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Nuclear Terrorism: target, consequences and threats

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International Atomic Energy Agency

Nuclear Terrorism: Targets, Consequences and Threats

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The four concerns of nuclear terrorism

- **Theft of nuclear weapon**
- **Theft of nuclear material to make improvised nuclear explosive device IND**
- **Theft of other radioactive material for RDD or RED**
- **Sabotage of facility or transport**

Interrelations in nuclear security

NUCLEAR SECURITY REGIME

Conventions
Laws/Penal codes
Regulations
Regulatory bodies
Enforcement
Export/Import
Threat assessment
Trustworthiness
Confidentiality
Accounting and control
Physical Protection
Detection/response
Deterrence
Coordination
Security culture

TARGETS for CONSEQUENCES

Nuclear weapons
Nuclear material
Radioactive material
Facilities
Transports
Transits
Technology
Cyberspace
Sensitive information
Industrial network at facility
National/interdepartmental secure networks
- and others

THREAT INDICATORS

Terrorist organizations
Criminal organizations
Terrorist and criminal acts (murders, robberies, thefts, arson, kidnappings, past nuclear facilities incidents, airplane hijackings, drug production, smuggling of drugs and weapons)
Political and economic instability, unemployment, social insecurity, corruption
Civil wars, religious tensions
Extremes wealth-poverty
National/ international cybercrime activities and/or abilities
- and others

Inventories – facilities and materials potential targets

> 25.000 nuclear weapons

>3.000 tons civil and military HEU and Pu

>676 research reactors (237 in operation,<100 with HEU)

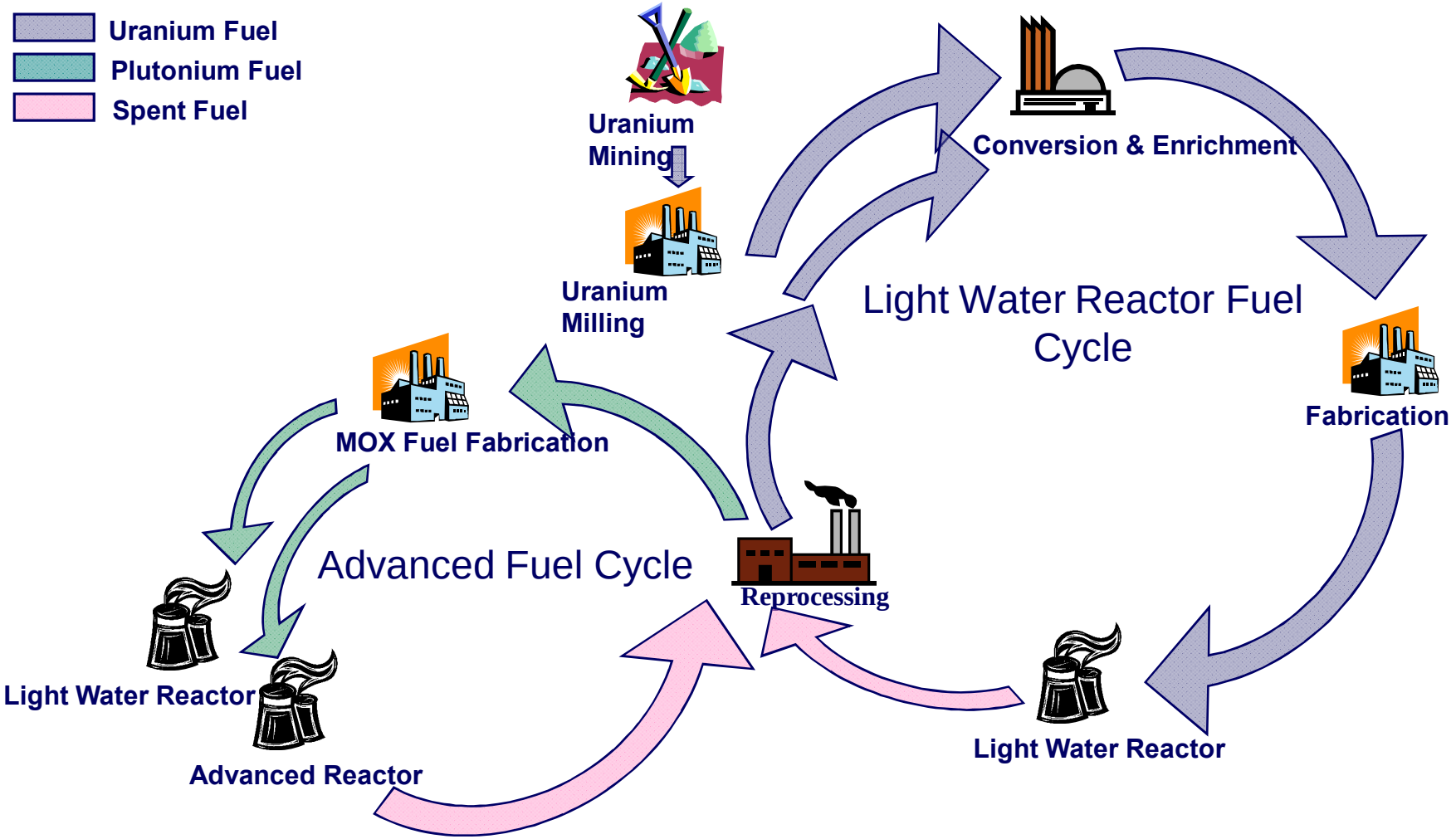
>100 fuel cycle facilities

>440 operating nuclear power plants

> 100.000 Cat I and II radioactive sources

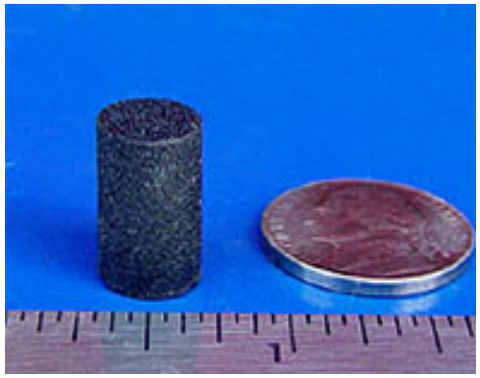
> 1.000.000 Cat III radioactive sources

Fuel Cycle Overview



What are the materials?

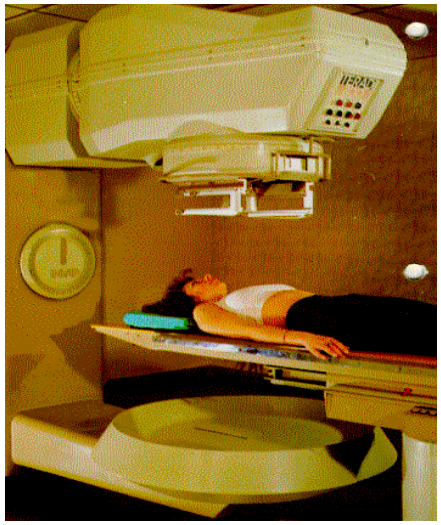
Nuclear materials (uranium, plutonium and thorium in different forms)



Radioactive sources

Radioactively contaminated materials

Widespread uses



Medicine

Industry

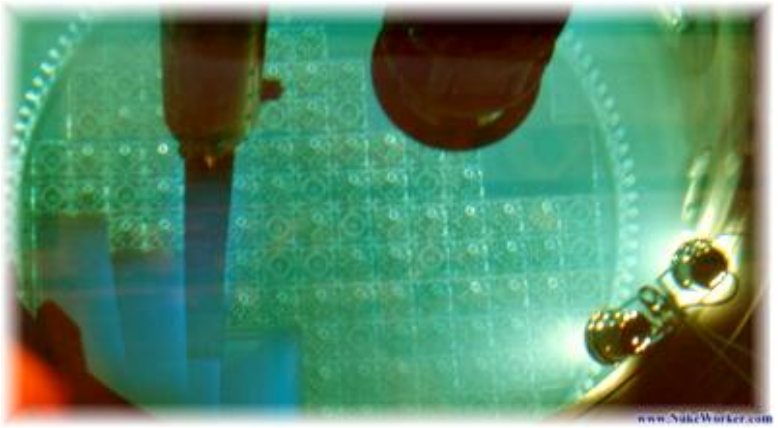
Nuclear energy

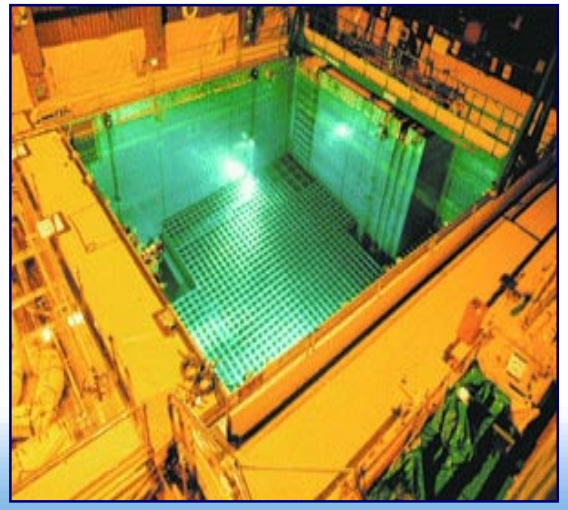
Research

Research reactors

Storage and disposal

Nuclear Power Plants





Milling, Enrichment and Reprocessing Facilities

Targets

- Nuclear or other radioactive materials
- Nuclear facilities, radiation facilities

  and also

- Population
- Critical facilities / infrastructure

Examples of Undesired Consequences

- Loss of Life/Severe Injury
  - Nuclear detonation
  - Radiation exposure
  - Radioactive material inhalation/ingestion
- Environmental Damage/ Relocation/Denial of access
  - Radioactive contamination
- Political Upheaval
  - Loss of public confidence
- Economic Loss
  - Costs from damage to persons, property, infrastructure and/or environment

Undesired Consequences

Effects of a 10 Kiloton NW

500 m: Most structures destroyed. 100% fatality rate.

1000m: Fatal radiation doses to directly exposed to the blast, serious damage to buildings, significant risk of a firestorm. Most people dead or seriously injured.

1500m: Area would be ravaged by radiation and fires.

Undesired Consequences

See the immense area destroyed by a nuclear firestorm

created by the explosion of one nuclear weapon

Choose a city or location (type in an address) and select the size or type of nuclear weapon to be detonated. Depending on the weather conditions, the size of the certain and probable area of the nuclear firestorm, created by the nuclear explosion, will vary.

The model used to approximate the size of the firestorm is accurate in the range of 10 to 20%. The simulator can produce this degree of accuracy for explosions that range from 15 kilotons to 2000 kilotons (2 Megatons or 2 MT).

1. CHOSE A LOCATION

City: Washington D.C. | USA

or

Address: trieste

2. CHOOSE A WEAPON

Nuclear Weapons: 550 kt – SS-25 road-mobile ICBM | Russian Type

or

15 kt

Click Here To Detonate

OPTIONS

Visibility: Clear

Automatically update map

Reset Map

Hide Google Maps controls

MAP AREA	CERTAIN MASS FIRES	PROBABLE MASS FIRES	FIREBALL HEIGHT
41 km2	7 km2	13 km2	169 meter
16 mile2	3 mile2	5 mile2	555 feet
6.4 km X 6.4 km 4.0 mile X 4.0 mile	radius 1.52 km radius 0.95 mile	radius 2.00 km radius 1.25 mile	

http://www.nucleardarkness.org/nuclear/nuclearexplosionsimulator/

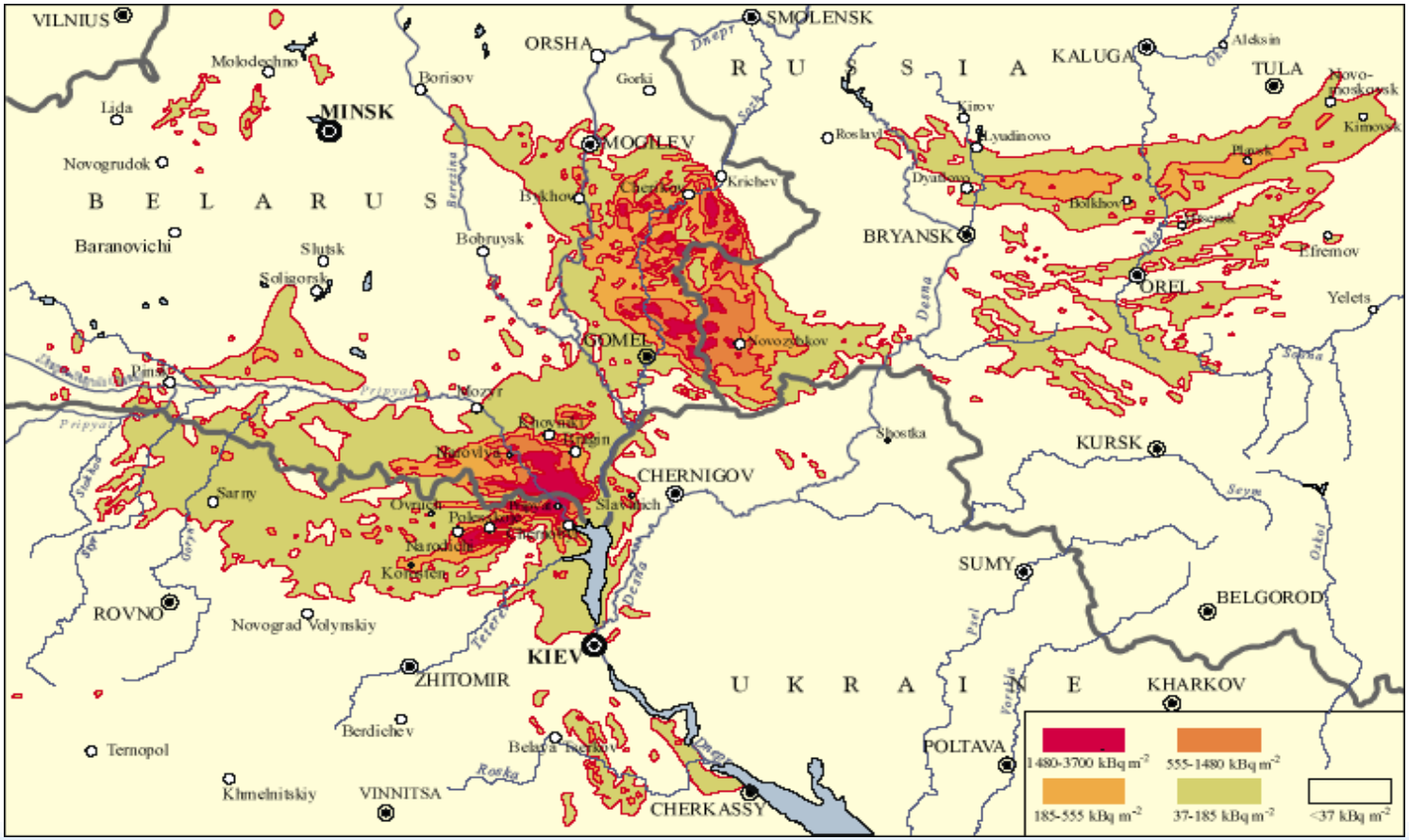
Two Ways Sabotage may lead to undesired consequences

- **Directly**
  - Adversary applies energy directly to nuclear/radioactive material to cause dispersal
  - Adversary must gain access to where material is located
  - Example: explosive or incendiary device used to disperse material
- **Indirectly**
  - Adversary uses energy present in material or system to cause dispersal
  - Requires initiating process upset and disabling mitigation systems
  - Example: disabling primary cooling system (initiating event), backup cooling capability (mitigating systems), and allowing material to overheat

Undesired Consequences

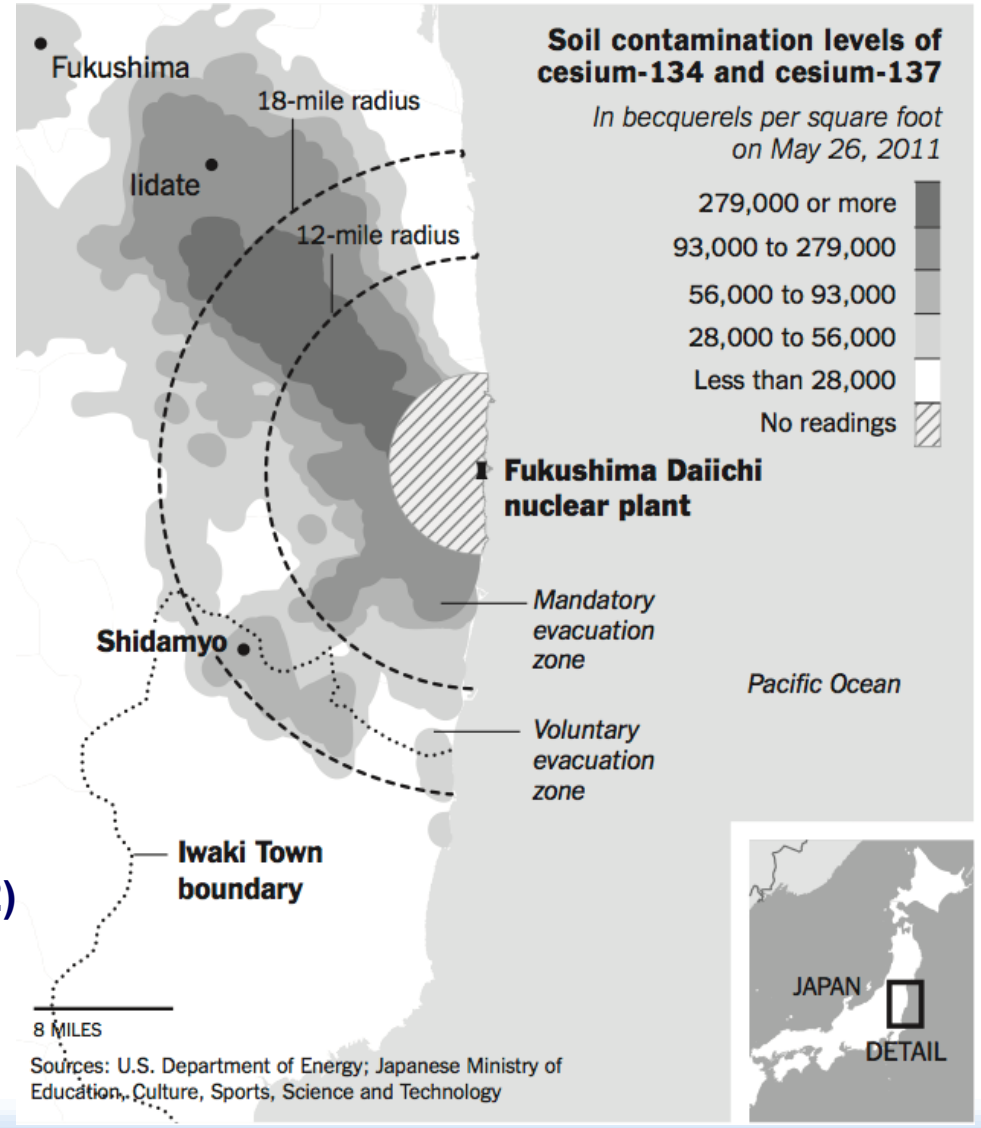
- Objective: protect facilities from radiological sabotage

Chernobyl accident illustrates potential consequences



Undesired Consequences

http://www.nytimes.com/2011/08/01/world/asia/01radiation.html?_r=1



- Fukushima accident illustrates potential consequences **(1m2=10,76ft2)**

Threats

- **Person or group with intent and means to:**
  - Steal nuclear or other radioactive materials
  - Sabotage nuclear facilities
  - Use nuclear or other radioactive materials in attacks against populations or critical facilities

Define Threats

Threat

The potential to cause an undesirable consequence

Threat Assessment

An analysis that documents the credible ***motivations***, ***intentions***, and ***capabilities*** of potential adversaries that could cause undesirable consequences to nuclear materials and nuclear facilities

Design Basis Threat

The attributes and characteristics of potential insider and/or external adversaries who might attempt unauthorized removal of nuclear material or sabotage, **against which a physical protection system is designed and evaluated**.

External And Internal Threats

- **External threat**
  - Terrorists
  - Protestors
    - Demonstrators
    - Activists
    - Extremists
  - Criminals

- **Internal threat**
  - Insider is anyone with authorized, unescorted access who could:
    - act alone or in collusion with external threat
      - May be passive or active
      - May be violent or nonviolent

Threat Assessment — Identify What needs to be known about Threat

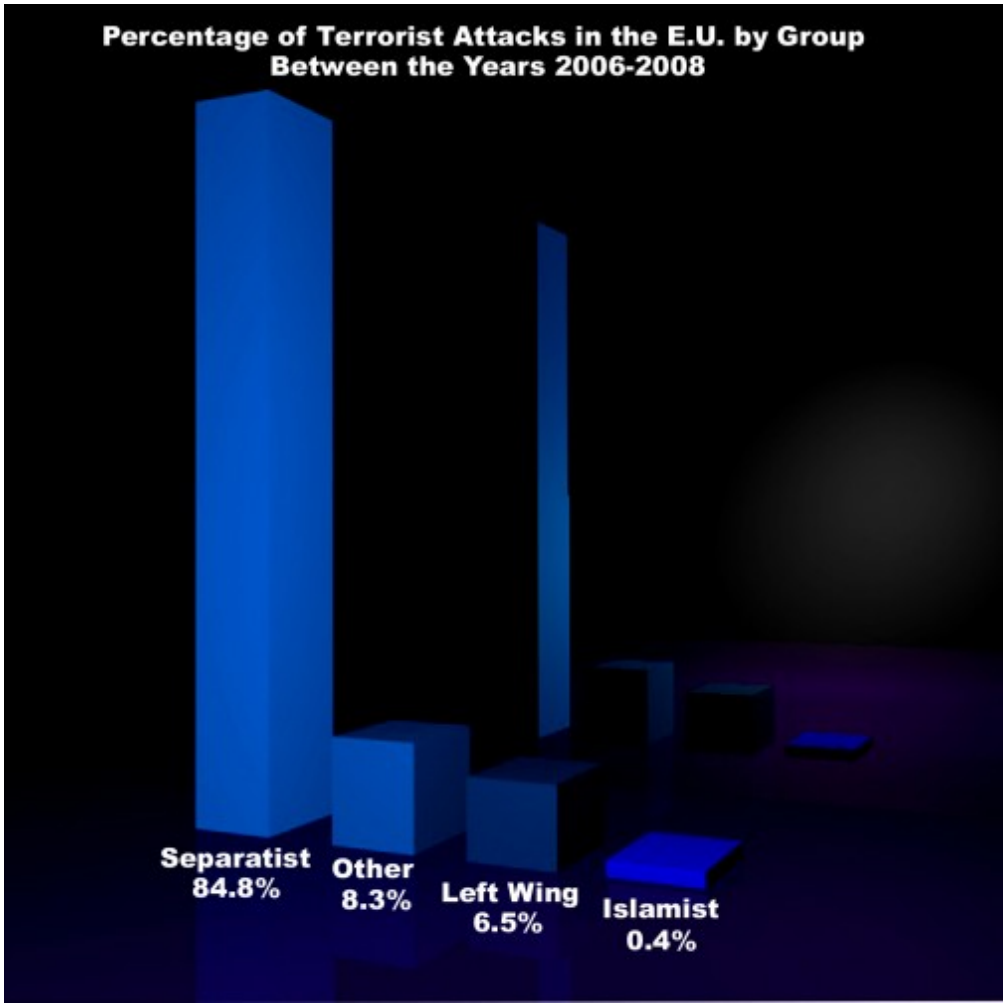
- **Motivation**
  - Ideological
  - Personal
  - Economic
- **Intention**
  - Theft
  - Sabotage
- **Strategies**
  - Stealth
  - Deceit
  - Force
- **Current Trends and tactics**

- **Capabilities**
  - Group size
  - Weapons
    - Specific types
  - Explosives
    - Types and quantities
  - Tools
    - Hand and power tools
  - Transportation
    - Land, air, water
  - Collusion from insider/s
  - Skills
  - Funding
  - Support structure

Large terrorist attacks - examples

- 1995 Tokio subway, WMD sarin attack Aum Shinrikyo cult 12 dead 1000 injured
- 1995 Oklahoma city, truck bomb, 168 dead
- 1998 Kenya and Tanzania, US embassies simultaneous car bombs 257 dead 4000 injured
- 1998 Omagh, Northern Ireland vehicle bomb, 29 dead
- 2000 Yemen, suicide attack at US navy USS Cole, 17 dead
- 2001 New York, Washington, 9/11 suicide attacks – 4 airplanes, 3000 dead
- 2002 Indonesia Bali suicide and truck bomb 202 dead 209 injured
- 2003 Morocco, 5 simultaneous bombs, 33 dead, 100 injured
- 2004 Spain, Madrid trains, 10 simultaneous backpack bombs, 191 dead, 1500 injured
- 2004 Russia, Beslan school, >1100 hostages, 385 dead, hundreds injured
- 2005 UK London subway and bus simultaneous suicide bombs, 56 dead, 700 injured
- 2005 Jordan, 3 hotels, simultaneous suicide bombs, 59 dead, 150 injured
- 2006 India, Mumbai, 7 simultaneous bombs > 200 dead
- 2007 Pakistan, Karachi, attack on Benazir Bhutto, >139 dead, >450 injured
- 2008 India, Mumbai, 4 teams, 4 targets simultaneous, hostages, online communications via mobile phone and satellite phones, live feedback from TV coverage, >172 dead
- 2009 Iraq, Baghdad, October 25, two vehicle bombs in Green Zone, 155 dead, 520 injured
- 2010 Russia, Moscow, Suicide bombing in the Metro, 40 dead, 100 injured
- 2011 Norway, Oslo, 1 person, two targets, several gov. buildings damaged, >80 dead

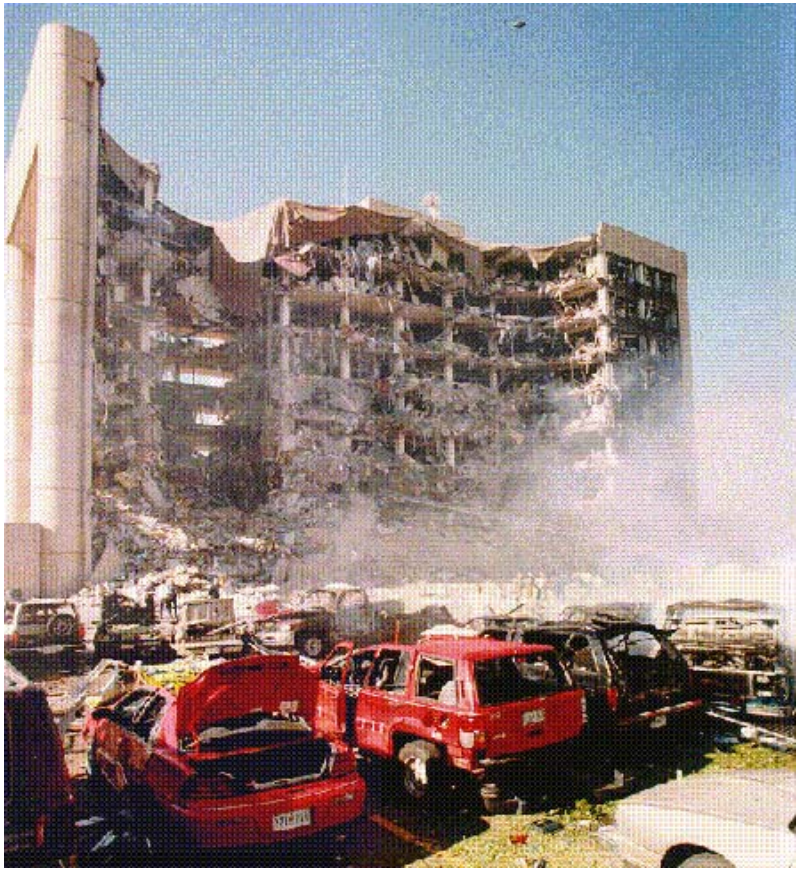
Large terrorist attacks - examples

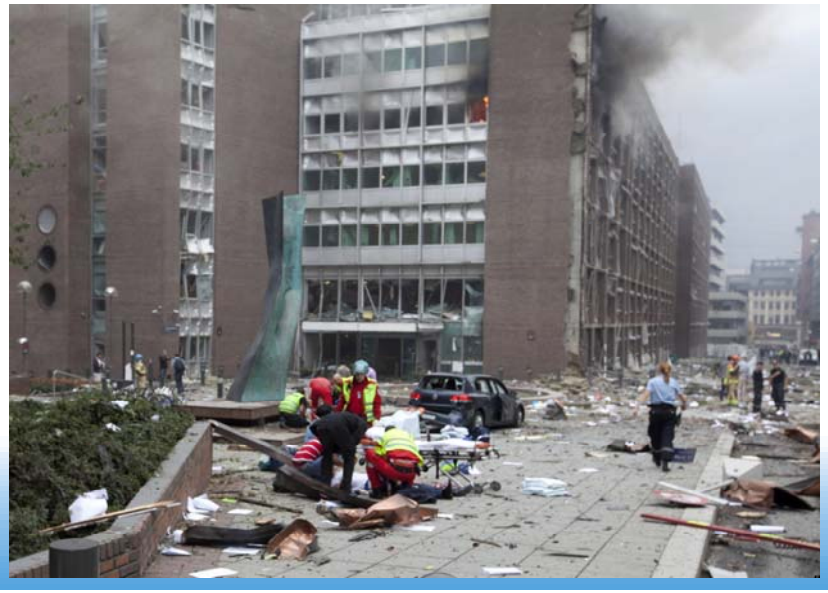


EUROPOL:
The European Union (EU) Terrorism Situation and Trend Report (TE-SAT) 2010

https://www.europol.europa.eu/sites/default/files/publications/tesat2010_0.pdf

Past terrorist act





Attacks on nuclear facilities – some examples - from open sources

- 1966-1977: Europe--10 terrorist incidents against European nuclear installations
- 1974-1986: USA--32 acts of intentional damage or suspected sabotage at NF
- 1978: Spain--Bomb exploded in steam generator of Lemoniz NPS
- 1982: France--Five rockets fired into Creys-Malville NF (Super Phenix, RR)
- 1982: South Africa-- Several bombings at the Koeberg NPP during construction.
- 1983: West Germany—4 persond gain forced entry to a Pershing missile site
- 1987: California--Bomb exploded in parking lot of Sandia National Laboratories
- 1992 Russia, reportedly 3 threats against NPPs
- 2002 and 2007 US: Al Qaeda member claims that attacks on NPP's were considered at time of 9/11 planning
- 2004: Australia--Alleged plot to attack Lucas Heights research reactor
- 2005: Lashkar-e-Toiba operatives reveal that Kaiga NPP in India was a target
- 2007: South Africa--Break-in at Pelindaba research reactor site. Gunmen stormed the facility's emergency response control room and shot and seriously wounded on-duty manager

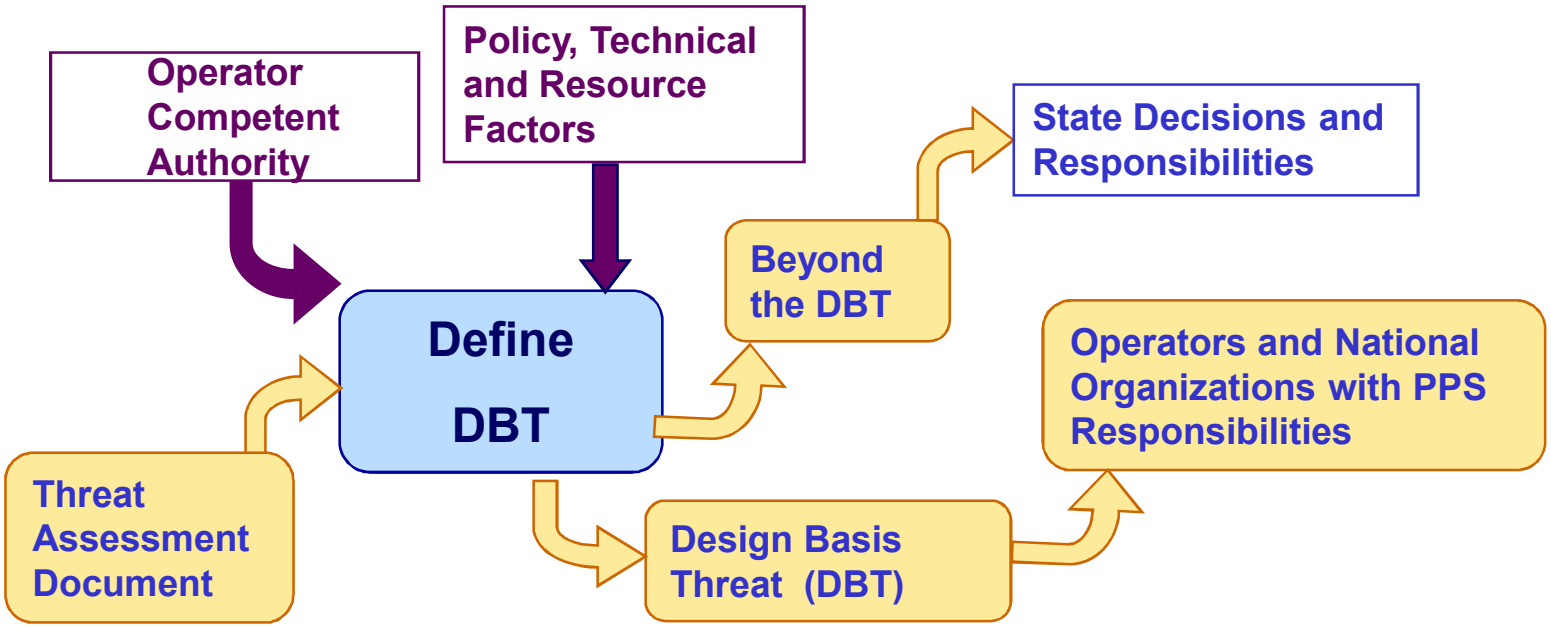
Some terrorist groups - examples

Group and its Home Base

(source RAND: "Sharing the Dragon's Teeth"
http://www.rand.org/content/dam/rand/pubs/monographs/2007/RAND_MG485.pdf)

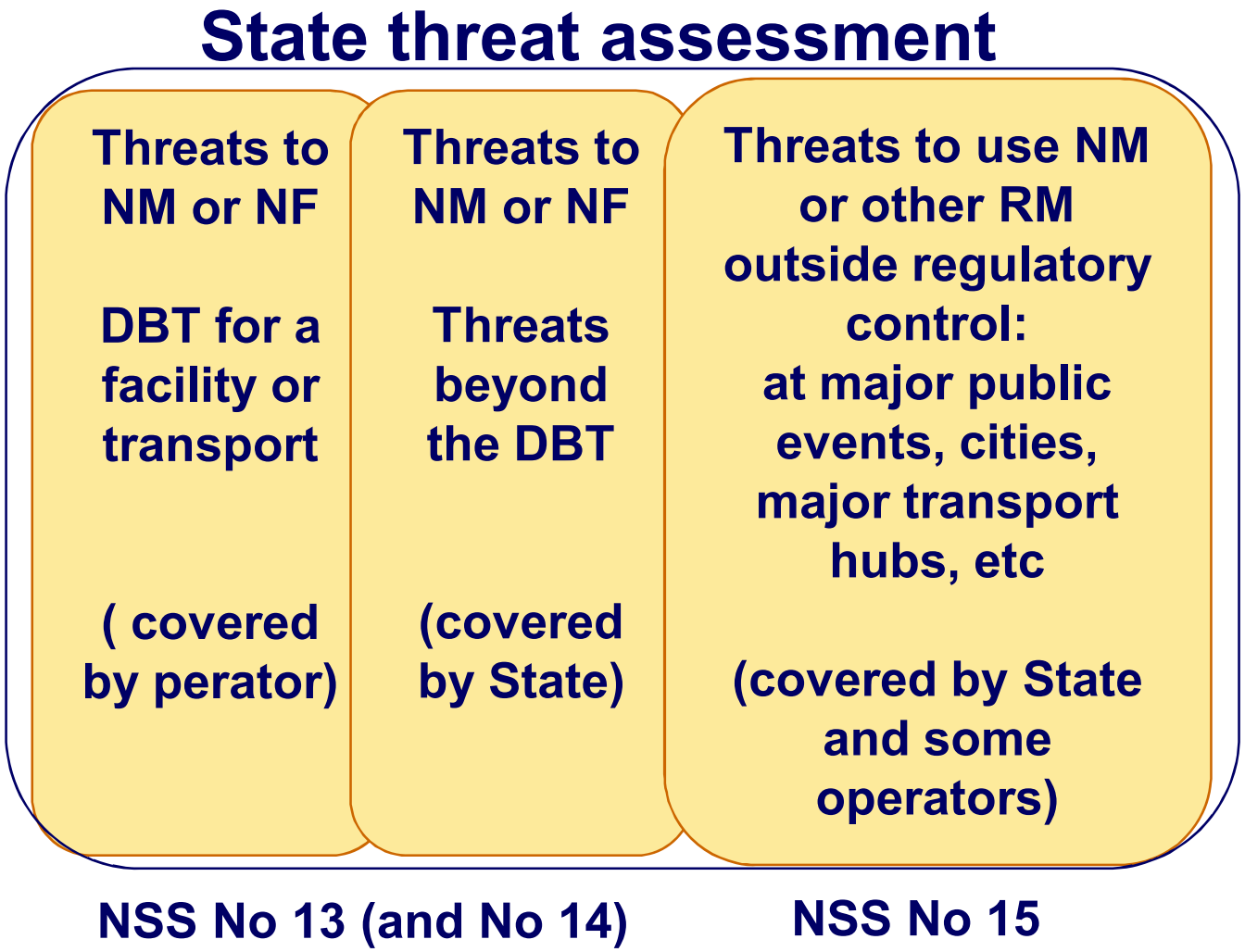
- al Qaeda
- ASG Philippines
- AUC Colombia
- DHKP/C Greece
- ELN Colombia
- ETA Spain
- FARC Colombia
- AQIM Algeria
- GSPC Algeria/Europe
- Hamas West Bank and Gaza
- Hizballah Lebanon
- IG Egypt
- IMU Uzbekistan
- Kach Israel
- LeT Kashmir
- LTTE Sri Lanka
- CPN-M Nepal
- MILF Philippines
- N17RO Greece
- PIJ West Bank and Gaza Strip
- PIRA Northern Ireland
- RIRA Northern Ireland
- Sendero Luminoso SL Peru

Define DBT



Competent authority uses threat assessment as basis for creating DBT to be issued to operators

State threat assessment and DBT

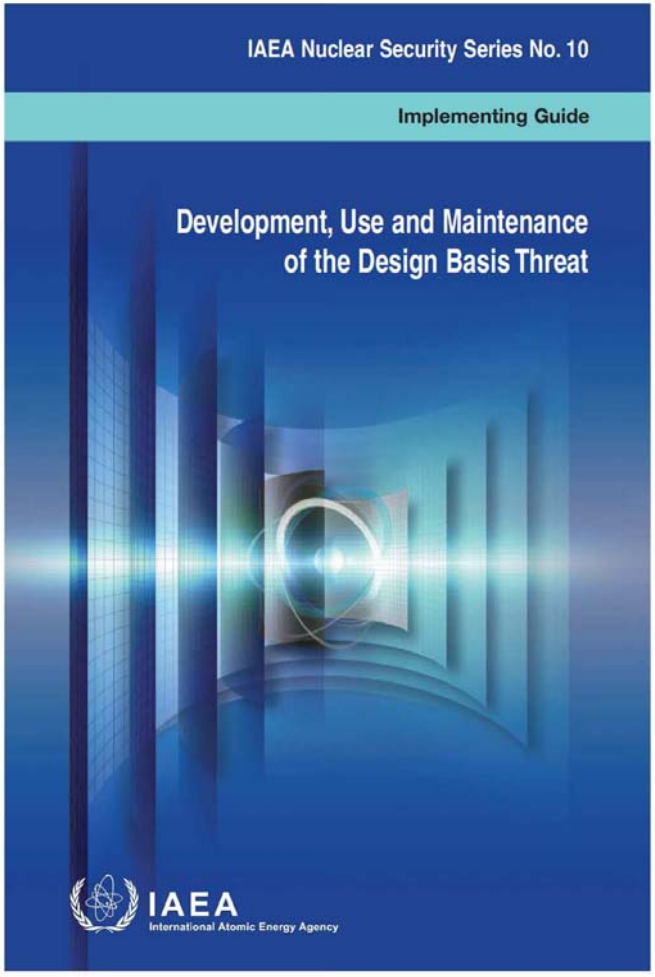


Threat Assessment Matrix

	EXTERNAL THREAT		
	Protestors	**Terrorists**	**Criminals**
MOTIVATION			
INTENTIONS Theft or Sabotage			
CAPABILITIES			
NUMBERS			
WEAPONS			
EXPLOSIVES Type & amount			
TOOLS Power or hand tools			
TRANSPORTATION Ground, air, water			
TECHNICAL SKILLS			
FUNDING			
INSIDER COLLUSION			
SUPPORT STRUCTURE			
CYBER ATTACK			
OTHER			

“Development, Use and Maintenance of the DBT”

IAEA Nuclear Security Series, Vol.10 (2009)



IAEA DBT Workshops were delivered to:

	Country	City	Dates
1	Czech Republic	Prague	1999/09/22-24
2	Poland	Warsaw	2000/04/11-12
3	Ukraine	Kiev	2000/07/17-21
4	Romania	Cernovoda	2001/04/03-04
5	Slovakia	Bratislava	2001/09/11-12
6	Kazakhstan	Almaty	2001/12/11-12
7	Russian Federation	Obninsk/Moscow	2002/03/19-21
8	Ukraine	Kiev	2002/04/09-11
9	Armenia	Yerevan	2002/07/18-19
10	Slovenia	Ljubljana	2002/09/02-04
11	Indonesia	Yogyakarta	2002/12/17-19
12	South Africa	Cape Town	2003/08/26-28
13	Brazil	Brasilia	2003/10/14-16
14	Bulgaria	Kozloduy	2004/03/30-04/01
15	Brazil	Rio de Janeiro	2004/04/05-08
16	Philippines	Quezon City	2004/04/27-29
17	Mexico	Mexico City	2004/08/06-08
18	Peru	Lima	2004/08/25-27
19	Iran	Teheran	2004/09/25-27
20	Argentina	Buenos Aires	2005/04/12-14
21	Chile	Santiago de Chile	2005/08/30-09/01
22	Lithuania	Visaginas	2005/10/03-05
23	Serbia	Belgrade	2005/10/18-20

	Country	City	Dates
24	Thailand	Bangkok	2005/11/01-03
25	The Netherland	Den Haag	2006/04/04-06
26	Belarus	Minsk	2006/09/26-28
27	Tunisia	Tunis	2006/11/20-22
28	Uzbekistan	Tashkent	2007/09/25-27
29	Morocco	Rabat	2007/10/23-25
30	Hungary	Budapest	2008/06/2-3
31	Korea, Rep. of	Seul	2008/06/16-18
32	Ukraine	Kiev	2008/07/9-11
33	Ghana	Accra	2008/09/1-3
34	Slovakia	High Tatras	2008/11/05-07
35	South Africa	Pretoria	2008/11/17-19
36	Moldova	Chisinau	2009/10/12-14
37	Namibia	Windhoek	2009/10/13-15
38	Finland	Helsinki	2009/11/10-12
39	Mexico	Mexico	2009/12/7-9
40	Cuba	Habana	2010/08/4-6
41	Indonesia	Jakarta	2010/10/11-13
42	Spain	Madrid	2010/10/18-20
43	Jordan	Amman	2010/11/23-25
44	Georgia	Tbilisi	2011
45	Belarus	Minsk	2011
46	Sweden	Stockholm	2011
47	Kuwait	Kuwait	2011

Starting from 2008/2009 the Guidance document published as NSS 10 is used as a background information for all DBT Workshop participants

Some useful links

General IAEA web site www.iaea.org

IAEA Office of Nuclear Security: http://www-ns.iaea.org/security/default.asp?s=4&l=33

PRIS Power reactor information system: http://www.iaea.org/programmes/a2/

Research reactors database: http://www.iaea.org/worldatom/rrdb/

IAEA - iNFCIS. Integrated Nuclear Fuel Cycle Information System
http://www-nfcis.iaea.org/

DIRAC (DIrectory of RAdiotherapy Centres)
http://www-naweb.iaea.org/nahu/dirac/default.asp

IAEA Technology review: http://www.iaea.or.at/Publications/Reports/ntr2008.pdf

RAND Worldwide Terrorism Incident Database:
http://www.rand.org/topics/terrorism-and-homeland-security.html

USA DOS Country Reports on Terrorism 2009:
http://www.state.gov/r/pa/prs/ps/2010/08/145737.htm

EUROPOL: The European Union (EU) Terrorism Situation and Trend Report (TE-SAT) 2010:
https://www.europol.europa.eu/sites/default/files/publications/tesat2010_0.pdf