential areas, surface and underground waters, railroads and motorways.

At many sites, serious incidents occurring simultaneously with windy weather would result in toxic fumes drifting across residential areas.

Long-term environmental damage is primarily associated with pollution of the groundwater. Large spills can render the groundwater unsafe.

5.2. Samin

The effects of direct contact with samin are described in chap. 4.2. Beyond that the environmental and public health risk results from the contamination of the groundwater. Major spillages can be detected by the typical dark-red to violet colour of the ground. The identification of groundwater contamination requires soil sampling.

6 Aspects of rocket fuel on-site storage and handling

For the Soviet and Allied Forces special storage sites were projected for storing of liquid rocket fuel components in stainless steel and/or aluminum reservoirs (containers) of various sizes. Common container types were RNS 100, RNS 40, RA 40, RA 33, RA 20, RA 17, RA 2, etc.

Fig. 3: Containers RA 20 RSN 100

Fig. 4: Containers RSN 100

Usually the reservoirs were installed in such a way that they could be inspected at all sites (see Fig. 5). In several cases, however, unneeded rocket fuel components have been provisionally stored in sites without appropriate infrastructural preparations (see Fig. 6).

Fig. 5: Examples of safe melange storage

Fig. 6: Makeshift melange storage facility

Usually the containers were painted in white or silver and shaded against sun radiation and put into tubs or surrounded by berms for damming averages. To maintain usability of fuel and preclude leakages periodic inspections of the reservoirs and fuel components as well as preventive maintenance measures were mandatory. Special safety regulations had been developed for working in rocket fuel storage sites (see annexes 3 and 4). For environmental and human safe storage and handling it is essential to keep available protective clothing and gas masks, oil binding agents for samin spillages, ammonia-water for melange spillages as well as water and pumps for fire fighting.

In inoperative rocket fuel storage facilities it has been observed increasingly that leakages appear mainly through welded seams and in the area of tank necks. This fact points to metal fatigue resulting from inadequate preventative maintenance and expiration life cycles. It should be noted that the number of usable reservoirs in some regions has decreased dramatically.

In makeshift storage sites the reservoirs have been partly buried in the ground; therefore, it is impossible to visually examine their lower sections which are most prone to leaking. Often there is no special maintenance, handling and safety equipment available such as pumps, pipes, hoses, field laboratory (8JU 44M). As a result the risks of continuing storage have increased unacceptably.

7 Aspects of rocket fuel transportation

Transportation of rocket fuel components has to follow the international and/or national rules for transportation of hazardous goods. This applies for military as well as civilian freight forwarders. Cross border transportation requires application of ADR* (road) and RID** (rail) rules as well as notification activities in transit and receiving countries. The military inventory knows special transportation vehicles licensed for rail or road transportation.

Fig. 7: Rail tank car

* ADR European Agreement concerning the international carriage of dangerous goods by road (Accord européen relatif au transport international des marchandises Dangereuses par Route)

** RID Regulation on the international transportation of hazardous goods by rail (Règlement concernant le transport International ferroviaire des marchandises Dangereuses)

Fig. 8: Tank truck, e.g. KRAZ 256

The same licenses are required for civilian vehicles. They must all carry the appropriate international labels.

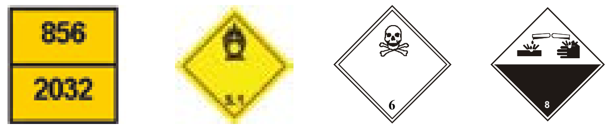


Fig. 9: Labels for transportation of red fuming Nitric Acid

8 Elimination of rocket fuel components

Many Soviet fabricated military rocket and missile systems had been designed for liquid rocket fuel propulsion. During their operational lifetime only minor quantities of melange, samin and isonit had to be eliminated, mainly in cases of accidents. For that purpose armed forces had ready emergency packages for neutralization of such contaminators. Continuously operating disposal or recycling facilities for major quantities of melange, samin and/or isonit had not been established and were not necessary. The reason is that the elimination of larger quantities of rocket fuel components was not relevant. Only after the fall of the Iron Curtain, did it become clear that action was required to deal with the excess melange. In the beginning some of the concerned States eliminated their fuel components stocks depending on their own technical and/or financial abilities. Later – beginning 2001 – international technical and financial assistance was offered by the OSCE and has been called for. Relevant policies and procedures are presently being developed.

8.1. Samin and Isonit

In almost all participating States the majority of obsolete high energetic samin and isonit has served as a substitute fuel mixed with diesel and/or kerosene or used for manifold other purposes after distillation. There are only minor deposits left which do not necessarily call for international attention. They should best be incinerated observing the appropriate environmental standards (pollution abatement).

8.2. Melange

Although theoretically manifold thermal and chemical methodologies for the elimination of melange have been conceived, in practice only four major options have become proven reality. Technical standards of performance are the same for all of them:

- The total volume of melange and tank wash residues must be converted to material safe for release to the environment.

- No pollutant releases exceeding the most stringent of local, federal, or EU standards will be allowed during the treatment operations. This includes standards for air emissions, wastewater discharges, solid wastes or land application standards.
- All operations must be conducted to fully protect the workers involved.
- After adhering to all environmental regulations, the "least cost to treat technology" is determined to be the best for a specific region.

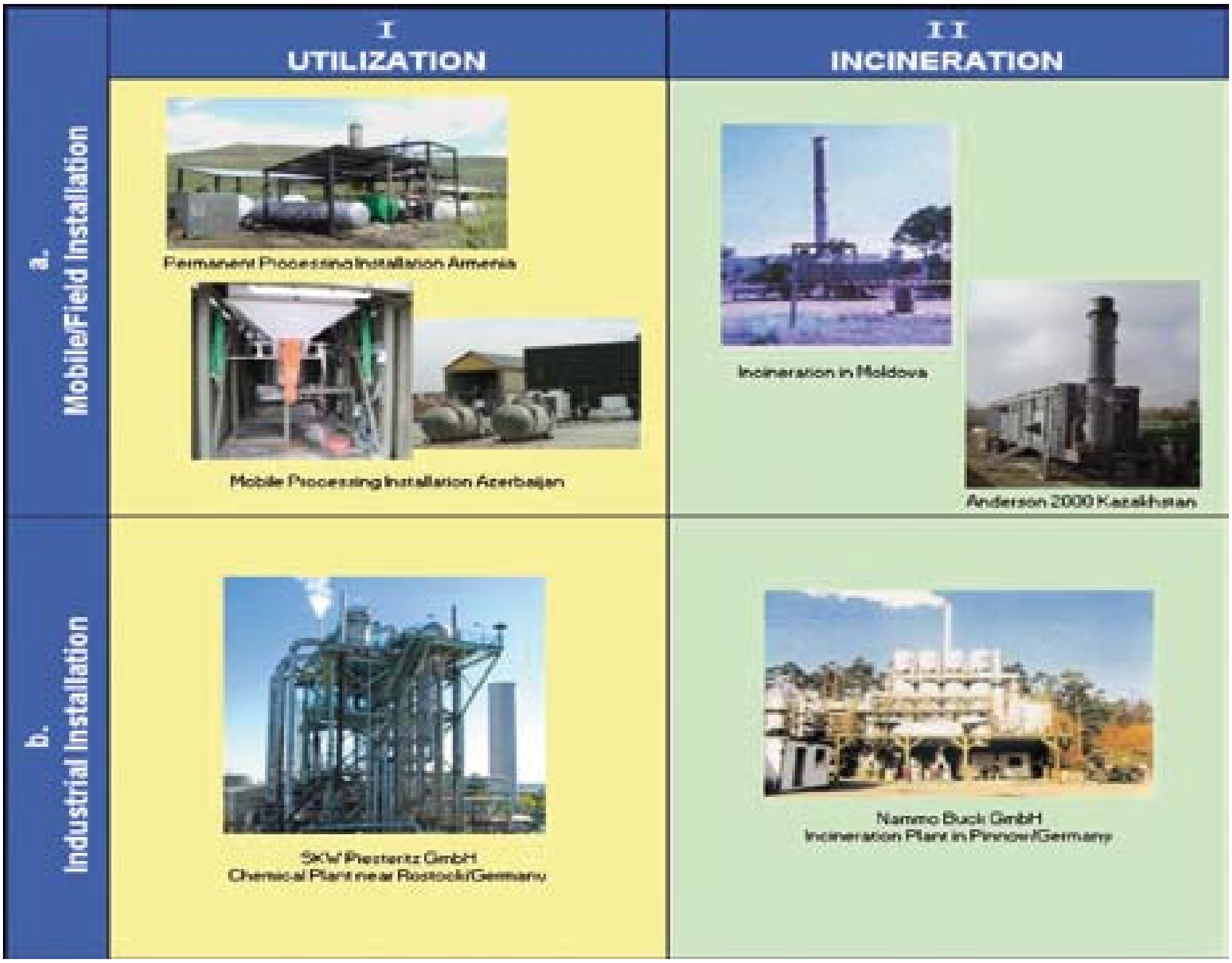


Fig. 10: Options for the elimination of melange

8.2.1 Conversion of Melange into Mineral Dressing or Compound for Fertilizer Industry in Mobile/Field Facilities (Option I a.)

At present four projects of this category of technologies, implemented by international organizations, have become reality:

State	Support	Tonnes	Status	Final Product
Georgia	OSCE	450	Completed	Mineral dressing
Armenia	OSCE	872	Completed	Mineral dressing
Azerbaijan	NATO	1,400	Completed	Compound for fertilizer industry
Uzbekistan	NATO	1,100	Ongoing	Compound for fertilizer industry

The **Georgian** and the **Armenian** projects have been established as field facilities using a lot of available military field equipment. International experts have monitored the processes under the supervision of the respective OSCE Missions.

The main steps of the conversion process are as follows:

- Controlled dilution of the melange in water (up to 1:10);
- Treatment with compressed air, transform residual N_2O_4 to HNO_3;
- Production of aqueous calcium oxide solution (lime milk);
- Merging of melange and lime milk for neutralization with the result of a watery solution of “Norge-Nitre” $Ca(NO_3)_2$ (mineral dressing).

The mineral dressing is sprayed on oligotrophic and acidic fellow grounds to improve the pH degree.

Experts’ evaluation:

- Non-dangerous operations within the melange storage area, excluding complicating transportation factor;
- Low-tech equipment, mainly available on site;
- Short-term training of working staff;
- Capacity about 5 tonnes per working day.

The **Azerbaijani** Project made use of a newly developed mobile unit under the auspices of NATO Science through Peace Programme. The main steps of the process are as follows: ¾ Neutralization with calcium carbonate; ¾ Final product – liquid calcium nitrate as compound for fertilizer industries.

Experts’ evaluation:

- Non-dangerous operations within the melange storage area, excluding complicating transportation factor;
- Capacity up to 5 tonnes per working day;
- Transportable in standard ISO containers, quick to assemble and disassemble.

There is also a project on Melange disposal in **Ukraine** that made use of a mobile plant, constructed in the framework of the foreign assistance programme of the Ministry of Foreign Affairs of Poland and financed by the Government of Poland. The conversion is performed on a site designated by the Ministry of Defense of Ukraine by:

- Controlled dilution of Melange with water;
- Separation of nitric(III) acid formed using diazotization method;
- The final product is nitric(V) acid utilized for production of nitrogen fertilizers.

Characteristics of the method:

- simple and safe technology,
- the process can be performed either in a stationary field facility or at a mobile plant,
- no wastes,

- capacity up to 5 tonnes per working day at the mobile plant,
- safe transportation of the final product to fertilizers industrial site.

8.2.2 Conversion of Melange into industrial product in industrial facilities (Option I b.)

In some countries this option has become a reality:

State	Tonnes	Status	Final Product
Germany for	GE 4,500 CZ 220 SK 100 FIN 40	Completed	Fertilizer
Russia	RU 53,000 BY 10,000	Completed	Industrial nitric acid
Poland	PL 1,000 UA 215	Ongoing Completed	Fertilizer Fertilizer

Chemical industries developed specific processes to convert melange into industrial nitric acid (strong or diluted), conditioned fertilizer or other industrial products. The details of methods and processes have not been laid open. This option requires established technologies available in countries with appropriate chemical industries and access to markets for the final products.

Experts' evaluation:

- Safe operation within certified and approved industrial plants;
- High-tech equipment;
- Most efficient for larger quantities.

The complicating factor is

- Specific transportation requirements, including borders crossing.

8.2.3 Disposal of Melange by High Temperature Incineration in Mobile/Field Facilities (Option II a.)

A common technology of thermal disposing of hazardous waste is to crack the chemical structures at high temperatures (1,200-1,400° C) and release the fragments in the open air after careful filtering and in some cases extremely fast cooling to prevent recombining of the fragments (dioxin-window). Melange is cracked at 1,200° C. Behind complex filters N_2 and O_2 are released into the air, harmless for the atmosphere. The temperature is generated by burning fuel using the melange in its original peculiarity as oxidizer. Compared with industrial facilities the technical processes of mobile equipment is more limited in throughput and effectiveness.

Presently, neither of the two known models used in OSCE States has performed satisfactorily and it is strongly recommended they not be used again:

a) Anderson 2000 (US fabricated) engaged in Kazakhstan at Kapchagay site (Fig. 10)

- Low throughput (249 tonnes in 5 years)
- High energy consumption (6-7 kg diesel for 1 litre melange)
- On site operation, no melange transportation

b) Ukrainian fabricated mobile unit engaged in Moldova (Fig. 10) 352 tonnes of melange were incinerated in Moldova in 2002 under NAMSA contract in 6 months.

- Daily throughput approx. 2.5 tonnes
- High energy consumption
- On site operation, no melange transportation

8.2.4 Disposal of Melange by High Temperature Incineration in Industrial Facilities (Option II b.)

This technological process is comparable to the previous option. However, instead of fuel needed for the incineration process special energetic waste is fed into the incinerator with melange as oxidizer. The advantage is that there are:

- High throughput and effectiveness;
- No requirement for fuel;
- Safe operation within certified and approved industrial plants.

The complicating factor is

- Specific transportation requirements, including border crossings.

8.2.5 Conclusion

Looking back over the last 15 years of intensive melange elimination, conversion into chemical compounds for industrial purposes has been and still is predominant. Starting with the industrial option during the first years and for large quantities presently the main emphasis is put on mobile/field solutions for smaller quantities in non-industrial countries like Armenia, Azerbaijan and Georgia. Three key criteria have proven themselves to be good working parameters when planning new initiatives:

• Throughput	5 tonnes per working day;
• Operational costs	about €1.00 per kilo melange:
• Project costs	€1.50-1.80 per kilo, depending on host nation in-kind contribution.

8.3. Environmental Remediation

Because of the long time of on-site RFC storage with a high degree of container corrosion and danger of leakages it is advisable especially in provisional storage sites to take periodic soil samples in order to identify contaminators and possible RFC entries into the groundwater exceeding the relevant national environmental regulations. In any case sampling should be done upon completion of the elimination of the rocket fuel components. Dependent on the degree of expected contaminators the following measures should be taken:

Melange area

- Organoleptic checks and/or soil sampling;
- Covering of the surface of the contaminated areas with sodium/calcium carbonate and mechanical incorporation in the ground with agricultural implements;
- Thorough watering of the ground:
- Three months later: soil sampling to prove that the residual components of melange (nitrate and nitrite) are not in existence any more.

Samin area

- Organoleptic checks or soil sampling;
- Dependent on the results of the analyses soil purification measures have to be identified. Worst case could be to remove the contaminated soil for industrial treatment (rotary kiln or chemical washer).

9 Elimination Project Philosophy

The OSCE Melange projects in Georgia and Armenia as well as the upcoming projects in Kazakhstan, Ukraine and others have followed and will follow the same vital principles:

- Performance guarantee;
- Legality;
- Safety, security and environmental soundness of all processes;
- Cost-efficiency and financial transparency;
- Accountability;
- Independent monitoring;

To enable the OSCE to verify the compliance of a project with all rules and regulations a Quality Assurance Programme (Armenian sample see annex 5) will be introduced binding all parties involved.

10 Project Strategy

OSCE Rocket Fuel Components elimination and site clean-up projects have been established upon the participating States request in Georgia, Armenia, Azerbaijan, Kazakhstan and Ukraine. Uzbekistan and others are expected to follow suit. A three-phase approach has turned out to be the most efficient one and can be described as follows:

Phase I – Scoping Study
Assessment is conducted through Fact Finding Operation of an International Experts Group, including on-site visits to elaborate:

- Quantity and characteristic of the melange;
- State of cisterns, storage sites and the vicinity;
- Risk analysis;
- Processing technology available in the region and internationally;
- Local facilities and resources available in-country;
- Recommendation of most appropriate technology for utilization/incineration of the melange;
- Cost and time frame for implementation of the project.

Findings, assessments and recommendations will be summarized by the experts group in an Independent Scoping Study.

Phase II – Planning, Tendering, Budgeting and Contracting
In Phase II all technical, organizational, contractual, legal and financial planning and design shall be elaborated. This encompasses the following issues (optional):

- Project Management Legal and Funding Structure;
- Terms of References;
- International Tendering;
- Licences, Permissions, Insurances;
- Development of Implementation Plan and Procedures;
- Quality Assurance Plan;
- Budgeting of Phase III – Implementation.

Phase III – Implementation
This phase represents the implementation of environmentally sound elimination of the melange. Main elements are:

- Contracting of executing agent;
- Working Plan;

- Working Schedule;
- Procurement and Delivery of the necessary equipment (optional);
- Training of the Staff, Safety measures (optional);
- Processing/Elimination of the melange;
- Legal, Technical, Environmental and Financial Monitoring and Reporting throughout the process;
- Site Cleaning.

The activities during all Phases will be conducted in co-ordination between the OSCE, the national states and local authorities, the international experts and as applicable the selected executing agent within the framework of the project management structure. This will ensure flexible and well-balanced professional discussion, qualified decision-taking and efficient implementation with due respect to the interest of the host nation, the donor participating States' claim for financial transparency as well as the OSCE's principles.

11 Project Management Structure

Each individual project calls for an individual project structure dependent on the specific circumstances in the host country and the facts found during fact finding mission (Project Phase I). Usual elements of the project management structures are

- OSCE fund manager;
- OSCE project manager;
- host nation governmental representatives;
- executing agent;
- donor participating States representatives;
- group of international experts.

Their specific interactions determine the individual management structure (example see annex 6) and are described in the relevant **T**erms **o**f **R**eferences (ToR).

As the OSCE does not have melange project funds at its disposal within its regular budget OSCE support requires extra budgetary voluntary funds sponsored by donor participating States and dedicated to individual melange projects. The voluntary fund is administered by an OSCE Fund Manager as trustee for the donor participating States. He is responsible that all expenses adhere to the OSCE rules. The OSCE fund manager is supported by an OSCE project manager who is responsible for project development and implementation according to OSCE principles and in co-ordination with the host participating States governmental representatives. During Project Phase II they commonly will ensure that the most suitable technology is selected and an executing agent be determined which can be an in-country or foreign commercial company or non-profit organization.

An OSCE melange roster of experts is generated consisting of independent international experts out of whom a group of experts will be designated for a specific project. The group will be extended by military and technical experts from the host country and shall conduct assessments and recommend suitable technologies and project structures to the project manager and monitor the implementation of the project on a case by case basis.

12 Project Budgeting and Funding

The total costs of a project include project related costs of any of the activities within the Phases I, II and III either assigned to the OSCE accounting system or specified as monetary or in-kind contributions of the host nation such as security, housing, utilities etc. The phase-by-phase approach facilitates a step-by-step budget forecast of all costs. Fund raising among the OSCE participating States will usually be required to meet the budget estimate to ensure the professional and financial support requested by a melange effected nation.

13 Potential Projects

An unknown quantity of Melange is still waiting for utilization in countries inside and outside the OSCE area and calls for further development of safe and cost effective disposal technologies.

Although only a small number of countries within the OSCE may become project candidates for smaller quantities of melange it can be assumed that there are countries outside the OSCE such as African, Near and Middle East states, India, Cuba and others where larger quantities of melange are still stored.

Annexes

Table of Annexes

1 Model questionnaire for a requesting state

1. Which Rocket Fuel Components in surplus are concerned?

Requesting States will specify in this paragraph, for each category, such indications as:

- The nature of the surplus;
- The amount;
- The condition of the surplus (overdue, unusable, etc.);
- A geographic description of location.

2. What are the nature and level of risk and danger caused by these surpluses?

A general assessment of the nature and level of risk and danger caused by these surpluses should cover the following items:

- The situation of the relevant stockpiles including environmental issues (especially the effect on the local population) and physical measures against sabotage, theft, trespass, terrorism or any other criminal acts;
- The safety situation of the relevant stockpiles including conditions of stocks, technical factors (e.g. degradation or deterioration rates) and the maintenance condition of storage facilities;
- Storage management and conditions;
- Details of any recent incidents/accidents and appropriate measures taken.

3. What is the intention of the requesting State in regard to the surplus?

Requesting States have to mention here if their aim, in regard of these surpluses, is basically:

- To eliminate them; or
- To enhance their storage conditions in order to avoid the assessed risks and dangers.

4. What assets are available?

The purpose of this paragraph is for requesting States to specify the nature, amount, and capability of the assets and the ways they could be:

- Used in order to solve themselves a part of the current identified problems;
- Put at disposal of the foreign assistance teams.

For example:

- Technical assets directly linked with the elimination or storage;
- All other logistic means to support the different necessary actions (transportation, accommodation, etc.);
- Possible financial contribution.

5. What type of assistance is requested?

Taking into account the different risks and dangers and regarding the above-mentioned available assets, requesting States have to specify in this paragraph the type of assistance required. It can be assistance, for instance, to:

- Make a detailed risk assessment;
- Develop an elimination programme for the concerned stockpiles;
- Enhance the stockpile management and security;
- Train the personnel involved in the elimination or in the stockpile management and security;
- Realize an awareness programme.

6. Details of bilateral/multilateral assistance already requested and/or granted.

7. Who is the point of contact (POC)?

Name, function and address, telephone and telefax numbers of the POC and, if relevant, email address, are to be mentioned.

8. Any further information.

2 Types of melange

AK-20f	
Nitric acid (HNO3)	no less than 73.50 %
Oxide of nitrogen (N2O4)	17.50 -22.50 %
Anhydrous hydrogen fluoride (HF)	0.50 -0.80 %
Phosphoric acid (H3PO4)	0.80 -1.10 %
Water (H2O)	1.20 -2.80 %

AK-20i	
Nitric acid (HNO3)	no less than 72.90 %
Oxide of nitrogen (N2O4)	17.50 -22.50 %
Inhibitor of corrosion (iodine/I)	0.15 -0.25 %
Aluminium salt (AL2O3)	up to 0.04 %
Water (H2O)	3.30 -4.30 %

AK-20k	
Nitric acid (HNO3)	no less than 73.00 %
Oxide of nitrogen (N2O4)	17.50 -22.50 %
Anhydrous hydrogen fluoride (HF)	0.50 -0.75 %
Phosphoric acid (H3PO4)	1.00 -1.30 %
Water (H2O)	up to 2.10 %

AK-27i	
Nitric acid (HNO3)	no less than 69.80 %
Oxide of nitrogen (N2O4)	24.00 -28.00 %
Inhibitor of corrosion (iodine/I2)	0.12 -0.16 %
Aluminium salt (AL2O3)	up to 0.03 %
Water (H2O)	up to 1.70 %

AK-27p	
Nitric acid (HNO3)	no less than 69.50 %
Oxide of nitrogen (N2O4)	24.00 -28.00%
Anhydrous hydrogen fluoride (HF)	0.30 -0.55 %
Phosphoric acid (H3PO4)	0.05 -0.15 %
Water (H2O)	up to 1.40 %

The H_2O share of the compound is not desired and due to the hygroscopic nature of melange, it shall not exceed two percent, therefore storage containers have to be airtight sealed.

3 Safety instructions for working in rocket fuel storage sites – samin

(Extract of “Betriebsanweisung nach § 20 Gefahrstoffverordnung der Buck Inpar GmbH, Pinnow”, Ge)

Workstation

Activity/Purpose	Handling, Maintenance, Cleaning
Workplace	Rocket Fuel Depot

Hazardous Substance *Samin*

Chemical composition	Triethylamin (50%) Xylidine (Dimethylaniline) (50%)
Condition	Liquid
Colour	Yellow-brown
Smell	Like ammonia, slightly pungent
MAK (Maximum permitted concentration at workplace)	25 mg/m^3
Flashing point	< 21° C

Human and environmental danger

 toxic  caustic  inflammable Symbols at working place	**Special danger** Highly inflammable Toxic upon • breathing • swallowing Caustic

SAFETY MEASURES

General conduct

- No open fire and light
- Smoking prohibited
- Prohibition of any and all materials that might lead to explosions caused by sparks (mobile phones, radios etc.)

Technical safety measures

- During charging and discharging readiness for fire fighting with water
- Ventilation
- Non-sparking safety tools and handling equipment
- Grounding

Personal safety measures

- Wearing antistatic full-cover safety clothing (rubber suit, -gloves and -boots; gas mask with filter for organic substances)
- Cleaning work within containers: Antistatic rubber suit with ventilation and oxygen apparatus
- Before entering the container to moisten suit with water
- Medical consultation at any indisposition

Personal health care

- Rubbing with protective skin cream
- Taking off soaked clothing immediately
- Washing with water and soap of any part of the body having come in direct contact with samin
- No food or drinks at work
- Showering at close of business

IMMEDIATE COUNTER-MEASURES UPON ACCIDENTS

Activation of contingency plans and alert systems in case of

Fire

- Fighting of minor source of fire with CO_2 or powder (fire extinguisher)
- Fighting of major source of fire with foam
- Preventing of fire spreading by water
- Cooling of containers by water spraying

Leakages

- Damming of samin with soil to prevent spreading and reaching sewerage or waters
- Removing all potential sources for ignition
- Remove leakage with oil binding agents

FIRST AID MEASURES

Skin contact	washing of contacted skin with much water and soap; change of soaked clothing
Eyes contact	rinsing of open eye with water for several minutes;
Breathing in	immediate provision of fresh air; personal or artificial respiration;
Swallow	no milk, no alcohol; immediate medical consultation
Burns	immediate medical consultation

WASTE DISPOSAL

- Filling remainders and mud and used oil binding agents in licensed barrels only; wearing protective clothing
- Transportation of only closed and cleaned barrels
- Following safety procedures for transportation

4 Safety instructions for working in rocket fuel storage sites – melange

(Extract of "Betriebsanweisung nach § 20 Gefahrstoffverordnung der Buck Inpar GmbH, Pinnow, Ge)

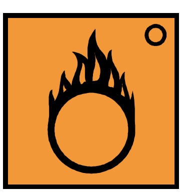
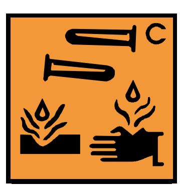
Workstation

Activity/Purpose	Handling, Maintenance, Cleaning
Workplace	Rocket Fuel Depot

Hazardous Substance *Melange* Inhibited Red Fuming Nitric Acid (IRFNA)

Types	AK-20k, AK-20i, AK-20k, AK-27i, AK27p
Chemical composition	HNO_3 ≥ 70% N_2O_4 18-27% Others approx. 3% (H_3PO_4, I_2, Al_2O_3, HF) H_2O ≤ 4%
Condition	Liquid
Colour	Clear, light brownish
Smell	Acidic, pungent Reddish-brown fuming,
MAK (Maximum permitted concentration at workplace)	5 mg/m³

Human and environmental danger

 increasing hazard of fire  caustic Symbols at working place	**Special danger** Liquidity as well as fumes are highly caustic to: • skin • mucous membranes • respiratory system • eyes Toxic upon swallowing Fire/explosion in contact with combustible substances Pollution of groundwater

SAFETY MEASURES

General conduct

- No open fire and light
- Smoking prohibited
- No direct melange contact with skin, eyes and clothing

Technical safety measures

- Containers and pipe systems have to be kept tightly shut
- Absorbing nitric gases by ammonia-water (10%)
- No contact with organic substances
- During charging and discharging readiness for fire fighting with water.

Personal safety measures

- Wearing acid-proof protective clothing such as (rubber suit, -gloves and -boots; gas mask with filter)
- Keeping handy clear bottled rinsing water in case of eye/skin contact

Personal health care

- Taking off soaked clothing immediately
- Washing with water and soap of any part of the body having come in direct contact with melange
- No food or drinks at work

IMMEDIATE COUNTER-MEASURES UPON ACCIDENTS

Activation of contingency plans and alert systems in case of

Leakages

- Air: Whirling water spray to absorb nitric gases. Blocking of endangered area in wind direction Evacuating of uninvolved people from endangered area
- Water: Warning of all users of drinking-, cooling- and industrial water. Preventing of melange entry into the sewerage
- Ground: Removing of minor leakages with oil binding agent Damming of major leakages with soil to prevent spreading and reaching sewerage or waters. Neutralization with calcium oxide or calcium carbonate. Removal of all organic substances to prevent fire

Fire

- Cooling of melange containers to prevent bursting

FIRST AID MEASURES

- Removing of injured to non-contaminated areas
- Removing of soaked clothing
- Washing of contacted skin with much water and soap
- Rinsing of eyes with clear water (Removal of contact lenses)
- After swallowing of melange drinking of much water, taking charcoal tablets
- No vomiting
- After breathing in treatment with auxiloson-spray
- In all contamination cases affected persons shall be medically surveyed for about 48 hours because of a retarded effect. In case of respiratory paralysis immediate artificial respiration.
- Medical consultation at any indisposition

WASTE DISPOSAL

- Neutralization of acidic cleaning water and contaminated ground with calcium oxide, calcium carbonate, sodium hydroxide or ammonia
- Intensive diluting with water

5 Quality Assurance Programme (Armenian sample)

osce Organization for Security and Co-operation in Europe

Quality Assurance Programme (QAP)

Organization for Security and Co-operation in Europe
Office in Yerevan

Elimination of rocket fuel component stocks
Republic of Armenia

Yerevan 2005

Copy No __

Organization for Security and Co-operation in Europe Office in Yerevan

We herewith put in force the – Quality Assurance Programme – to become effective as of:

Yerevan, ...
(Date)

Head of OSCE Office and
Fund Manager

Ambassador Vladimir F. Pryakhin

Special Representative of the Minister of Defense
and Senior Project Coordinator

Major-General Tigran S. Gasparyan

Distribution

Note
In the event that this document is translated into any language other then English, the terms of the English language version shall prevail in the event of any discrepancy.

11. QA-Obligations

Quality Assurance will be facilitated by on-site QA-Inspectors, who act on behalf of the Project Manager. They will survey all on-site activities within the framework of the Elimination Programme with emphasis on

- Security
- Safety and
- Transparency

This will be in particular:

a) assisting the Project Manager in the evaluation of

- the on site performance of the Operator's equipment
- the Operator's weekly progress
- the Operator's quality plan

b) surveying and inspecting the Operator's compliance with

- the directions of the PM
- the Quality Assurance System
- the operator's internal work procedures, instructions and manuals
- the safety and environmental regulations

c) certifying

- Certificates of Recycling, invoices and reports

The QA-Inspectors will record their inspections and observations in a daily log to be presented to PM on a regular basis. They will report special incidents to PM in an unformatted Special Incident Report.

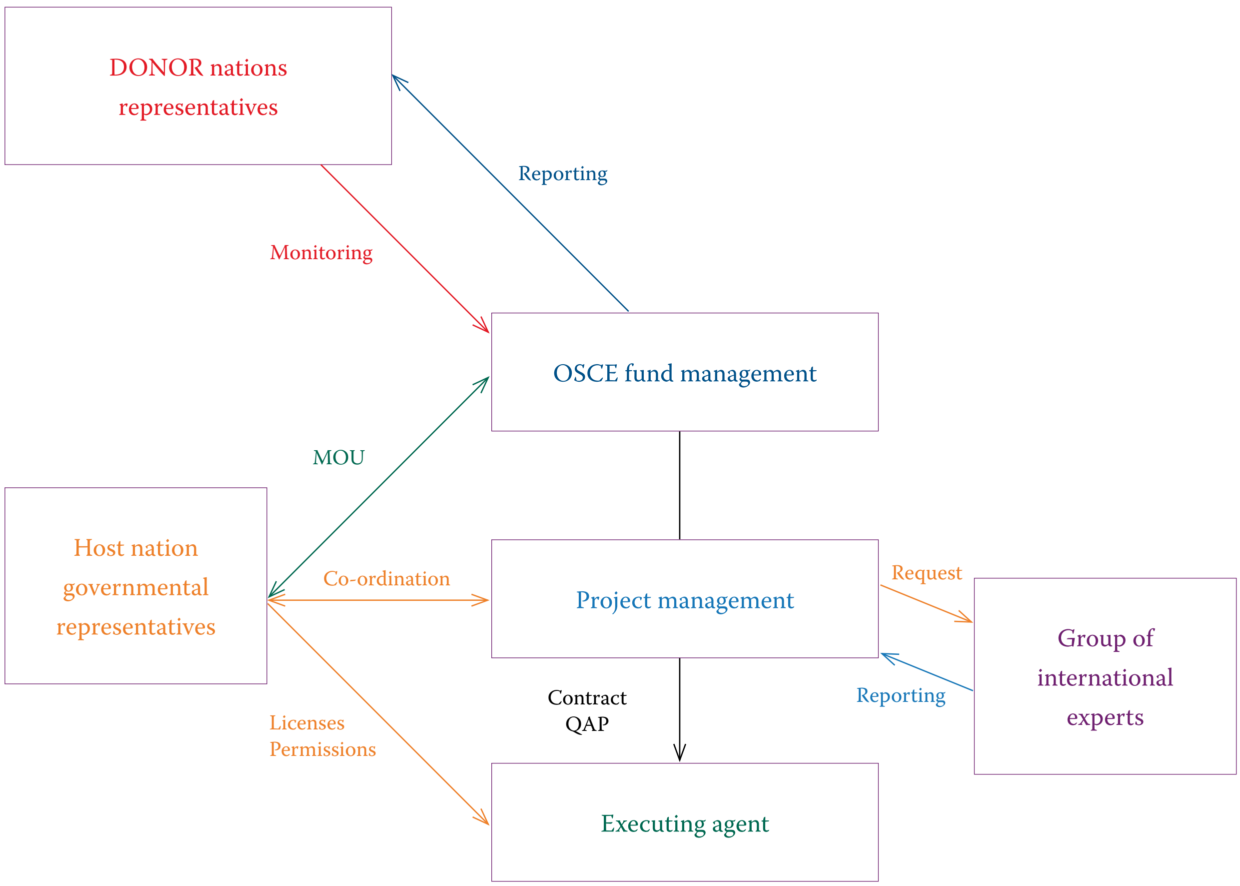
12. Documentation

Effective

- Project Management
- Contract Monitoring and
- Quality Assurance

require a consolidated documentation structure (see Annex 3) and system, thus ensuring.

6 Melange Project Management Structure (Sample)



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Forum for Security Co-operation

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