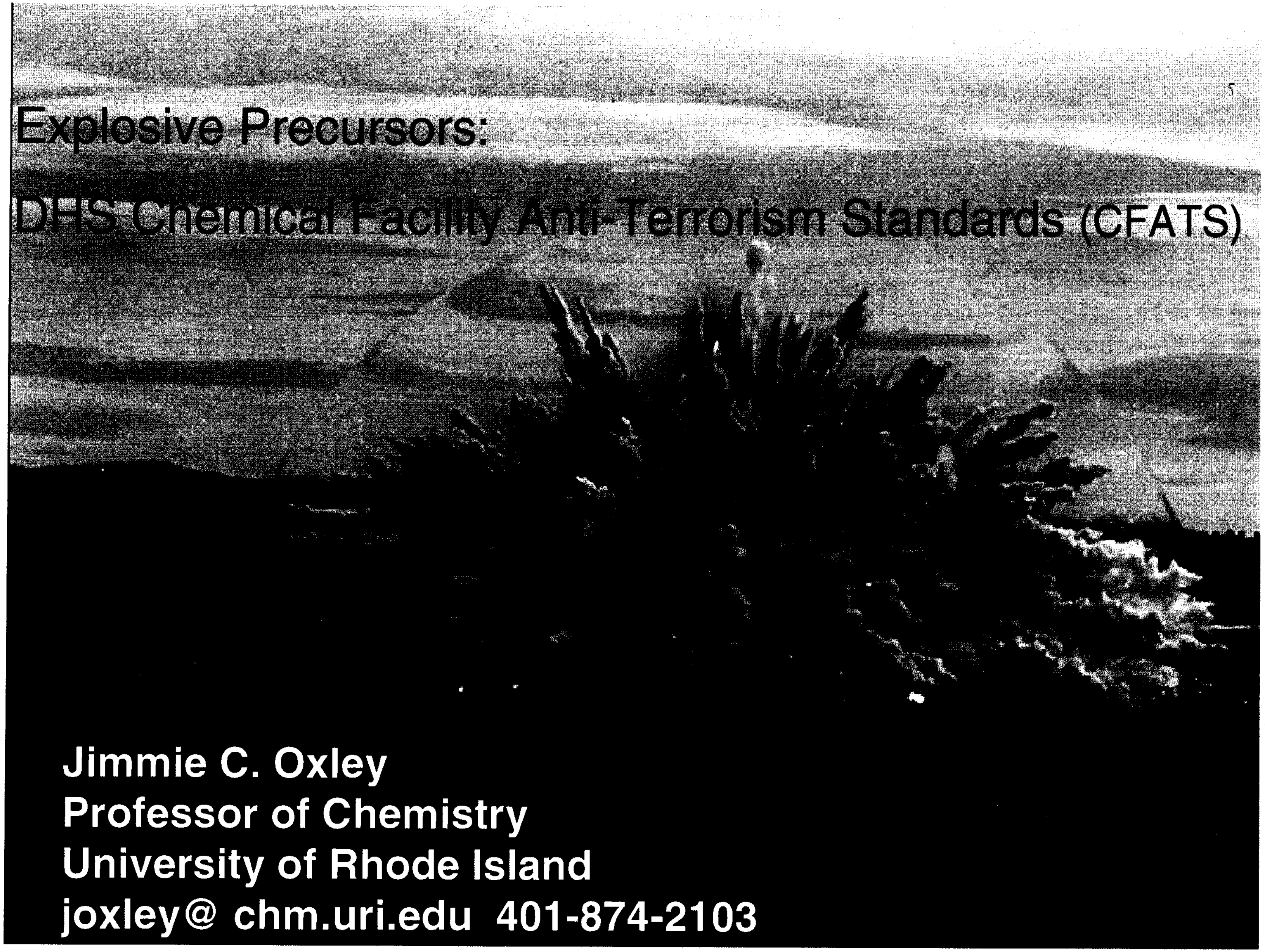

Explosive Precursors:

DHS Chemical Facility Anti-Terrorism Standards (CFATS)

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Executive Summary

Exclusion of $Ca(NO_3)_2$ from the DHS Appendix A is appropriate. It is not a threat.

The properties of K & Na nitrate are the same as Ca nitrate, and, like Ca nitrate, they should be excluded from the DHS Appendix A.

What makes detonation more deadly than a fire?

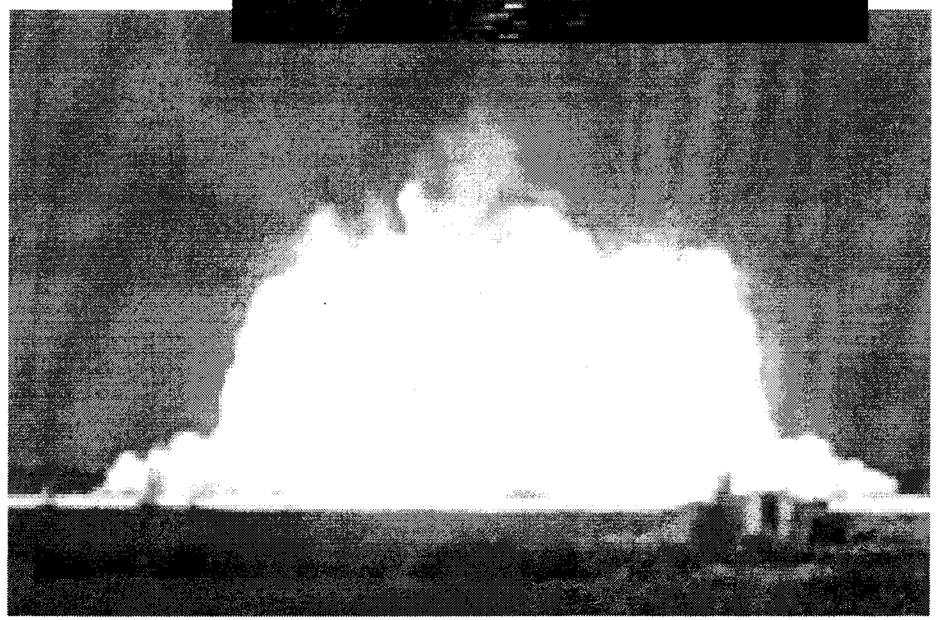
Because detonations travel at wave speed, like light or sound, large amount of explosive is forced to react in a very short time.

Energy released in burn may be greater than in detonation.

	kJ/g
Burning petroleum	50
coal	33
wood	17
Detonating Dynamite	5.4

But detonation power is in the rapidity of release.

	W/cm^2 $=J/sec\ cm^2$
Burning acetylene	10^3
Deflagrating propellant	10^6
Detonating high explosive	10^{10}



Size Matters

Size is important - especially for potential runaway reactions.

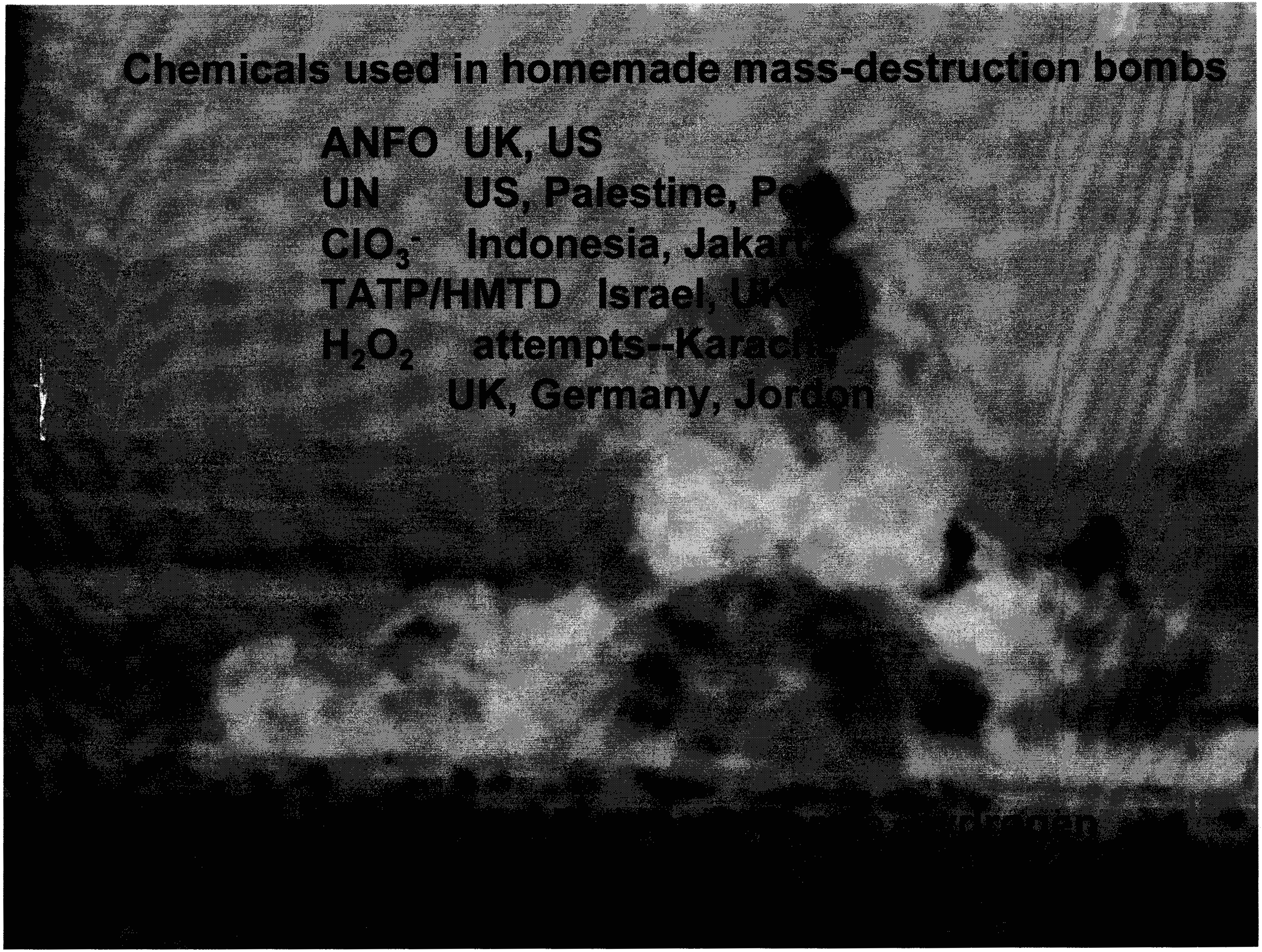
Thermal Runaway is a matter of the size of the sample. A safe temperature for a small amount of material is not necessarily a safe temperature for a large amount of material.

Initiation of detonation is a matter of the size of the sample & the booster. A sample will not detonate below its critical diameter or with insufficient boostering.

History of Use: Large-Scale Terrorist Bombings

year	location	type of explosive	injured	dead
1983	Beirut Marine & French Barracks	2 trucks, 12K lb C4?		300
1988	Pan Am 103, Lockerbie Scotland	Semtex RDX/PETN		269
1992	St Mary's Axe/Docklands, London	**1000's lb AN icing sugar**		3
1993	World Trade Center, NY	**1200 lb, urea nitrate**	~1000	6
1993	Bombay 13 car & scooter bombs	RDX?	~1200	317
1993	Bishops Gate, London	**3000 lb AN/icing sugar**	40	1
1995	Oklahoma City Federal building	**5000 lb ANFO**	~1000	168
1996	Canary Wharf/Docklands London	**3000 lb AN/icing sugar**	39	0
1996	Manchester, UK	**1000's lb AN/icing sugar**	~200	0
1996	Khobar Towers, Saudi Arabia	0.5-30 K lb C4?	372	19
1998	Kenya & Tanzania	2000 lb TNT & PETN?	1000s	224
2000	U.S.S. Cole, Yeman	1000 lb TNT?	39	17
2002	Limburg oil tanker	TNT?	12	1
2002	Bali nightclub bombs	**chlorate**	**209**	**202**
2003	Istanbul, Turkey	2 bombs	450	28
2004	Madrid subway, 10 suicide bombs	gelignite in 4 locations	~600	191
2005	London subway, 4 suicide bombs	**peroxide explosive**	~700	56
2006	Mumbai, India railroad	7 explosions	625	190

*PIRA bombs targeted economic loss rather than human loss; warnings were issued


Chemicals used in homemade mass-destruction bombs
ANFO UK, US
UN US, Palestine, Pe
ClO_3^- Indonesia, Jakar
TATP/HMTD Israel, UK
H_2O_2 attempts--Karach
UK, Germany, Jordon

Homeland Security

How Appendix A: Chemicals of Interest Was Developed

The Department of Homeland Security developed a chemicals of interest list (Appendix A) that includes chemicals that present one or more security issues.

In developing the list, the Department looked to existing expert sources of information including other federal regulations related to chemicals. Among the other sources that the Department referenced in part are the following:

- Chemicals covered under the Environmental Protection Agency's Risk Management Program;
- Chemicals included in the Chemical Weapons Convention;
- Hazardous materials, such as gases that are poisonous by inhalation; and
- Explosives regulated by the Department of Transportation.

The Department of Homeland Security has identified three security issues related to chemicals:

- **Release**—Toxic, flammable, or explosive chemicals or materials that, if released from a facility, have the potential for significant adverse consequences for human life or health.
- **Theft or Diversion**—Chemicals or materials that, if stolen or diverted, have the potential to be misused as weapons or easily converted into weapons using simple chemistry, equipment or techniques, in order to create significant adverse consequences for human life or health.
- **Sabotage or Contamination** —Chemicals or materials that, if mixed with readily available materials, have the potential to create significant adverse consequences for human life or health.

www.dhs.gov/xprevprot/programs/gc_1185909570187.shtm

Ca, K, Na nitrates not on hazard lists

KNO_3 is <u>not</u> on hazard's lists:

the EPA's Risk Management Program (RMP)

the Chemical Weapons Convention (CWC) precursors

DoT 1.1 explosives

ATF lists explosives. On the ATF list

"calcium nitrate explosive mixture

potassium nitrate explosive mixture

sodium nitrate explosive mixture

sodium nitrate-potassium nitrate explosive mixture"

Presumably that means materials that were made to be explosive or were demonstrated to be 1.1 and contain some amount of the alkali $Ca(NO_3)_2$,KNO_3 or $NaNO_3$ salt.

These salts are used in explosives to control density & adjust oxygen balance, but they cannot replace ammonium nitrate (AN).

Examining the DHS criteria

"Release" presumably is not at issue.

"Theft or diversion" ?

"Sabotage or contamination" ?

These are not an issue if the material is not or cannot be transformed into a threat.

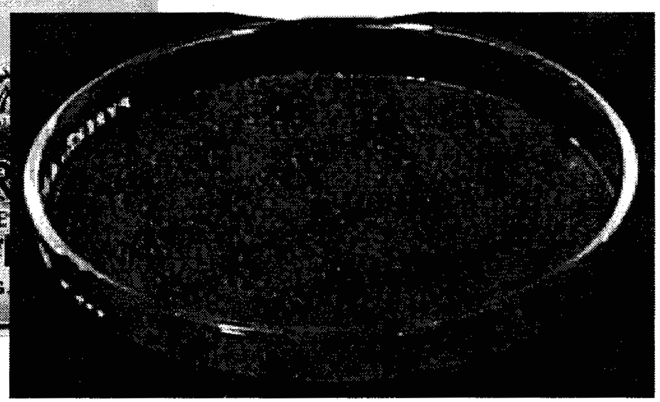
We agree that $Ca(NO_3)_2$ is not a potential threat, and DHS has rightly excluded it.

We are puzzled why KNO_3 & $NaNO_3$ are on the list.

Potential Threat

Nitrates are oxidizers, albeit weak. They can be used to make the propellant black powder. But black powder is not a threat for production of large bombs.

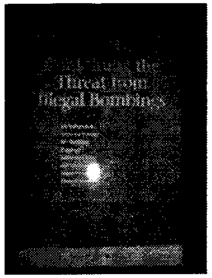
“Although **bombs made from black or smokeless powder are usually small** (… in comparison to the explosives used in …the World Trade Center and Oklahoma City bombings), they are the devices most commonly used in criminal bombings (FBI, 1997). Metal pipes are the containers used most often for effective black and smokeless powder bombs, which thus are frequently referred to as pipe bombs.” *Black and Smokeless Powders: Technologies for Finding Bombs and the Bomb Makers; NRC 1998*



74% nitrate

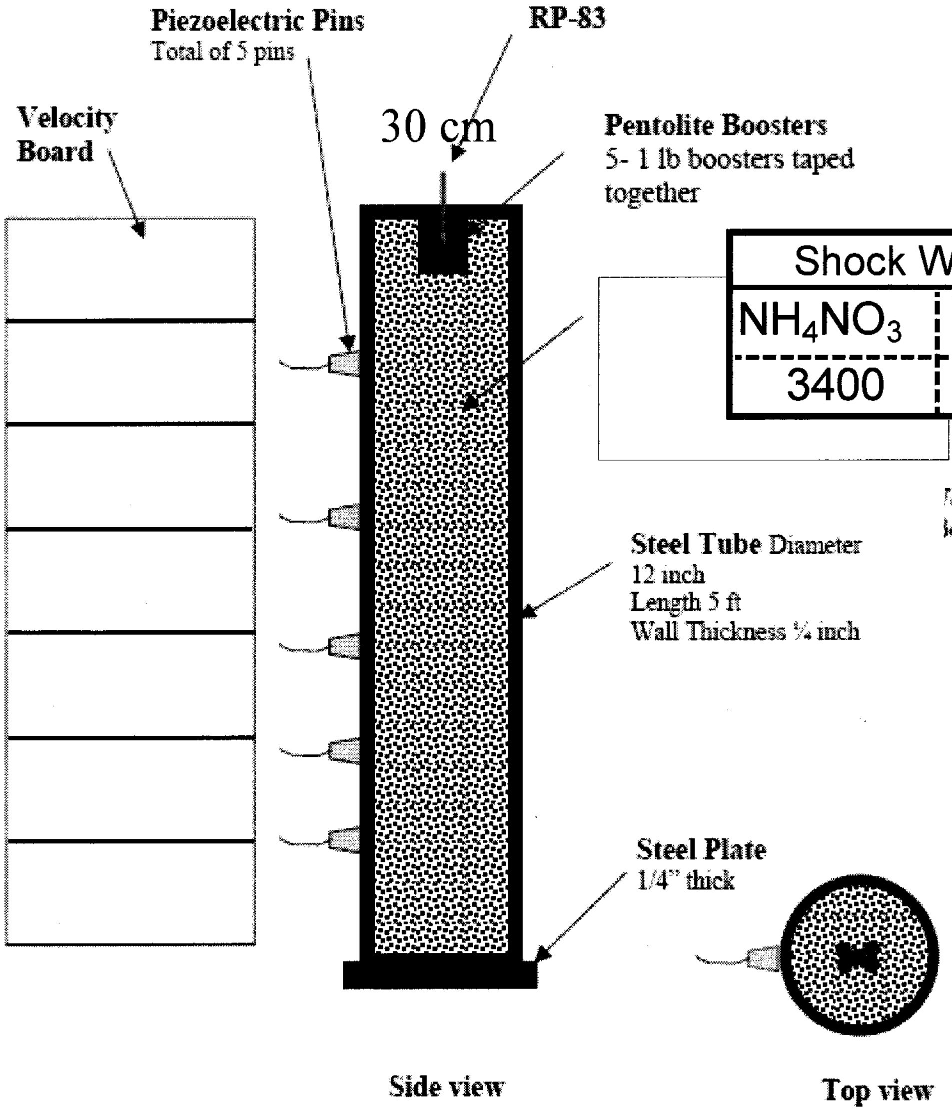
10% sulfur

16% charcoal

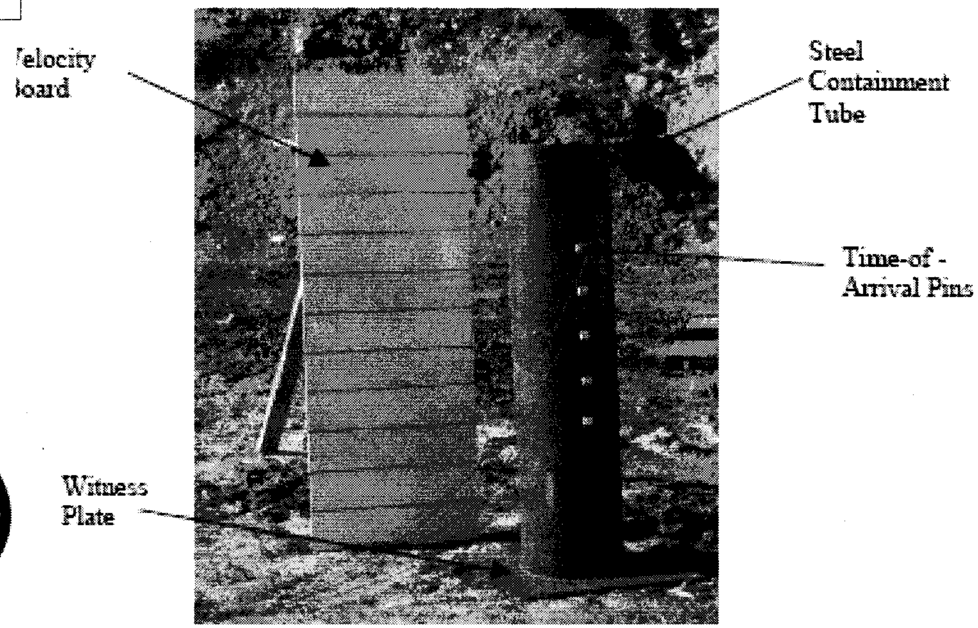


Potential Threat

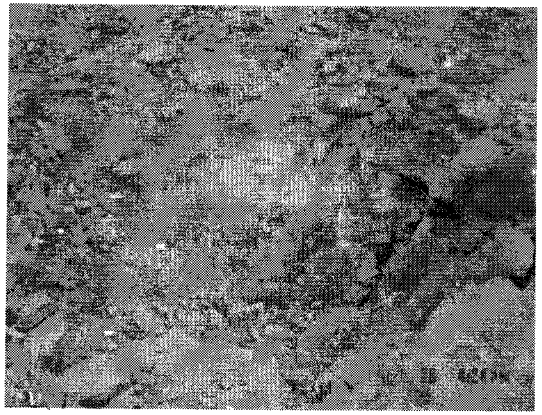
In NRC suggested detonability test (~100 kg, 220 lb) shock wave from 2.3 kg Pentolite booster did not propagate in K,Na, Ca nitrates. They did not detonate! AN did.



Shock Wave Velocity (m/s) 14" into 12" x 60" long charge				
NH_4NO_3	KNO_3	$NaNO_3$	$Ca(NO_3)_2$	
3400	1000	1200	1150	



Nitrate salts with 2% diesel fuel results of 100 kg detonability test

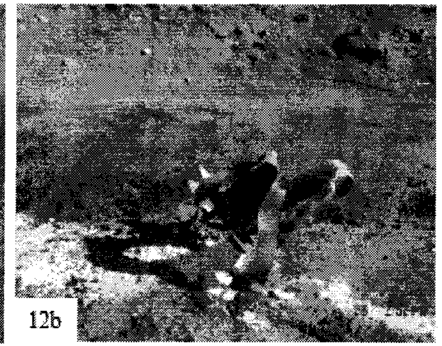


AN

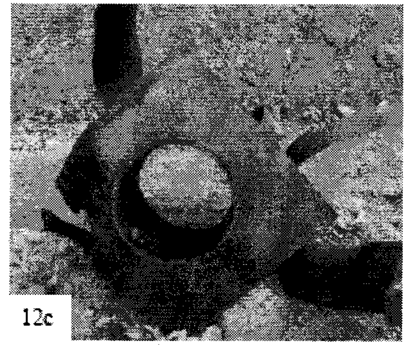
steel pipe totally fragmented

$Ca(NO_3)_2$

12a



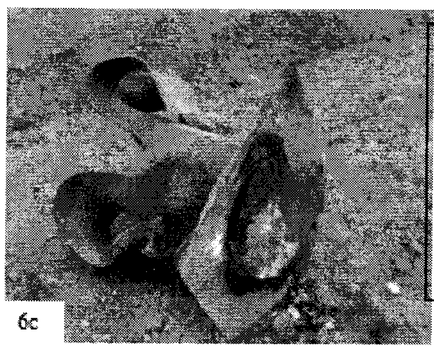
12b



12c

6a

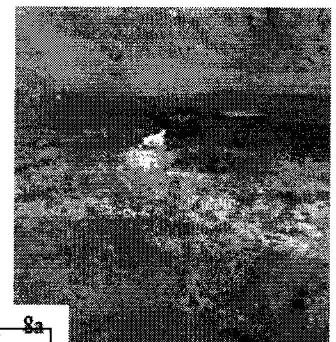
6b



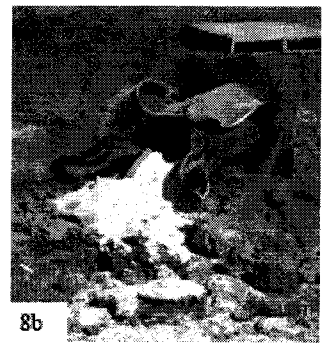
6c

KNO_3

Unreacted K & Na nitrates & unpunched witness plate show they did not detonate.



8a



8b

8c

$NaNO_3$

Chemicals used in homemade mass-destruction bombs

ANFO UK, US
UN US, Palestine, Pe
ClO_3^- Indonesia, Jakar
TATP/HMTD Israel, UK
H_2O_2 attempts--Karach
UK, Germany, Jorden

Composite explosives have low ... to mono-molecule explosives; thus, they require large ... detonate & to cause ... damage. **Only large ... should trigger**

Partial DHS List of Chemicals

	STQ, pounds
nitric acid	2000
ammonium nitrate	2000
urea	2000
sodium chlorate	2000
potassium chlorate	2000
hydrogen peroxide	>30%, 2000
potassium nitrate	2000
potassium perchlorate	2000
ammonium perchlorate	2000
nitromethane	2000
acetone	2000
dinitrotoluenes	not included
calcium hypochlorate	not included
calcium ammonium nitrate	not included
calcium nitrate	not included

Conclusions

$Ca(NO_3)_2$ is not on the DHS list, suggesting only good oxidizers were included. But KNO_3 & $NaNO_3$ are weak oxidizers, and many strong oxidizers have been ignored [$Ca(OCl)_2$].

Were KNO_3 & $NaNO_3$ included only for historical reason?

Alkali nitrate salts are not detonable compared to NH_4NO_3 and testing showed them less responsive than $Ca(NO_3)_2$.

Yet KNO_3 and $NaNO_3$ are regulated at the same threshold as AN and $Ca(NO_3)_2$. is ignored entirely.

Inclusion on the DHS list may stigmatize a chemical & flag it for other regulations. Thus, its imperative that inclusion on the list be logical and even-handed. The cost of unnecessary regulation is high—to the manufacturer & to the Nation.