

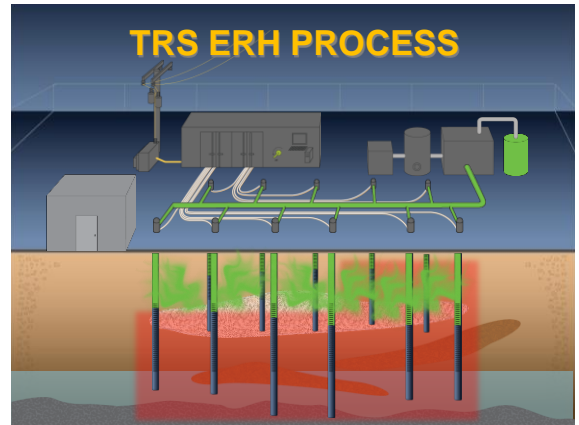
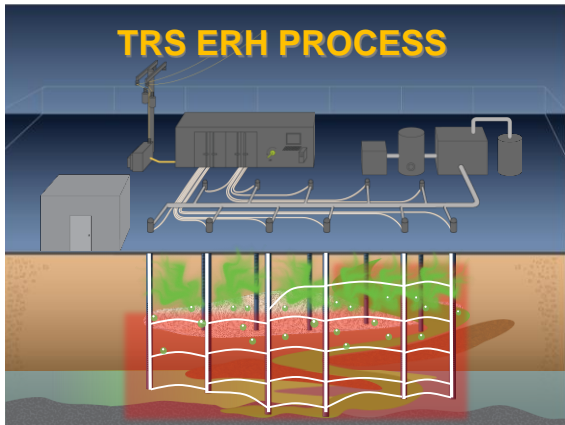
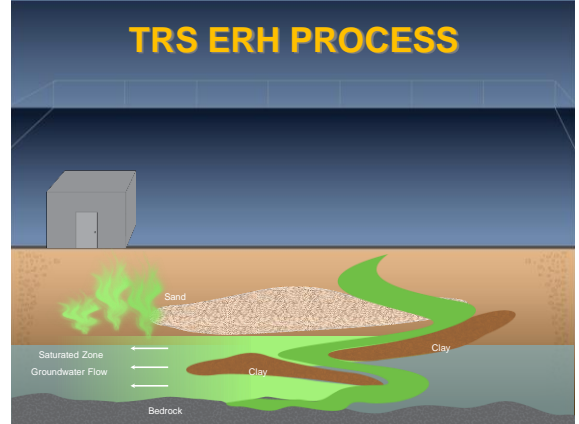
Remediation using Thermally Enhanced Hydrolysis

November 2017

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www.thermalrs.com



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Hydrolysis

- Breaking chemical bonds through a reaction with water
- Water substitution or elimination
- Neutral, base-, or acid-catalyzed
- Vadose zone?



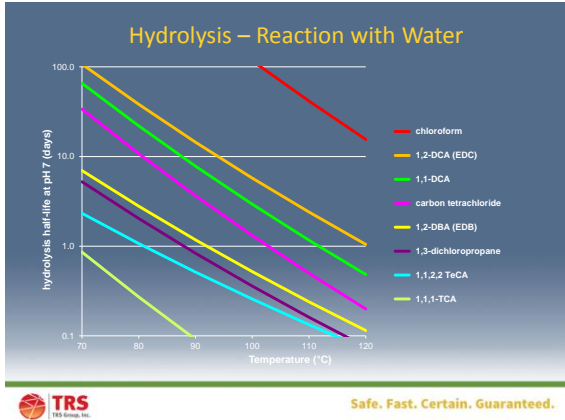
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Hydrolysis Rate Determination

- Heat to 60-90°C
- Activation Energy
- Arrhenius Equation
- Two pHs



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Important Pesticides

- Dieldrin*
- Aldrin*
- Toxaphene*
- Heptachlor*
- Lindane
- DDT*
- 1,2-dibromo-3-chloropropane (DBCP)
- 1,2-dichloropropane
- Ethylene dibromide (EDB)
- 1,2,3-trichloropropane
- Pentachlorophenol (PCP)

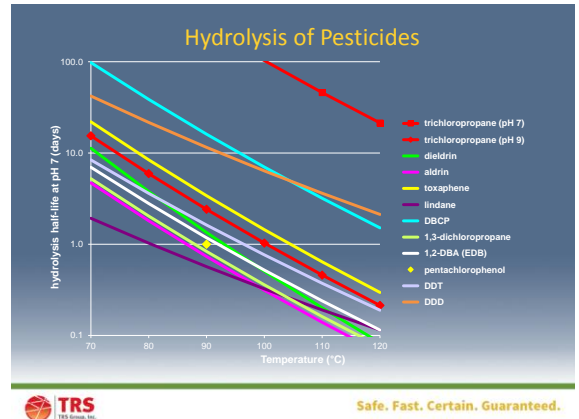
*Dirty Dozen POP

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Pesticide Mechanisms

- Prompt chemical reaction (not stable)
- Specific biochemical pathway

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Hydrolysis Products

- Mostly unknown, except for fumigants
- Pesticide mechanism of action
- Toxicity reduction factor: 100-1000

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Vapor Protection

<u>Probably No</u>	<u>Probably Yes</u>
<ul style="list-style-type: none"> Dieldrin Aldrin Toxaphene Heptachlor Lindane DDT Pentachlorophenol 	<ul style="list-style-type: none"> 1,2-dibromo-3-chloropropane (DBCP) 1,2-dichloropropane Ethylene dibromide (EDB) 1,2,3-trichloropropane

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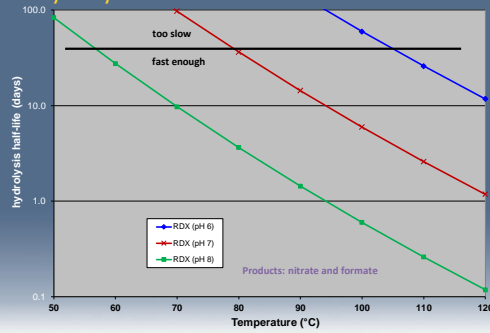
Important Explosives

- TNT
- RDX



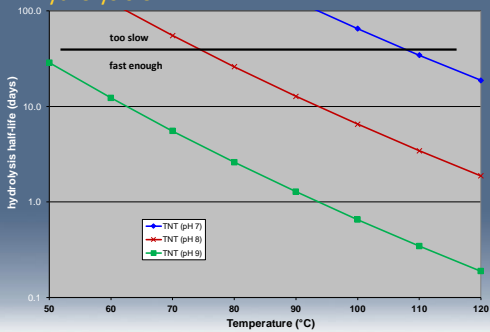
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Hydrolysis of RDX



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Hydrolysis of TNT



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Cook Off and Melting

- Cook off is the temperature at which the explosive reaction become self-sustaining.
- TNT cook-off is about 220°C. Yellow dye.
- RDX cook-off is about 180°C.
- TNT melts at 81°C.
- RDX melts at 206°C.
- Composition B melts at 81°C and the RDX remains suspended in the liquid.



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