



Environmental concerns in utilizing detonation as the clearance method for dumped munitions

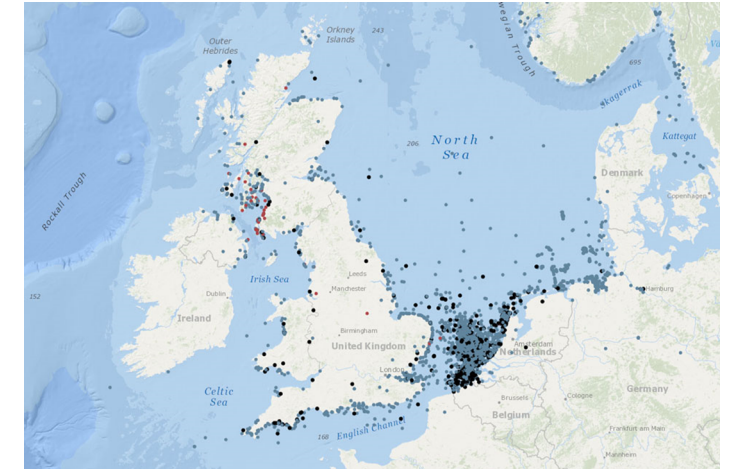
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www.cranfield.ac.uk



World War munitions in UK waters



Condition of WW I&II Munitions in sea



Aim and Objectives

Aim: Comparison of Low order and High order Detonations under semi-controlled conditions

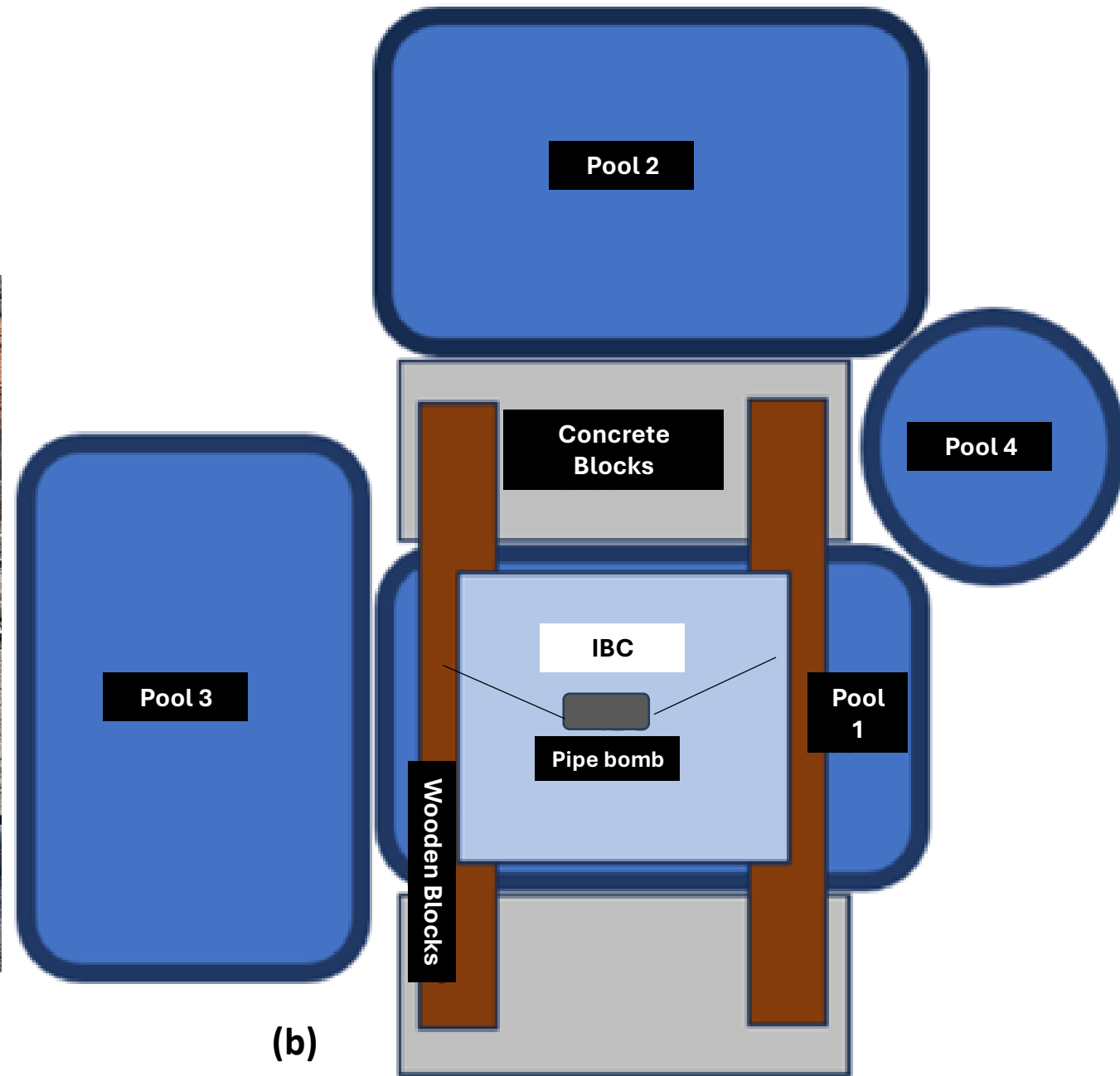
Objectives:

1. To perform the low and high order detonation in an IBC tank
2. To estimate the impact of fragmentation on the environment
3. To analyze the extent of explosive residues left post-detonations

Experimental Setup

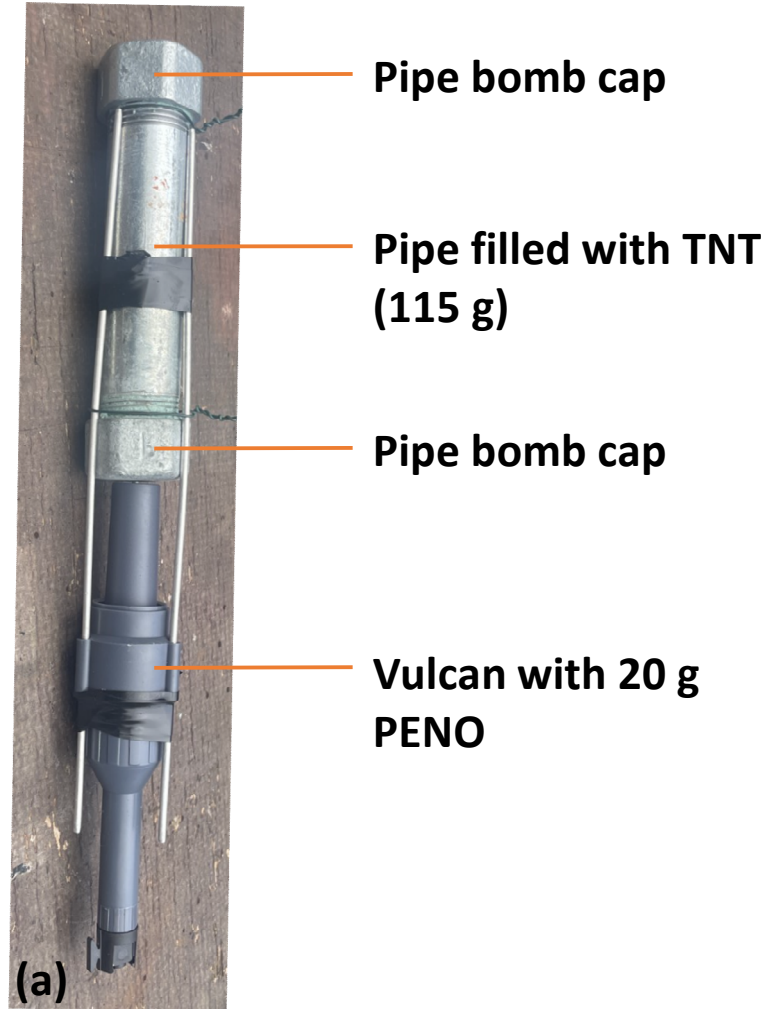


(a)

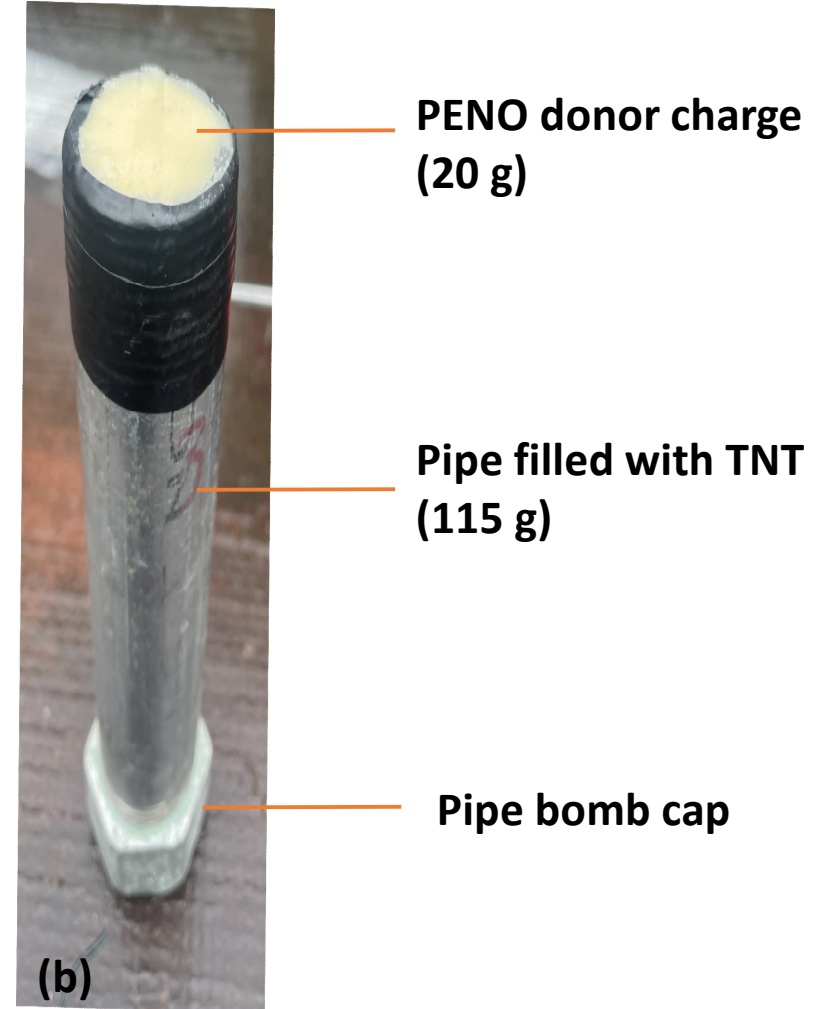


(b)

Pipe Bomb: Detonation Mechanism



LO Detonation

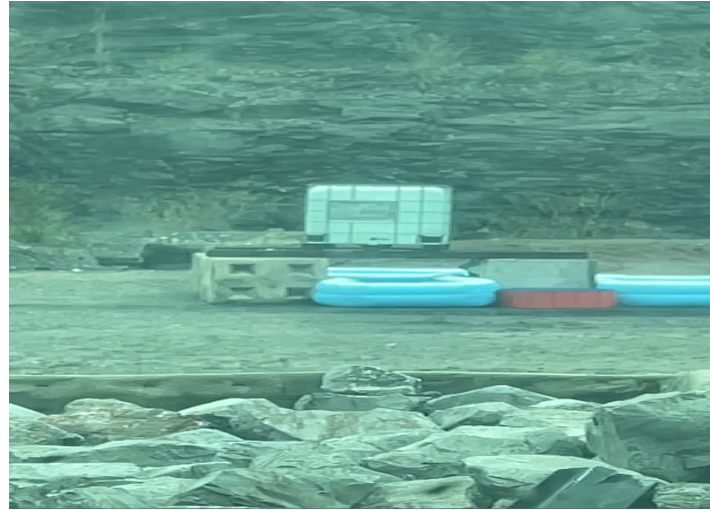


HO Detonation

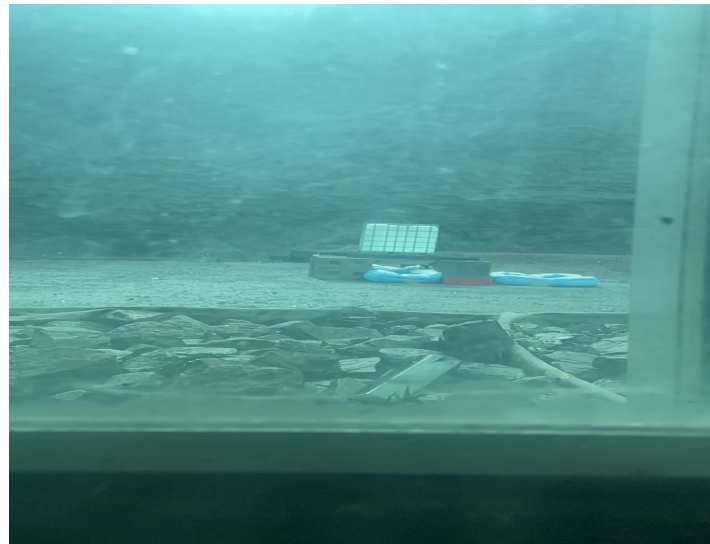
Stages and Effects of detonations



IBC Tank



LO Detonation



HO Detonation



Pushing Effect



Shattering Effect



LO Fragments

vs

HO Fragments



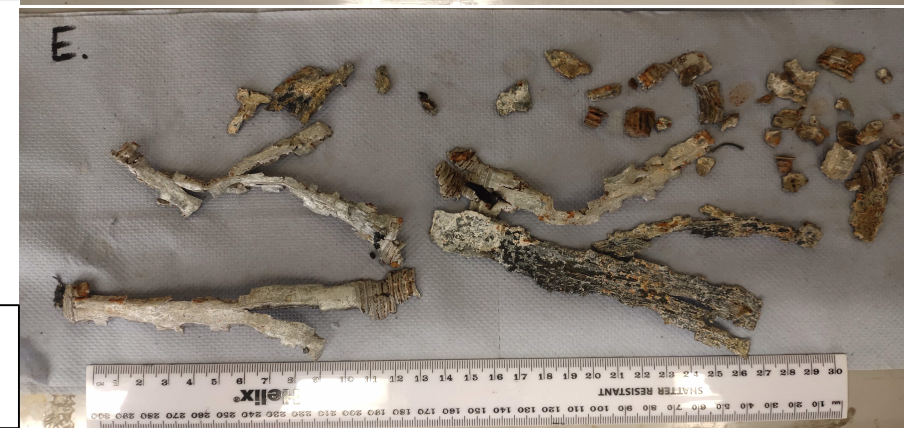
Tank: A
Weight: 471.6 g



Tank: B
Weight: 550.5 g



Tank: C
Weight: 197.6 g



Tank: D
Weight: 161.8 g

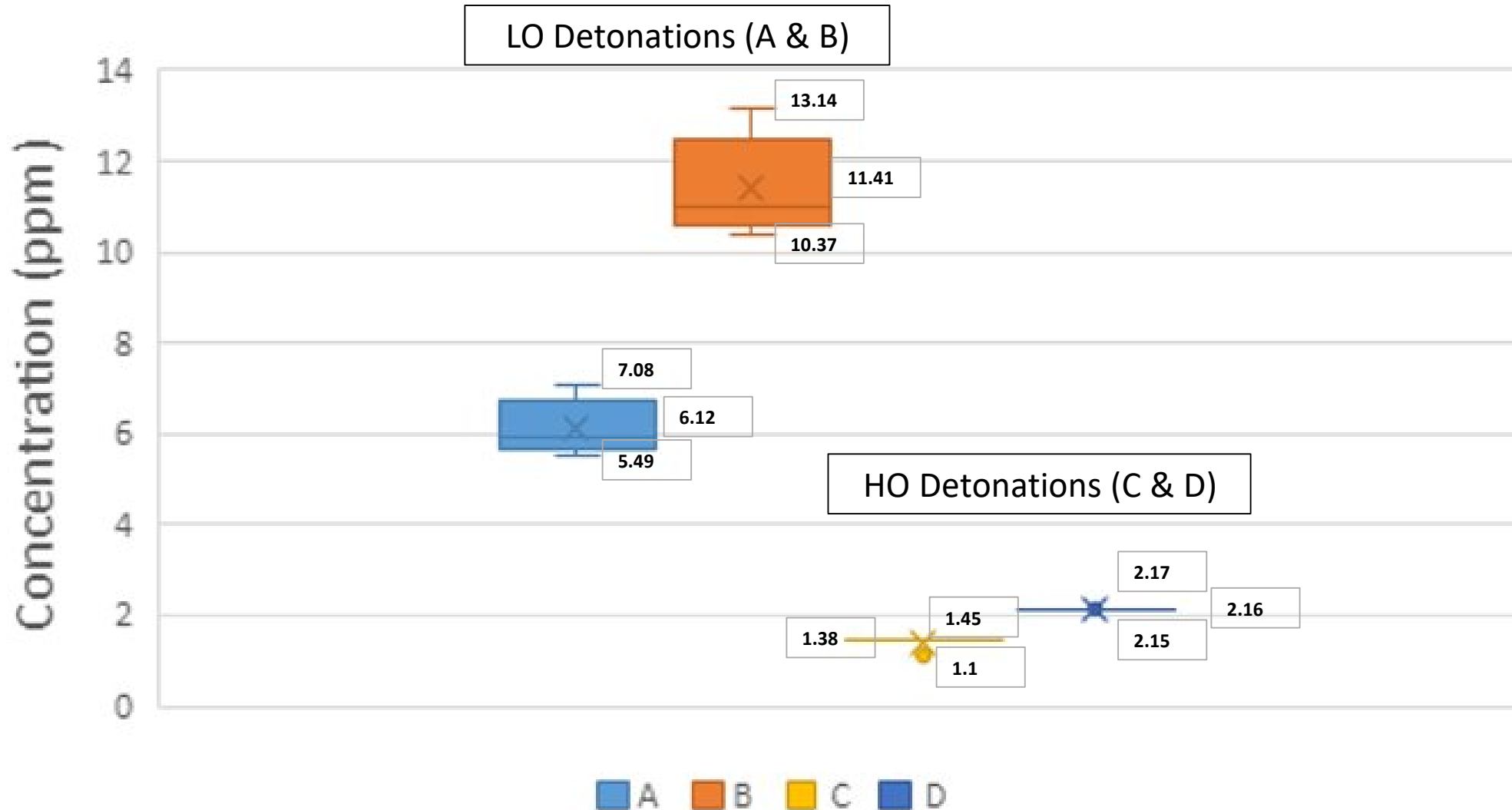
Total weight of pipe bomb: 623 g



Comparison of LO and HO Fragments

	Tank A			Tank B			Tank C		Tank D	
Fragment category	>100 (g)	10-100 (g)	<10 (g)	>100 (g)	10-100 (g)	<10 (g)	10-100 (g)	<10 (g)	10-100 (g)	<10 (g)
Number of fragments	1	6	19	1	5	30	6	57	4	43
Weight (g)	288.0	41.4	4.7	270.0	49.7	5.34	25.82	2.83	27.76	5.96
Velocity of Detonation (m/s)	449.2	1930.4	2637	473.9	1764.4	2563.3	1882.8	2573.3	1866.2	2551.4
Length (mm)	133	29.6	12.42	142	52.4	16.03	133.83	15	129	17.76
Width (mm)	104	23.83	6.1	47	22.4	8.6	13.6	12	14.25	11.95

Box plot comparing the TNT concentrations of LO & HO Detonations





Environmental Concerns

Parameters	LO	HO
Impact	Localized	Wider
Secondary Injuries from fragments	Low	High
Toxicological issues	High	Low
Noise related issues	Low	High
Suggested Solutions	Absorptive techniques	Noise abatement techniques

Thank you...



References:

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