REDUCING THE THREAT OF IMPROVISED EXPLOSIVE DEVICE ATTACKS BY RESTRICTING ACCESS TO EXPLOSIVE PRECURSOR CHEMICALS

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Background

- Terrorists and other malicious actors employ large- and small-scale IEDs
  - Vehicle-borne IEDs (VBIEDs): ~40-10,000(s) lbs.
  - Person-borne IEDs (PBIEDs): ~1-40 lbs.
- Materials, devices, and instructions for producing IEDs are highly accessible
- Recent IED attacks in Boston, Paris, Brussels, New York, Manchester, and Sri Lanka - demonstrate the ongoing threat
- Proposed Ammonium Nitrate Security Program (ANSP) focuses on just one of many precursor chemicals, other policy options merit consideration

Event Location	Main Charge	Mass (lb)*
1970-Sterling Hall Bombing (Madison, WI) #	ANFO	2,000
1983-Beirut Barracks Bombing (Beirut, Lebanon)	PETN	20,000
1983-US Embassy Bombings (Beirut, Lebanon) %	ANFO	2,000
1992-St. Mary Axe Bombing (London, United Kingdom) #	CAN/IS	2,000
1993-World Trade Center Bombing (New York, NY) #	Urea Nitrate	1,200
1993-Bishopsgate Bombing (London, United Kingdom) #	CAN/IS	4,000
1995-Oklahoma City Bombing (Oklahoma City, OK) #	AN/NM	5,000
1996-Manchester Shopping Mall (Manchester, United Kingdom) #	CAN/IS	3,000
1996-South Quay Bombing (London, United Kingdom) #	CAN/IS	3,000
1996-Khobar Towers Bombing (Khobar, Saudi Arabia)	C4	20,000
1998-US Embassy Bombings (Tanzania, Kenya)	TNT	2,000
1999-Millennial Bomber Interdiction (Port Angeles, WA) #	Urea Nitrate	500
2000-USS Cole Bombing (Aden, Yemen)	Mil. Exp.	1,000
2001-Shoe Bomber (AA Flight 63)	PETN	1
2002-Bali Nightclub Bombing (Bali, Indonesia) #	$KClO_3$/S/Al	2,000
2003-Marriott Hotel Jakarta Bombing (Jakarta, Indonesia) #	$KClO_3$/S/Al	100
2003-Britsh Consulate Bombing (Istanbul, Turkey) #	AN/Al	2,000
2003-Casablanca Bombings (Casablanca, Morocco) #	TATP/AN	20
2004-Australian Embassy Attack (Jakarta, Indonesia) #	$KClO_3$/S/Al	2,000
2004-US Consulate Failed Attack (Karachi, Pakistan) #	CHP/Flour	2,000
2004-Distrupted Jordanian Attack (Amman, Jordan) #	CHP/Cumin	10,000
2004-US Embassy Attack (Tashkent, Uzbekistan) #	AN/Al	20
2004-Madrid Train Bombings (Madrid, Spain)	Dynamite	20
2005-7/7 Underground Bombing (London, United Kingdom) #	CHP/Black Pepper	20
2005-7/21 Bombing (London, United Kingdom) #	CHP/Flour	20
2006-Operation Overt (London, United Kingdom) #	CHP/Tang	1
2006-Disrupted Plot (Ontario, Canada) #	ANFO	7,000
2007-Disrupted Bomb (Ramstein, Germany) #	CHP/Flour	1,000
2008-US Empassy Attack (Sana'a, Yemen)	TNT	100
2009-Underwear Bomber (NWA Flight 253)	PETN	1
2009-Operation Highrise Interdiction (Denver, CO/New York, NY) #	CHP/Flour	10
2010-Printer Bombs (United Kingdom, United Arab Emirates)	PETN	1
2010-Failed Times Square Plot (New York, NY) #	AN/IS/Sawdust	100
2011-Khalid Ali-M Aldawsari Plot (Lubbock, TX) #	Picric Acid	20
2011-Oslo Bombing (Oslo, Norway) #	ANFO/CAN/Al/MB	2,000
2012-Aurora Theater Shooting (Aurora, CO)	BP	20
2013-Boston Marathon Bombings (Boston, MA)	Pyrotechnic Filler	20
2015-Paris Attacks (Paris, France) #	TATP	20
2016-Brussels Attacks (Brussels, Belgium) #	TATP	40
2016-Ahmad Khan Rahami (New York/New Jersey) %	AN ET/BP/HMTD	10
2017-Concert Bombing (Manchester, United Kingdom)	TATP	

*Upper limit of charge mass.
NOTE: AN: ammonium nitrate, ANFO: ammonium nitrate/fuel oil, BP: black powder, CAN: calcium ammonium nitrate, CHP: concentrated hydrogen peroxide, HMTD: hexamethylene triperoxide diamine, IS: icing sugar, NM: nitromethane, PETN: pentaerythritol tetranitrate, TATP: triacetone triperoxide, TNT: trinitrotoluene.
Gray (#): event involving precursor chemicals. White: event using commercial or military explosives. Black (%): event with ambiguous sources.

NAS Areas of Study

1. Review literature and data, both domestic and international, to identify and list chemicals that have been used or are susceptible to use in IEDs, either in U.S. or internationally

2. Analyze movement of chemicals through commercial supply chains and assess vulnerabilities and weaknesses of supply chains with respect to misappropriation

3. Use information obtained in Steps 1 and 2 to develop priority ranking of chemicals to consider for control

4. Describe and assess existing control measures, both in U.S. and internationally, for priority chemicals

5. Suggest controls that might be effective for voluntary or regulatory strategy and discuss security, economic, and other tradeoffs

Precursor Chemicals

Synthesis Chemicals

Acetone
Aspirin
Erythritol
Ethylene Glycol
Glycerol
Hexamine
Hydrazine
Mannitol
Methanol
MEK
Pentaerythritol
Phenol
Sodium Azide
Urea
UAN Solution

Strong Acids

Sulfuric Acid
Hydrochloric Acid
Nitric Acid

Weak Acids

Citric Acid
Acetic Acid
Ascorbic Acid

Oxidizers

Hypochlorite Salts (Ca^{2+}/Na^{+})
Chlorate Salts (Na^{+}/K^{+})
Hydrogen Peroxide
Metal Peroxides (Ba^{2+}/Na^{+})
Nitrate Salts ($Ca^{2+}/Na^{+}/NH_4^{+}/K^{+}$)
Nitrite Salts (Na^{+}/K^{+})
Perchloric Acid
Perchlorate Salts ($Na^{+}/NH_4^{+}/K^{+}$)
Potassium Permanganate

Fuels

Organic Materials

Diesel
Kerosene
Mineral Oil
Motor Oil
Sawdust
Vaseline

Inorganic Materials

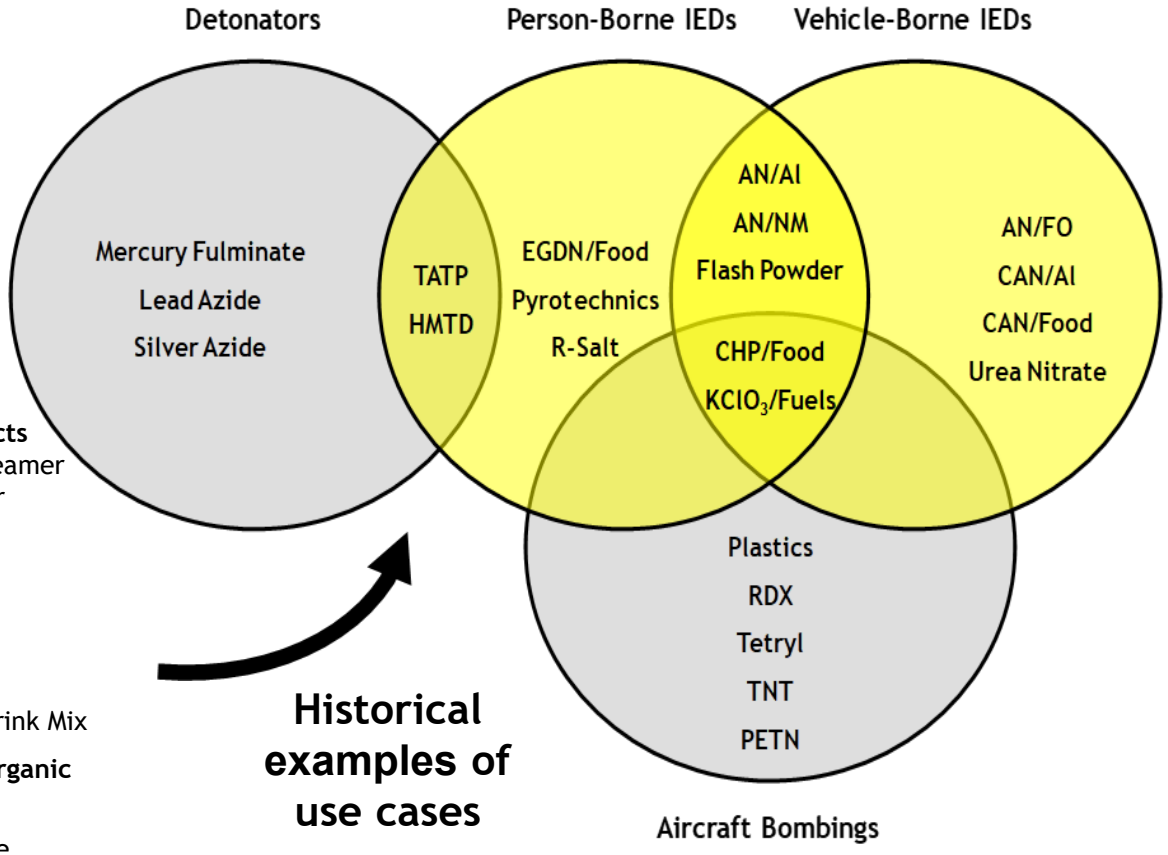
Aluminum Powder
Aluminum Paste
Antimony Trisulfide
Charcoal
Magnalium Powder
Magnesium Powder
Red Phosphorus
Sulfur
Titanium Powder
Zinc Powder

Food Products

Artificial Creamer
Black Pepper
Black Seed
Cinnamon
Cocoa
Flour
Honey
Icing Sugar
Powdered Drink Mix

Energetic Organic Compounds

Nitrobenzene
Nitromethane



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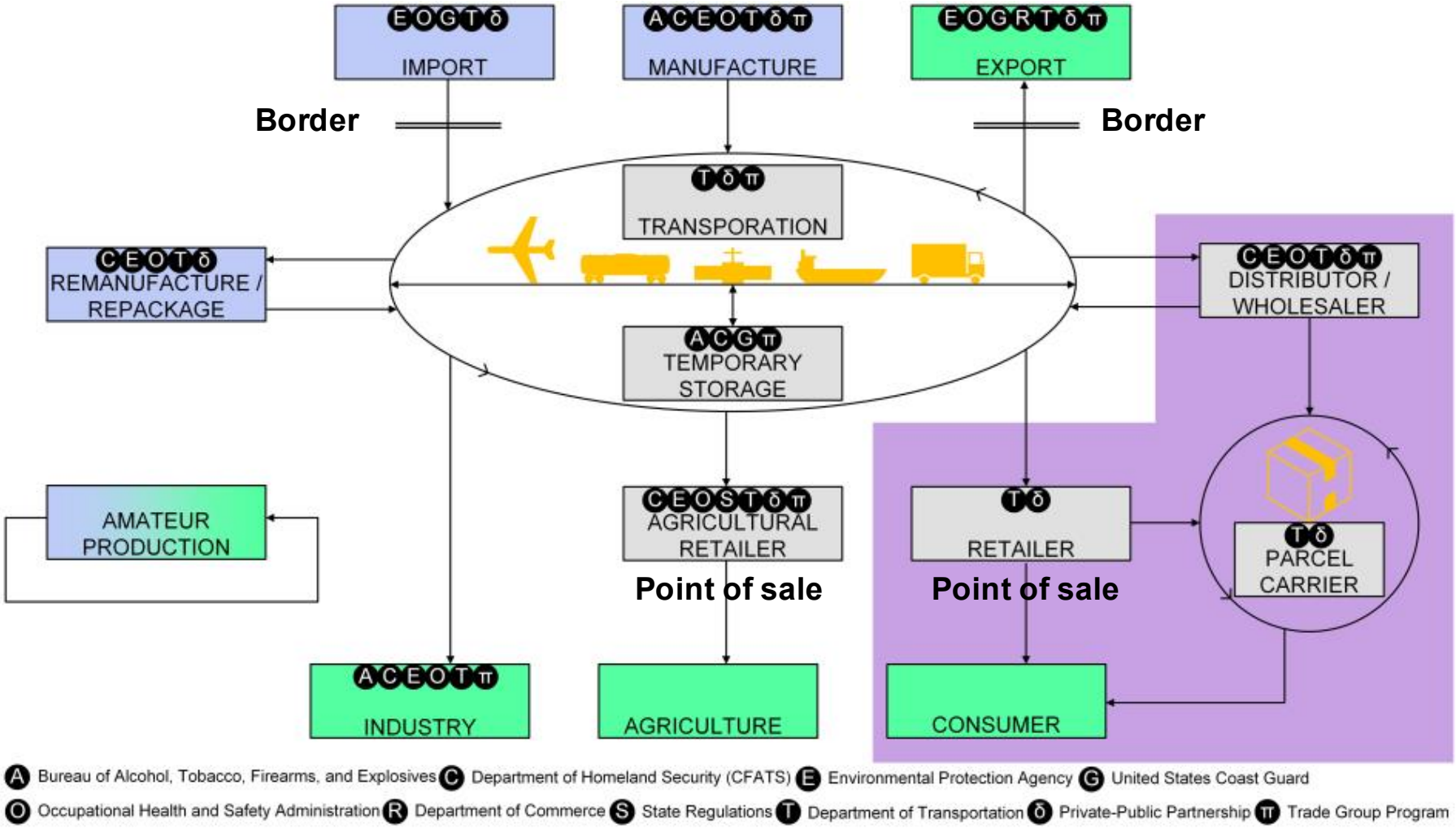
NAS Study Results

- Eliminated some precursor chemicals on basis of amounts of use and ubiquity
- Ranked remaining 28 precursor chemicals on basis of three criteria
  - Utility in VBIEDs and/or PBIEDs (V/P, V, or P)
  - History of prior use (Yes (Y), No (N))
  - Role in synthesis (Independent (I), Dependent (D))
- Assigned chemicals to Group A, B, or C
  - Precursor chemicals in Group A generally satisfy all three criteria (V/P, Y, I) and pose most immediate threat
  - Evolving threat environment could elevate status of chemicals in Groups B and C

		Charge Size	Prior Use	Dependency
Group A	Aluminum (powder, paste, flake)	V/P	Y	I
	Ammonium nitrate	V/P	Y	I
	Calcium ammonium nitrate	V/P	Y	I
	Hydrogen peroxide	V/P	Y	I
	Nitric acid	V/P	Y	I
	Nitromethane	V/P	Y	I
	Potassium chlorate	V/P	Y	I
	Potassium perchlorate	V/P	Y	I
	Sodium chlorate	V/P	Y	I
	Urea ammonium nitrate solution	V/P	N*	I
Group B	Calcium nitrate	V/P	N	I
	Hydrochloric acid	V/P	N	I
	Potassium nitrate	V/P	N	I
	Potassium permanganate	P	Y	I
	Sodium nitrate	V/P	N	I
	Sodium nitrite	P	Y	I
	Sulfur	V/P	N	I
	Sulfuric acid	V/P	Y	D
	Urea	V/P	Y	D
	Zinc (powder)	P	Y	I
Group C	Ammonium perchlorate	P	N	I
	Antimony trisulfide	P	N	I
	Hexamine	P	Y	D
	Magnalium (powder)	P	N	I
	Magnesium (powder)	P	N	I
	Pentaerythritol	P	Y	D
	Phenol	P	Y	D
	Potassium nitrite	P	N	I

Mapped Policy Mechanisms



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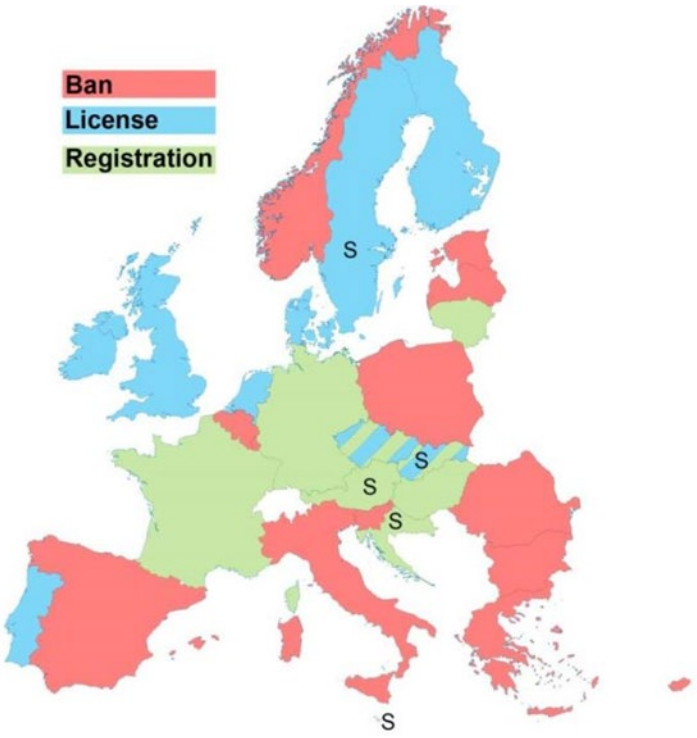
Drawing on Insight from Others' Experience



Implementation of Regulation 98/2013 by country. S: the country licenses or registers a subset of the precursor list.

- EU has implemented controls on general public's possession and use of "restricted explosive precursors"
- Controls consist of restricting access for the general public (e.g. via licensing/permitting) at the member state's discretion
  - 16 have adopted licensing/registries
  - 12 have continued to restrict access
- EU has actively engaged industry and other stakeholders to assist with implementation
  - Training materials and outreach
  - Regional meetings
  - Mystery shopping provides feedback
- EU reports improvements in security at some cost to industry and end users, along with concerns about coordination, coverage, and e-commerce

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NAS Options for Retail-Level Control Strategies

- Consisting of different combinations of voluntary and regulatory programs, featuring either
  - Restricted access for personal use via licensing/permitting:
  - Licensing; and/or
  - Registry (ID and signature); or
  - Business as usual (BAU)

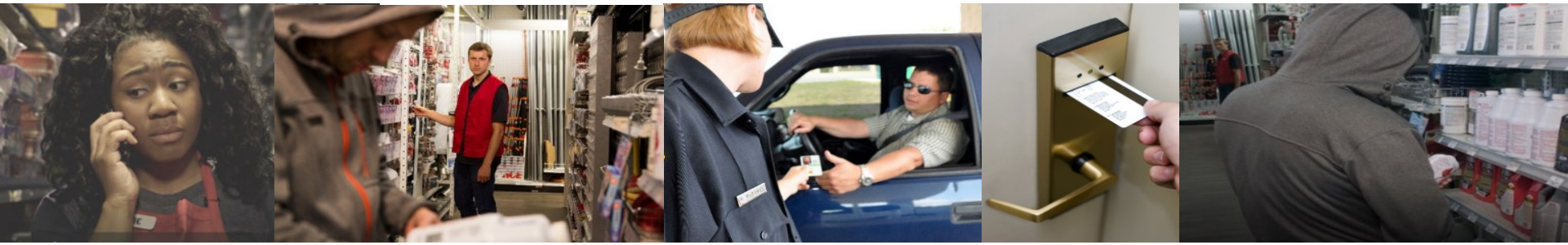
+ other measures and activities, such as outreach, training, reporting, etc.

- Exempting commercial end-users with evidence of commercial status, which might require new credential

Strategies might also include right to refuse sales under suspicious circumstances

NAS: Key Recommendations

- Combat both Small and Large IEDs
- Consider Multiple Chemicals
- Focus on Retail-Level Access
- Explore Opportunities to Harmonize Oversight of Kits for Making Explosive Targets
- Analyze Specific Provisions for Strategies
- Provide Additional Support for Voluntary Programs



Stakeholder Engagement

- Engagement Stats
  - 7 in-person meetings and 2 webinars
  - 100+ attended in-person
  - Invited trade associations and the sector councils involved in the sale of EPCs
- Trends
  - This is a very complex problem to address
  - Need to more fully engage retail industry
  - E-commerce is a critical gap
  - Need clarification on what EPCs would be covered
  - Lean toward a light regulatory approach (i.e., Sudafed)
  - Agree that a strong voluntary component to the framework is essential
  - Extensive outreach and training would be essential
  - Recognition and reporting of suspicious transactions is key
  - Leverage existing industry stewardship programs

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