



Prospective Risk Assessment and Technology Engagement in Countering Evolving Chemical, Biological, Radiological and Explosive threats

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CBRE Threat Evolution

- A war threat becoming one of great concern to homefront security
- WMD and Hazmat materials becoming equally feared as terrorist explored frightening combinations
- Increasing use of nuclear power resulting in availability of radioactive waste materials
- Homemade explosives becoming an increasing concern as tightening controls are placed on military explosives
- Novel methods of launching explosive reactions.





The Chemical Threat

- International convention and group agreements do control some key precursors for example thiodiglycol for sulphur mustard and pinacolyl alcohol for soman.
- This direct the terrorist's attention to the use of uncontrolled materials to make highly toxic compounds.
- Gaseous cyanide from cyanide salts, ferrocyanide and carbonate reactions.
- Arsine from arsenides found in pest control materials.
- Hazardous compounds taught in schools like osmium tetroxide, methyl iodide and butyric acid.



Chemical threats prioritization changes

- From CW compounds to suffocating and toxic gases like HCN, phosphine, arsine and toxic industrial gases
- Threat prioritization depends largely on vigilance of entry checks, availability in local industries and chemical suppliers, copy cat syndrome, intelligence indicating intended terrorist use and awareness of hazardous nature.

Preventive Steps

- Checkpoint check technology, education and capabilities for a changing trends of chemicals of concern
- Sensitizing suppliers to find out intended use on bulk purchase.
- A centralised technical authority to monitor changing threats and recommend technological solutions, validation of best technologies and maintaining databases for detection.

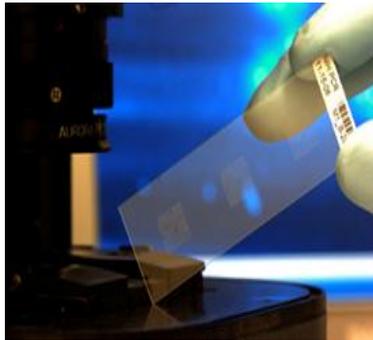


Explosive Precursor	Molecular formula	Appearance
Ammonium nitrate	NH_4NO_3	White solid 
Ammonium perchlorate	NH_4ClO_4	White granular 
Barium nitrate	$\text{Ba}(\text{NO}_3)_2$	White crystals 

Technological Approach

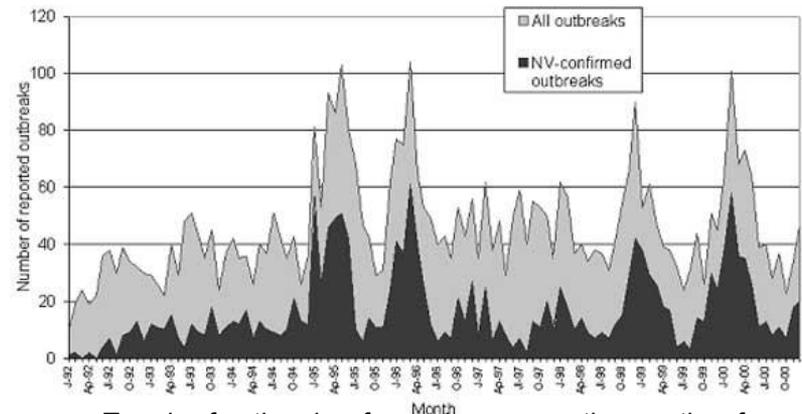


- Complimentary technologies to cover range of chemicals of concern.
- Monitoring technologies vis-à-vis technologies for checks upon suspicion
- Continuous deployment of non-intrusive detection capabilities



Biological Sabotage and Infectious Diseases Outbreaks

- Biological sabotage can be more devastating as an outbreak where there is little preparedness takes the country by surprise.
- Insufficient effective antibiotic/antiviral stockpiles and isolation facilities for human transmissible infections.
- Naturally occurring diseases can be aggravated by sabotage efforts. Phenological outbreaks can be exploited by terrorists to aggravate the outbreak through deliberate food and water borne infections for example.



Trends of outbreaks of noroviruses over the months of a year can be observed in certain countries



Full protective postures for HCWs amidst outbreak arising from a new virus

Biological Threats Assessment

- The CDC's select agent rule that places weaponizable agents with higher priority.
- Terrorist intent to use alternatives like toxins – plant and fungal.
- Should anthrax, botox and plague be at the top of the biological threat list or should it be supplemented by easily derivable toxins like amanitoxins (mushroom), ricin, abrin and alkaloid bioregulators.



Detecting A Biological Attack Fast To Minimise Impact



- Environmental background checks
- Biowatch equivalent programmes or periodic surveillance of chemical and biological profiles in key facilities?
- Key facilities to be equipped with capabilities to minimise infection risk and bio-segregation to minimise vector borne illnesses.
- Antitoxins and network of toxin experts for advise on therapy in the event of novel toxin attacks.

Reduction of Staphylococcus aureus isolation with Ionization of -5 kV



Reference:
Makela 1979

Fear Of Environmentally Persistent Radiological Threats

- **Positive development in IAEA security and safety protocols that demands tightening controls of nuclear materials.**
- **Increasing use of nuclear power and fear of nuclear waste going into hands of the terrorists.**
- **Relative ease of dispersing radioactive compounds with explosives as the substances are inert to destruction by explosive effects.**

Radiological Scanning To Prevent Ilegitimate Entry

- Integrated cargo inspection system using gamma imaging and radioactivity detection.
- Sensitive detection technologies for shielded materials in suspicious cargoes.



Knowing the weak points and closing the gaps

- Domestic controls on site, storage and worker requirement.
- Option to have environmental surveillance capabilities and air sampling and radioactive scintillation analysis undertaken to detect even gradual rise in environmental signatures.

Emergence Of New Explosive Threats

- Liquid explosives from sensitizable liquids formulations for example, nitromethane, hydrazine and hexamine solutions.
- Nitrate explosives in fuel oil.
- Incendiary and thermite reactions in the launching of explosions amidst better technologies to detect detonation devices.

Video On Thermite Induced Explosions of TATP



Video On Thermite Induced Explosions of TATP And TNT

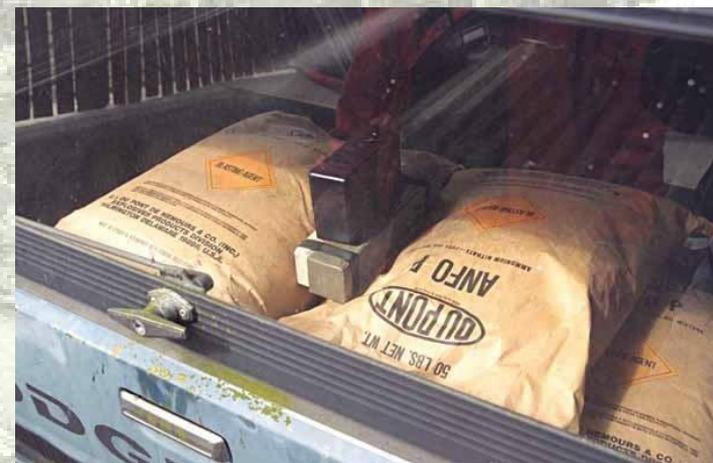


Controlling key precursors of homemade explosives

- 30% and above of hydrogen peroxide formulations may need monitoring and control as it is a key precursor for TATP.
- Ammonium nitrate prills in pure form is the key ingredient to ANFO.
- 200 ml of nitroglycerine was enough to rip off the floor of an aircraft in a terrorist operation in the Philippines.
- To minimise threats to aviation, high throughput scanning capabilities for threshold amounts must be put in place for example X-ray technologies that can pick up 200 ml or 300 grams of explosives which may be disruptive or destructive to flights.



The impact of 200 ml of nitroglycerine on the floor of the aircraft



Field Deployable Technologies At Checkpoints And Response Missions

- Complimentary technologies based on ion mobility and infrared to detect solid and liquid explosives in purer and adulterated forms.



Remote detector for NO signatures from explosives



Putting explosive detectors on spreaders for cargoes

Containment Technologies To Minimise Effects

- Blast guard and blast wrap to contain explosions.
- Research and development into chemical mitigation methods.
- Blast protection outreach programmes for building developers



There is potential of shock absorbent materials to be made into covers for large explosive devices

Conclusion

- **Prospective risk assessment is indispensable in a pre-emptive approach to tackling a fluid terrorist threat in CBRE.**
- **It needs to be undertaken hand in hand with a proactive technology assessment, validation and operationalisation programme to ensure timely deployment of the best and most suitable suite of technologies to deal with the changing threats.**