



PFM 1 Series APM Destruction Study (Phase 1 Report)

Geneva International Centre for
Humanitarian Demining
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Brief background

- **9.59M PFM in Belarus and Ukraine.**
- **Russian Federation stocks?**
- **Particular risks and hazards during storage and destruction.**
- **Explosive could be corrosive?**
- **Internal degradation could occur?**
- **Internal seals could leak?**
- **Evolved products could be toxic?**

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Study aim (Phase 1)

To scientifically validate the actual dangers posed by the storage of PFM 1 and to establish the real evolved products of combustion and detonation in order that a realistic assessment can be made of destruction options by the international community.

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Study conclusions - products

- The type, quantity and toxicity of evolved products can not be predicted using thermo-chemical detonation hydrocodes.
- Principle pollutants could be NH_3 , CO , HCl , HCN , NO_x , Al_2O_3 and unreacted liquid phase VS6-D.
- Live trials are essential.

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Study conclusions - products

- **Diffusion and dispersion of product gases and particulates can be accurately predicted.**
- **This prediction is dependent on quantitative data from containment chamber live trials.**

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Study conclusions - degradation

- **That based on the best predictive chemistry, the risks of degradation are genuine.**
- **Lack of available trials data means that these risks can not be quantified.**
- **Liquids react more quickly than solids due to molecular mobility.**

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Study conclusions - degradation

- ❑ Moisture ingress will contribute to the internal reactions.
- ❑ The presence of impurities will contribute to the internal reactions.
- ❑ Once all impurities used, internal reactions cease.
- ❑ Exposure to storage temperatures of +40°C will increase the possibility of internal reactions.

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Study conclusions - destruction

- ❑ Manual disassembly from the dispenser canister is NOT recommended.
- ❑ Mechanical disassembly carries a significant risk.
- ❑ Cryofracture is possible, but has problems.
- ❑ Rotary kiln or plasma arc incineration will have feed system problems and will require specific PCS.

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Study conclusions - destruction

- ❑ **Contained detonation is a serious contender, but production rates may be slow.**
- ❑ **OBOD has not been ruled out at this stage of the study.**
- ❑ **The 'Cementation' proposal has issues that require independent technical validation or approval. This can be done during any international tendering process.**


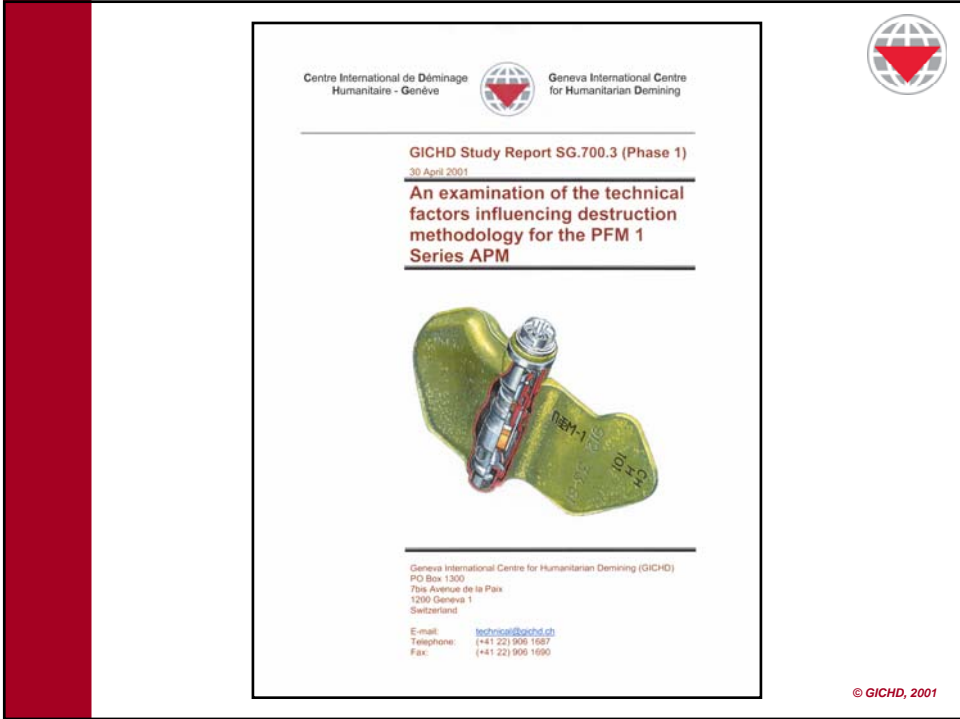
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Study - recommendations

- ❑ **Full scale tests should be conducted in large containment chambers.**
- ❑ **Diffusion and dispersion modeling should then take place.**
- ❑ **It must be assumed that some degree of internal degradation of the liquid explosives has taken place.**

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Phase 2

- **Confirm suitable trial location.**
- **Identify transportation requirements.**
- **Identify donor funding for Phase 2 trials.**
- **Write Trial Plan.**
- **Conduct trials.**

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Phase 2

- **Capture data on the type and quantity of evolved products of deflagration and detonation.**
- **Assess air pollution risk to human life and the environment from the OBOD of PFM 1 series APM.**
- **Compare this environmental hazard against other common air pollutant systems.**

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Phase 2

- **Compare air pollution results against selected international legislation.**
- **If trial results prove favourable, then develop a safe and viable OBOD destruction technique.**
- **Prepare a financial model to allow cost benefit analysis to be conducted comparing OBOD costs against any proposed industrial destruction solution.**

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Requirements of trial location

- Extensive previous experience of environmental assessment trials
- Contained detonation facility with on-line environmental monitoring system
- Experienced at type of trial
- Academic expertise of evaluating results obtained

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Requirements of trial location

- Robust containment chamber capable of dealing with ~4kg NEC
- Accredited to international standards:
 - International Laboratory Accreditation Conference (ILAC)
 - European Cooperation on Accreditation (EA)
 - International Accreditation Forum (IAF)

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Why accreditation?

- ❑ **Test and evaluation standards in accordance with relevant ISO**
- ❑ **Quality of trials conduct**
- ❑ **Accuracy of trial equipment calibration levels**
- ❑ **Repeatability and replicability of trials**

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The future ?

- ❑ **Live trial programme**
- ❑ **Mechanism for international expressions of interest**
- ❑ **Mechanism for international tender**
- ❑ **Technical evaluation of proposals**

- ❑ **Any solution must provide for sustainable development and be operated by the indigenous population**

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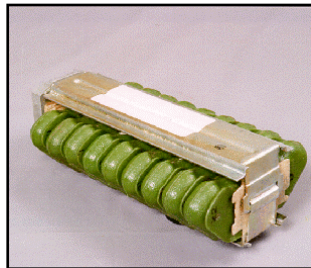
Facts

- **9.59M PFM series APM ~ =**
 - 149,800 Canisters
 - 6675 tonnes All Up Weight (AUW)
 - 1688 tonnes Explosive (NEC)
- **European commercial demilitarization costs vary between US\$500 to US\$2500 per tonne AUW**
 - Minimum costs = US\$ 3.3M
 - Maximum costs = US\$ 16.7M (??!!)

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