

Photolytic Treatment of Energetic Substances using Sunlight - A Solution for Heidkate Ammunition Dump?

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Basic requirements for minimizing potential toxic & kinetic hazards

- **Safe recovery and transport**
- **Suitable site for storage, handling and treatment**
- **Qualified analytical control of the process**

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- **Safe Recovery and Transport**

- SchW39 must not be allowed to become or remain dry.
- Lumps can be collected & moved in submersed state.
- Water jet or air lifting are suitable for the collection process.



Pic. 1: Labor-intensive DMM* recovery.

* Dumped Military Munitions.

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- **Safe Recovery and Transport**

Nature of the "Heidkate Problem":

- Physical state of cast SchW39* in warheads is unknown.
- Complete high order detonation is less likely to produce permanent contamination.

* lit. "shooting wool"; dating from obsolete use of wet nitrocellulose.



Pic. 2: Oxygen rich detonation.



Pic. 3: Oxygen depleted detonation.

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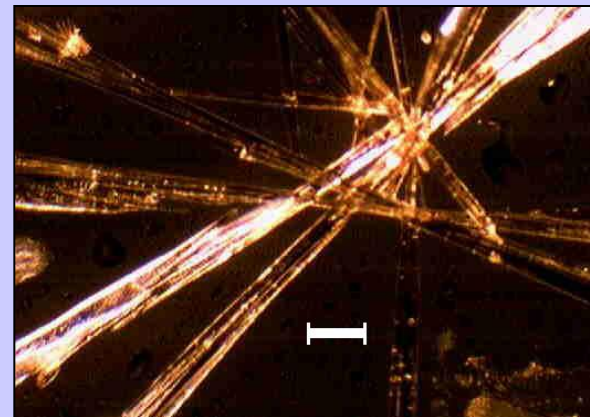
- **Safe Recovery and Transport**
 - Incomplete detonation may yield solutions, fine or crude residue from cast charges.
 - Solids resemble the primary persistent contamination problem.



Pic. 5: Encrusted RDX Particles.



Pic. 4: TNT Solution.



Pic. 6: TNT- Fine Crystals.

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- **Suitable Site for Storage, Handling and Treatment**

- Recovered energetic materials can be safely stored under water in dilute state or as a sludge. Illicit acquisition attempt risk is minimal!
- A controlled specially prepared processing site is required for storage and destruction facilities.



Pic. 7: Processing Pond.



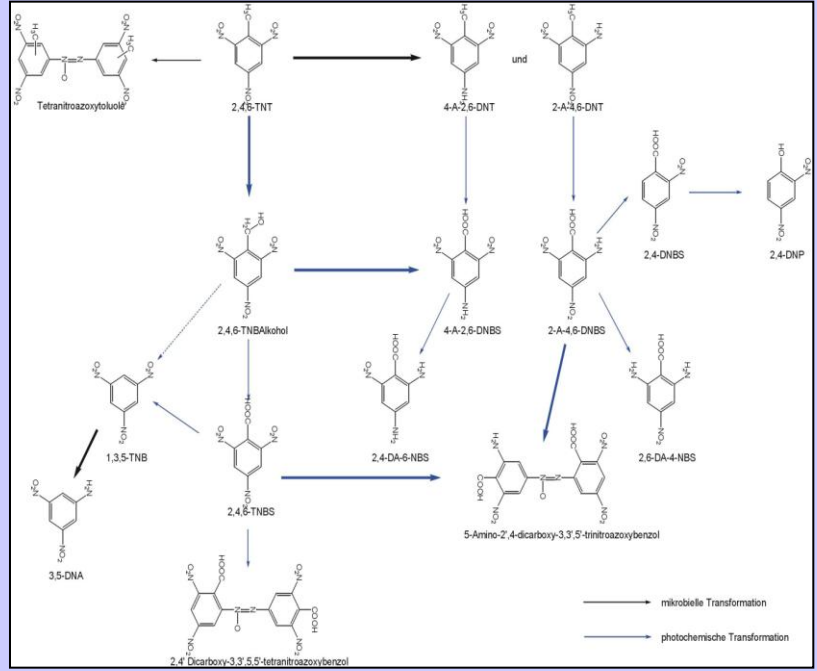
Pic. 8: Water Sample (TNT & RDX).

- Handling effort is minimal due to water jet transfer between storage & processing ponds.

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- **Suitable Site for Storage, Handling and Treatment**

- The transformation of energetic materials is the result of a combined process.
- Inorganic, photolytic, plant and microbiological pathways are known and *site specific*; field experience indicates that there is no "standard" degradation regime.



Pic. 9: Some Transformation Pathways.

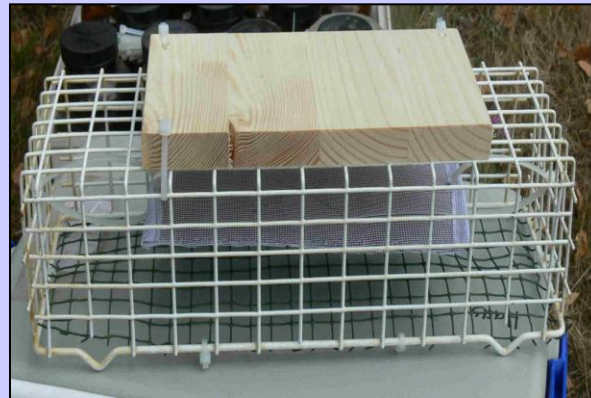
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• Qualified analytical Control of the Process

- Efficient *site adaptable* analytical control of transformation products is available.
- The field proved control regime results from a decades experience in sampling and analysis of energetic substances.
- A combination of dip probes, passive collectors (pc) and detectors for chemical equilibria in the pond volume are used.



Pic. 10: Volume Sample.



Pic. 11: Passive Collector, caged.



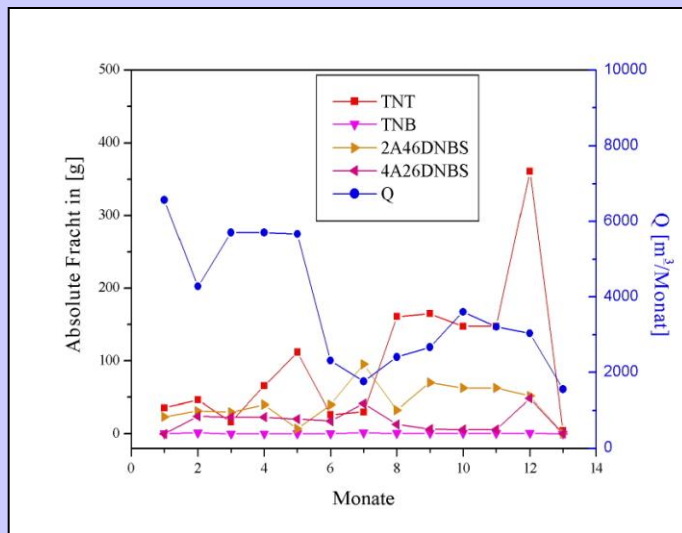
Pic. 12: Steel Redox Detector.

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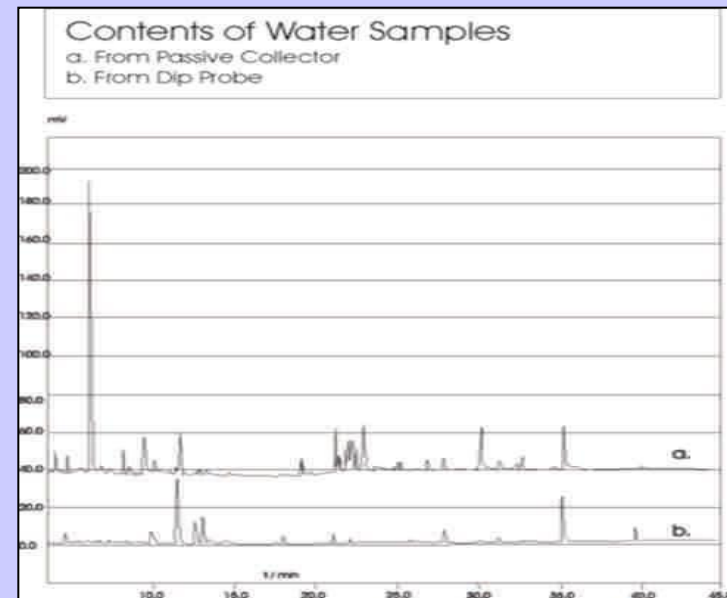
• Qualified analytical Control of the Process

-Monitoring-

- The total contaminant load can exclusively be monitored with pc's.
- Trace contaminants are collectable with pc's.



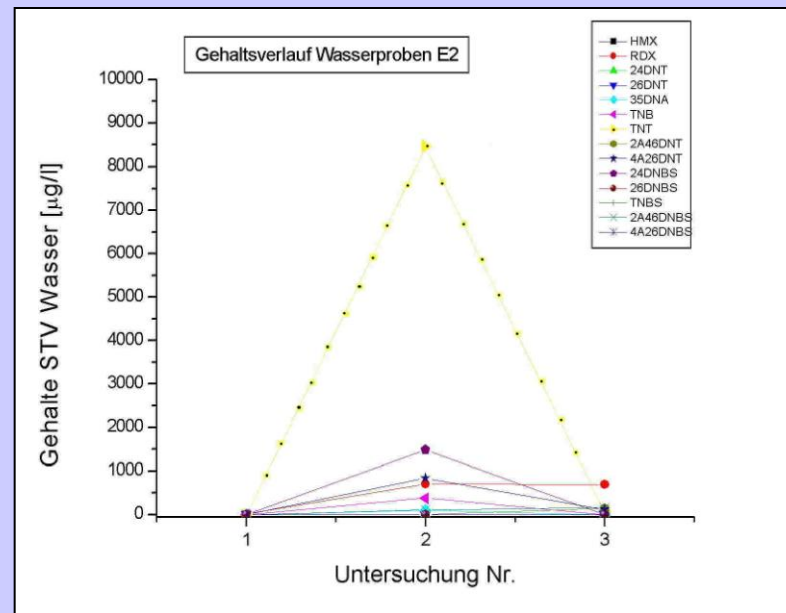
Pic. 13: Runoff Volume vs. Solution load.



Pic. 14: Trace Contaminant Enrichment on pc's.

• **Qualified analytical Control of the Process**

- TNT-degradation example from live multi stage treatment site (Pic.7).
- Final run off volume contains no more TNT down to the lower detection limit!
- Adequately processed water can be discharged into the surface runoff .



Pic. 15: TNT-Transformation over a 3 month period.

• Discussion

- Combined photolytic treatment of nitro aromatics and nitramines is feasible and efficient for complete destruction of the aforementioned contaminants.
- A live working site including a multistage pond system serves as a reference and proof of principle for the photolytic destruction of energetic compounds.
- Hot water transfer of energetic solutions is practicable.
- Processing site requires small numbers of personal & work hours per month.
- The photolytic process is safe for personnel and environment.

•Summary

- Residue from energetic substances like SchW39 can be successfully recovered, transported and destroyed via a combined photolytic treatment scheme.
- The process, *once site adapted*, is safe, requires few man hours and small amounts of energy.
- Processed water can be discharged without further treatment.
- Analytical control schemes are established and can be tailored to meet customer specific requirements.

**Thank You
for
Your attendance**

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