Remediation using Thermally Enhanced Hydrolysis

April 2018

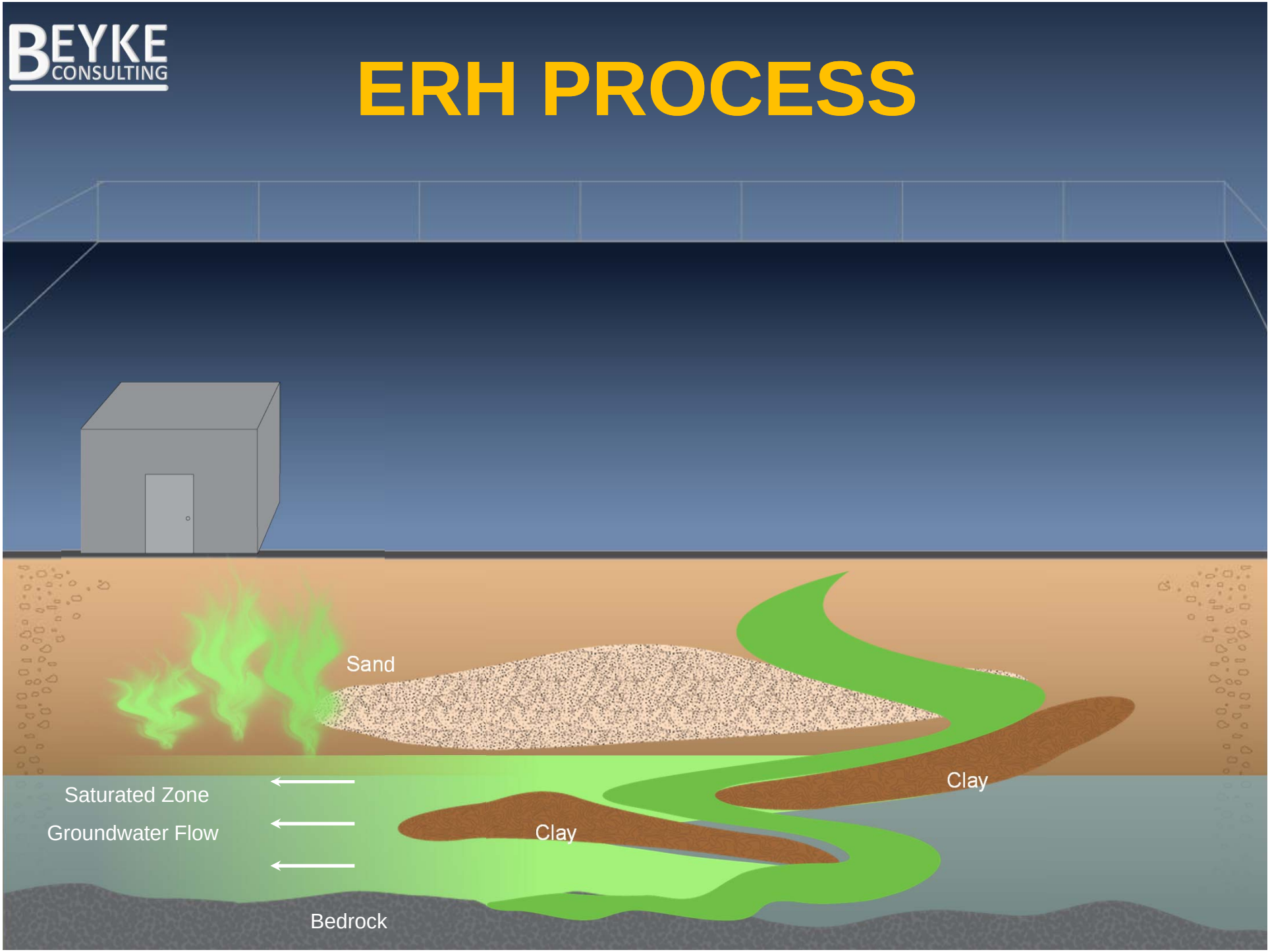
Greg Beyke
greg@beykeconsulting.com

BEYKE CONSULTING

TRS
Accelerating Value

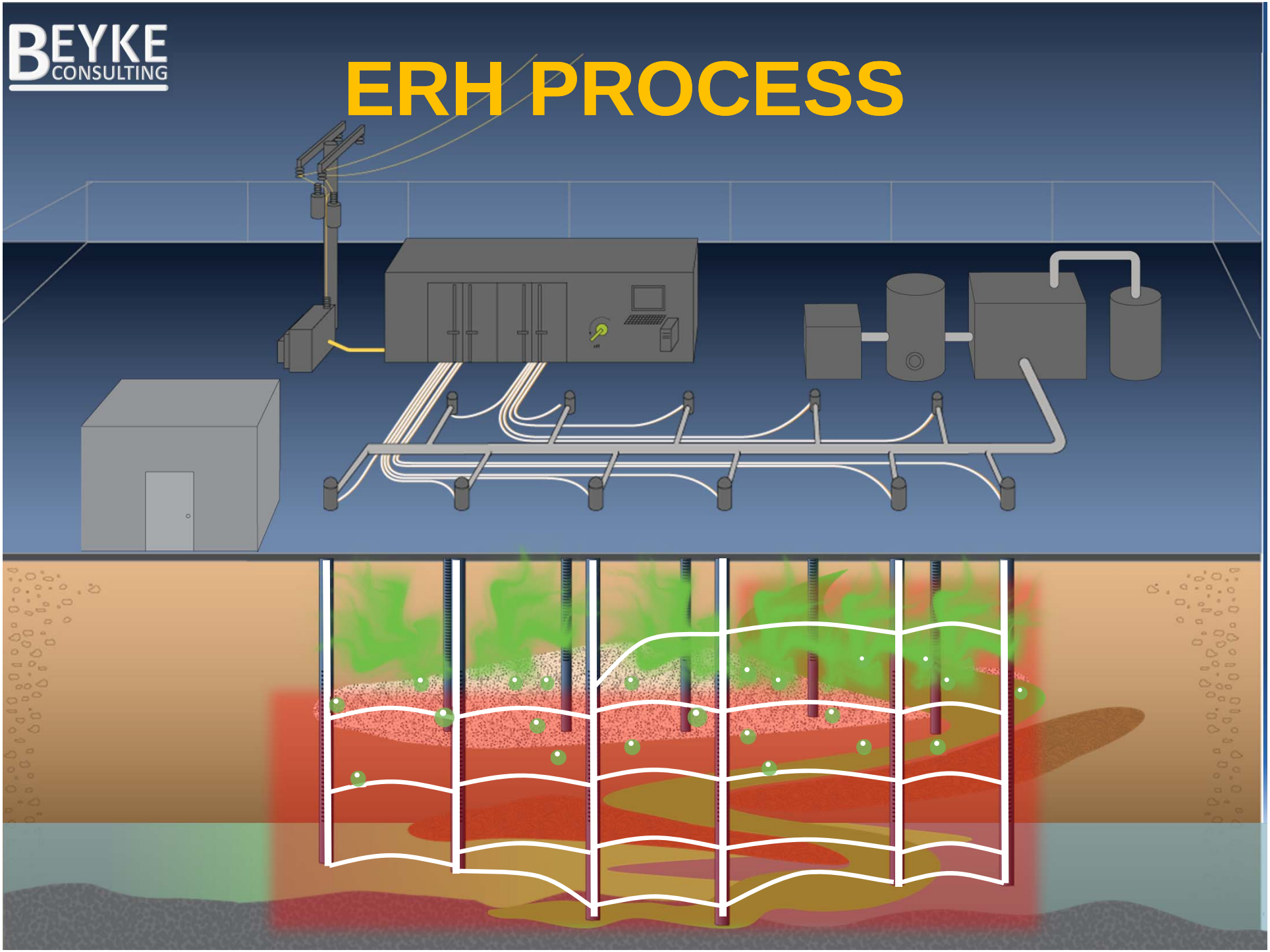
BEYKE CONSULTING

ERH PROCESS



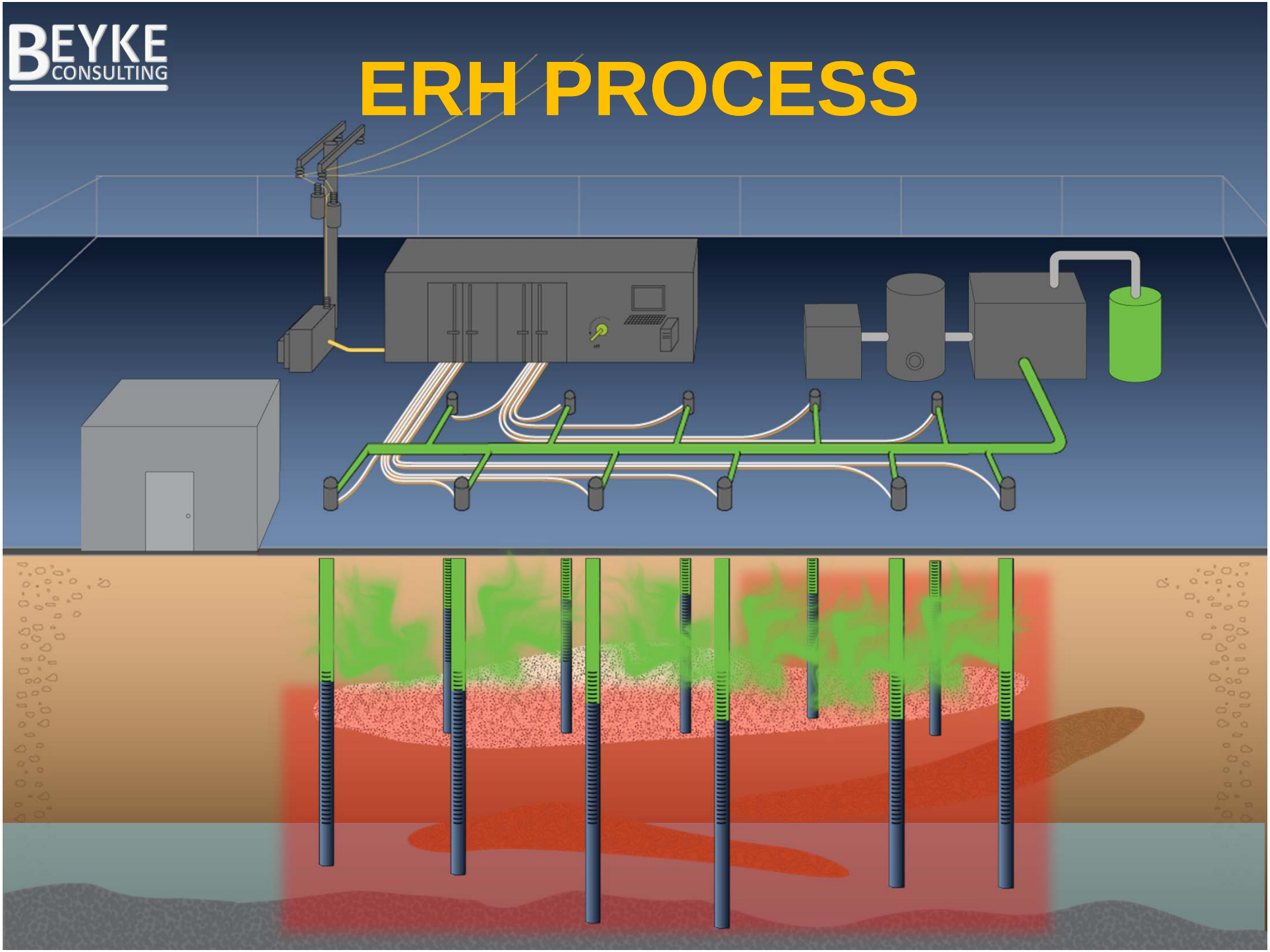
BEYKE CONSULTING

ERH PROCESS



BEYKE CONSULTING

ERH PROCESS



Hydrolysis

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

- Vadose zone?

BEYKE CONSULTING

TRS Accelerating Value

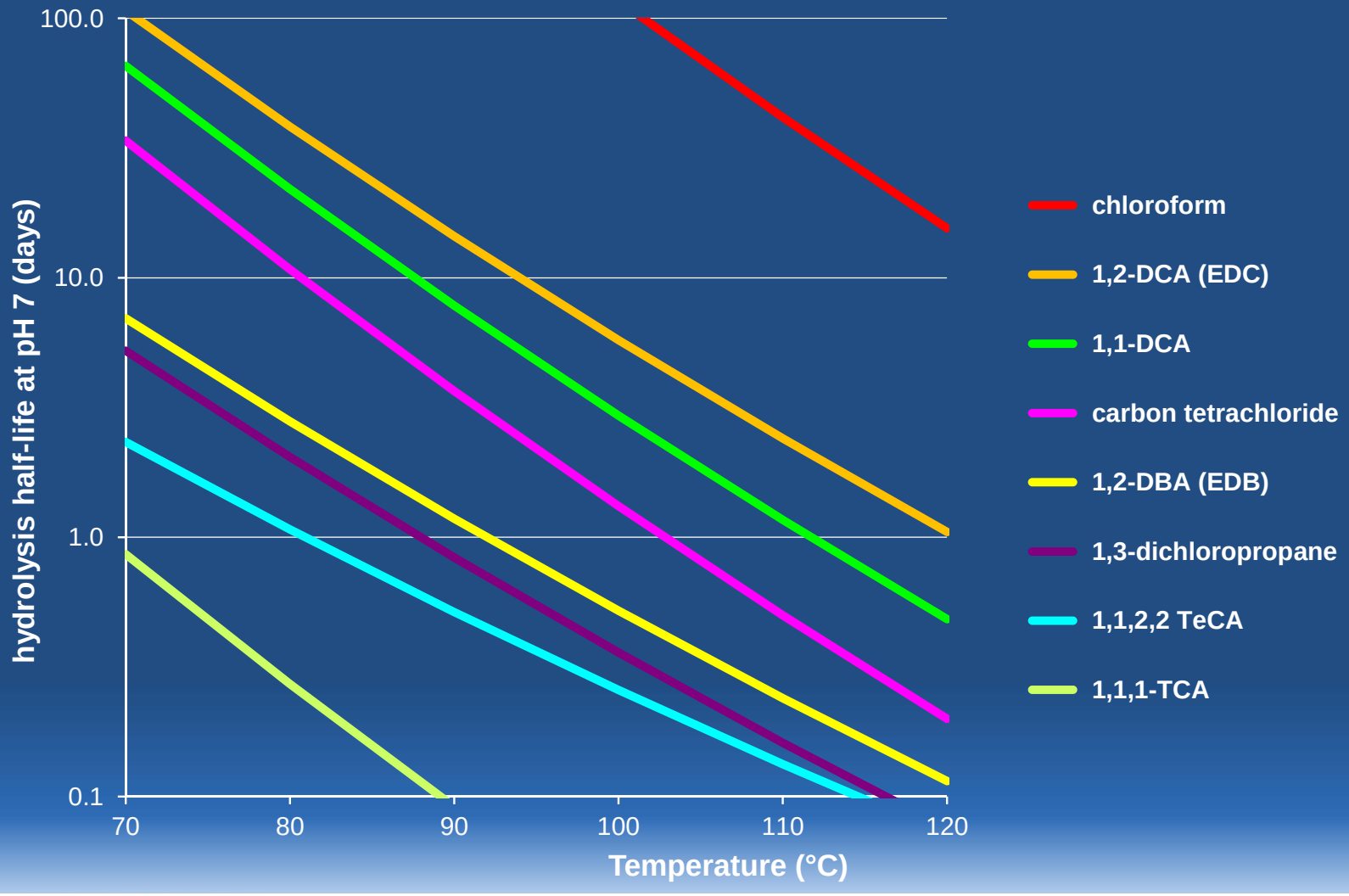
Hydrolysis Rate Determination

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

BEYKE CONSULTING

TRS Accelerating Value

Hydrolysis – Reaction with Water



BEYKE CONSULTING

TRS Accelerating Value

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

BEYKE CONSULTING

TRS Accelerating Value

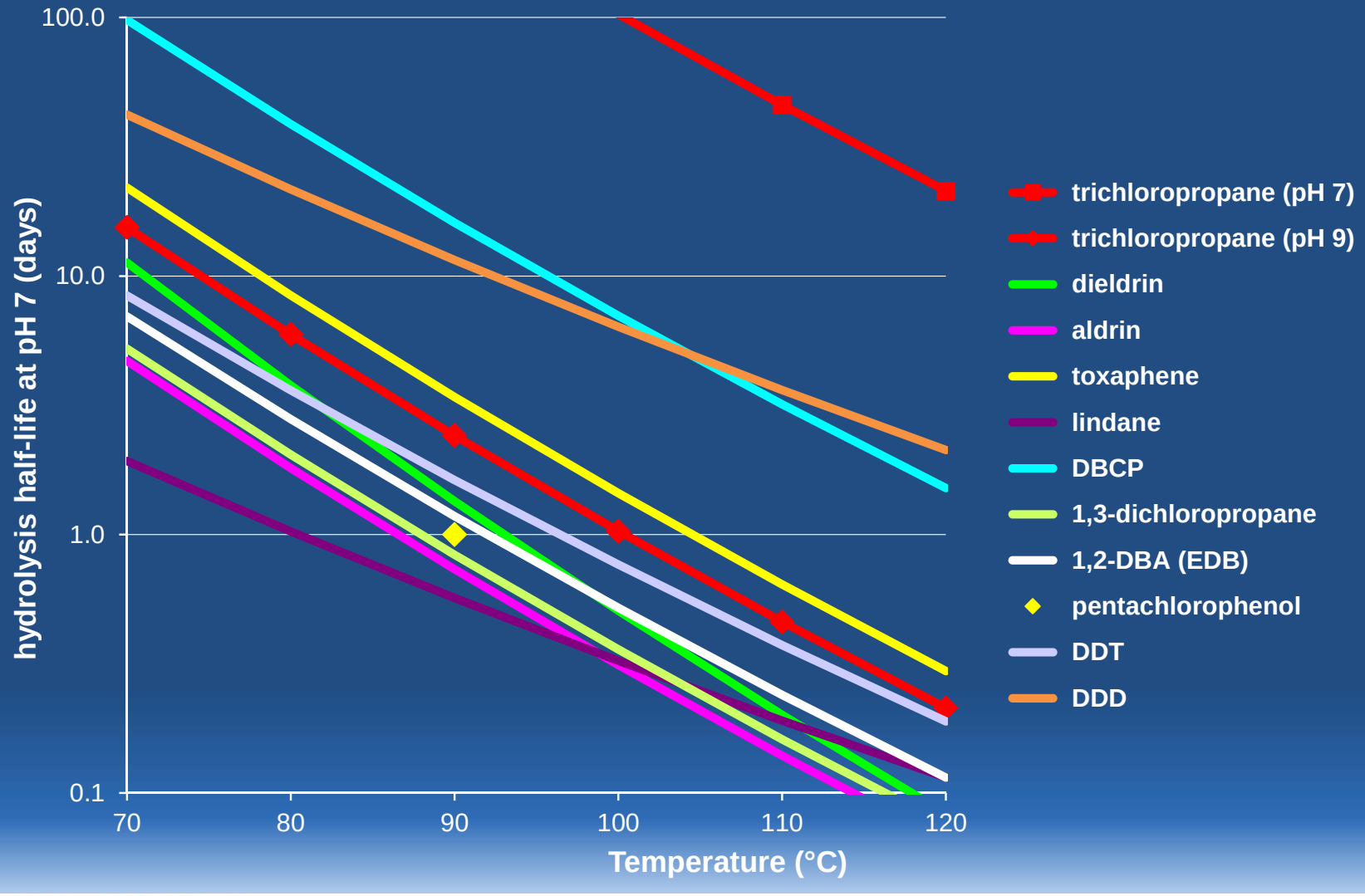
Pesticide Mechanisms

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

BEYKE CONSULTING

TRS Accelerating Value

Hydrolysis of Pesticides



BEYKE CONSULTING

TRS Accelerating Value

Hydrolysis Products

- Mostly unknown, except for fumigants
- Pesticide mechanism of action

- Toxicity reduction factor: 100-1000

BEYKE CONSULTING

TRS Accelerating Value

Vapor Protection

Probably No

- Dieldrin
- Aldrin
- Toxaphene
- Heptachlor
- Lindane
- DDT
- Pentachlorophenol

Probably Yes

- 1,2-dibromo-3-chloropropane (DBCP)
- 1,2-dichloropropane
- Ethylene dibromide (EDB)
- 1,2,3-trichloropropane

BEYKE CONSULTING

TRS Accelerating Value

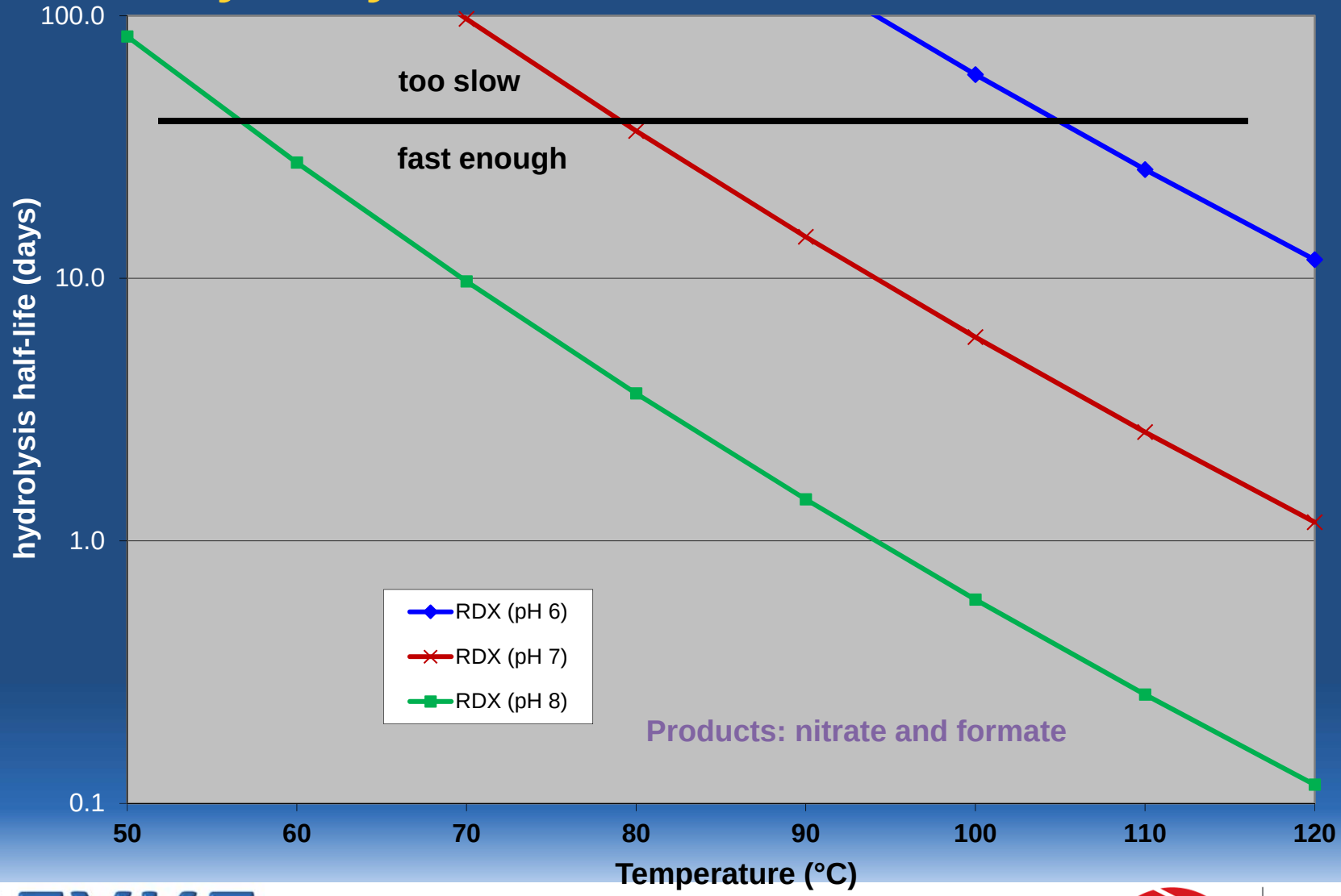
Important Explosives

- TNT
- RDX
- Composition B

BEYKE CONSULTING

TRS Accelerating Value

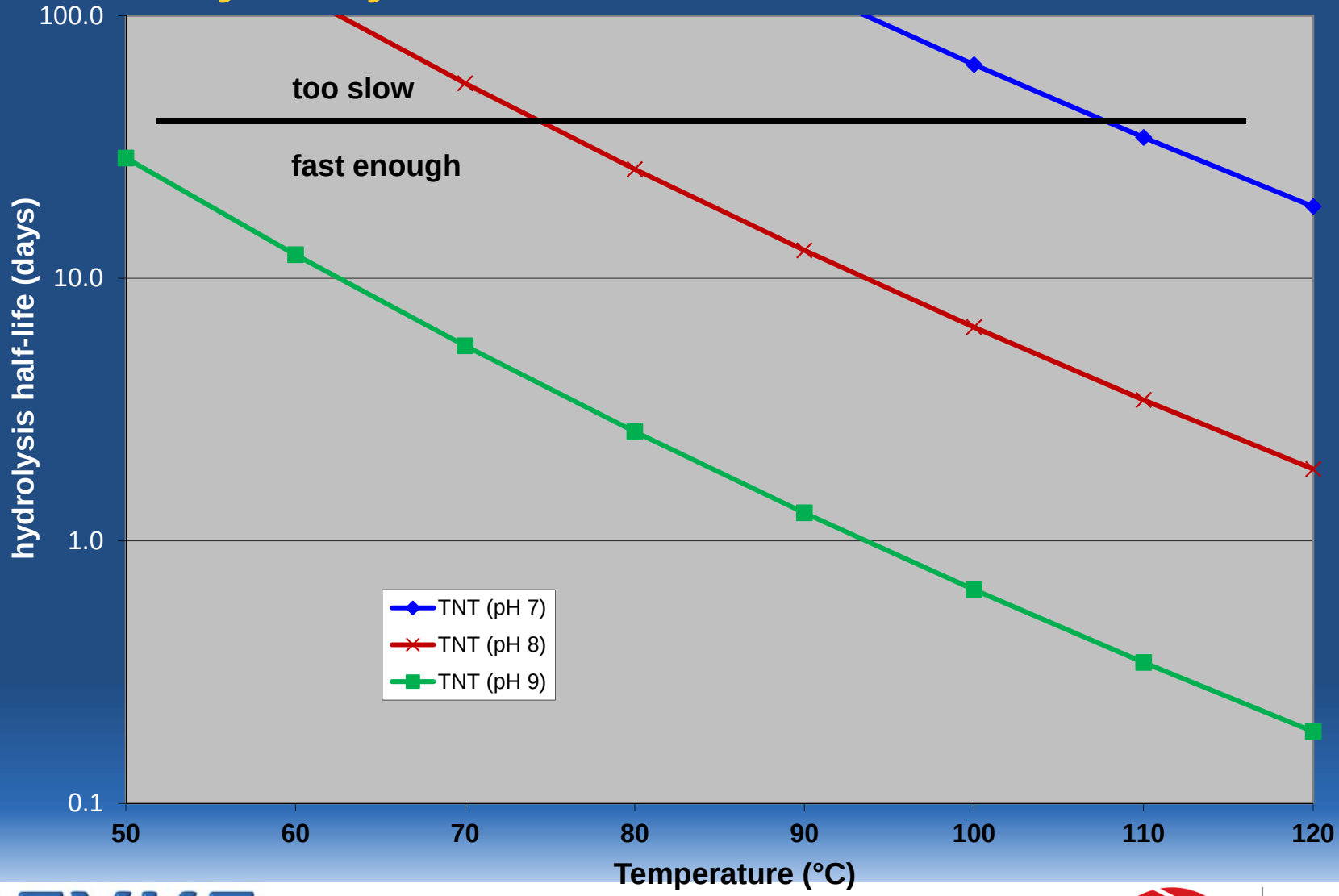
Hydrolysis of RDX



BEYKE CONSULTING

TRS Accelerating Value

Hydrolysis of TNT



BEYKE CONSULTING

TRS Accelerating Value

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.
- Pink Water

BEYKE CONSULTING

TRS Accelerating Value