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Nuclear Terrorism: Targets, Consequences and Threats

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International Atomic Energy Agency

Nuclear Terrorism: Targets, Consequences and Threats

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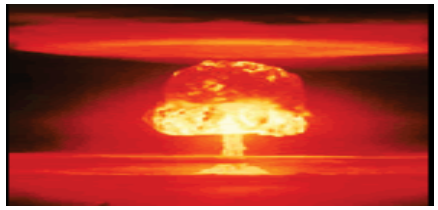
The Four Concerns of Nuclear Terrorism

- **Theft of a nuclear weapon**
- **Theft of nuclear material to make an improvised nuclear explosive device (IND)**
- **Theft of other radioactive material for radiological dispersal device (RDD or "dirty bomb") or radiological exposure device (RED)**
- **Sabotage of a 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
-others

THREAT INDICATORS

-Terrorist and criminal organizations

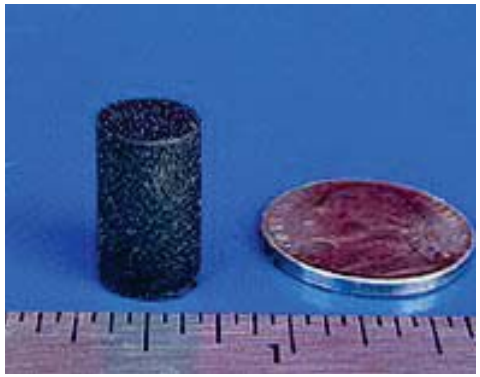
Terrorist and criminal acts (murders, robberies, thefts, arson, kidnappings, past nuclear facilities incidents, airplane hijackings, drug production, smuggling of drugs and weapons)

-Political and economic instability, unemployment, extremes in wealth-poverty, social insecurity, corruption, civil wars, religious tensions

-National/ international cybercrime activities and/or abilities

What are the materials?

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



Radioactive sources (eg.Co60, Ir192, Cs137)

Radioactively contaminated materials

Inventories – Facilities and Materials: Potential Targets

~ 25,000 nuclear weapons

>3000 tons of HEU and Plutonium in civilian and military uses

-229 research reactors in operation worldwide (<100 with HEU)

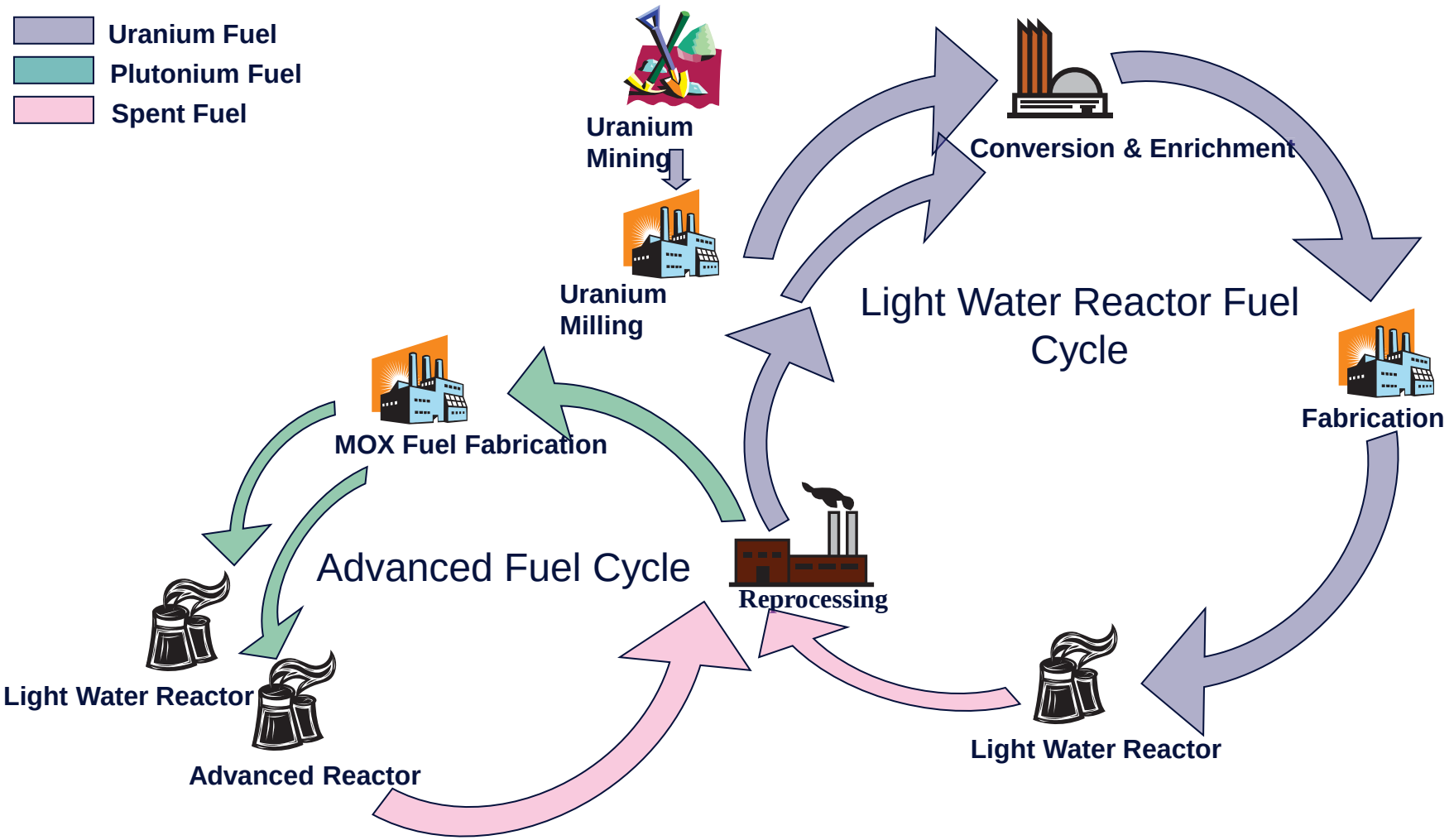
-332 nuclear fuel cycle facilities in operation

-437 power reactors in operation in 30 different countries

> 100,000 Cat I and II radioactive sources

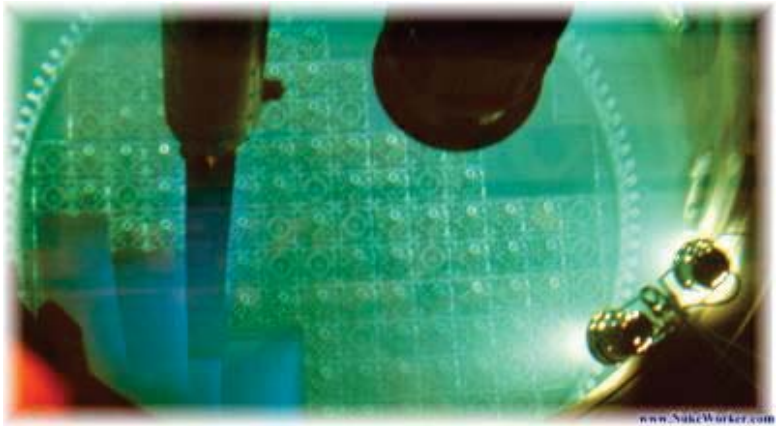
> 1,000,000 Cat III radioactive sources

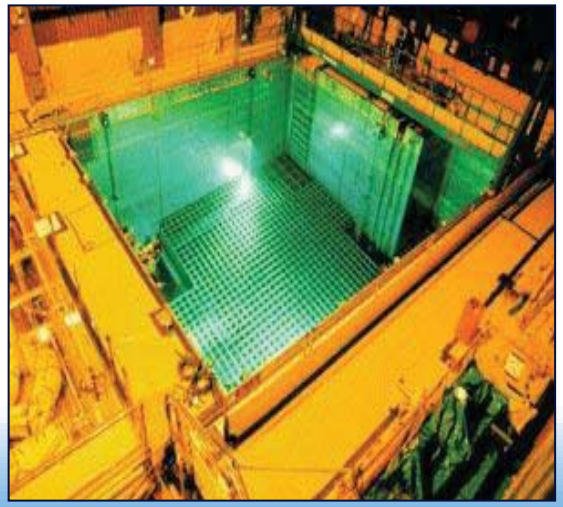
Fuel Cycle Overview



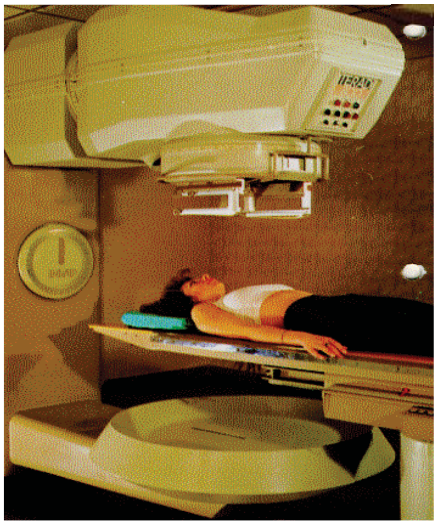
Milling, Enrichment and Reprocessing Facilities

Nuclear Power Plants





Widespread Uses

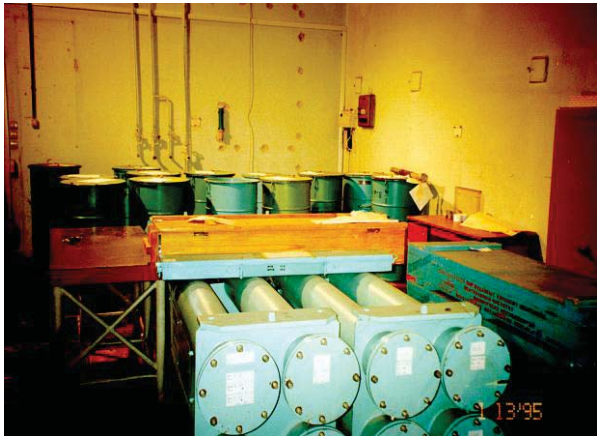


Medicine

Industry

Nuclear energy

Research



Research reactors

Storage and disposal

Targets

- Nuclear or other Radioactive Materials
- Nuclear Facilities, Radiation Facilities
- 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

500m: 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.

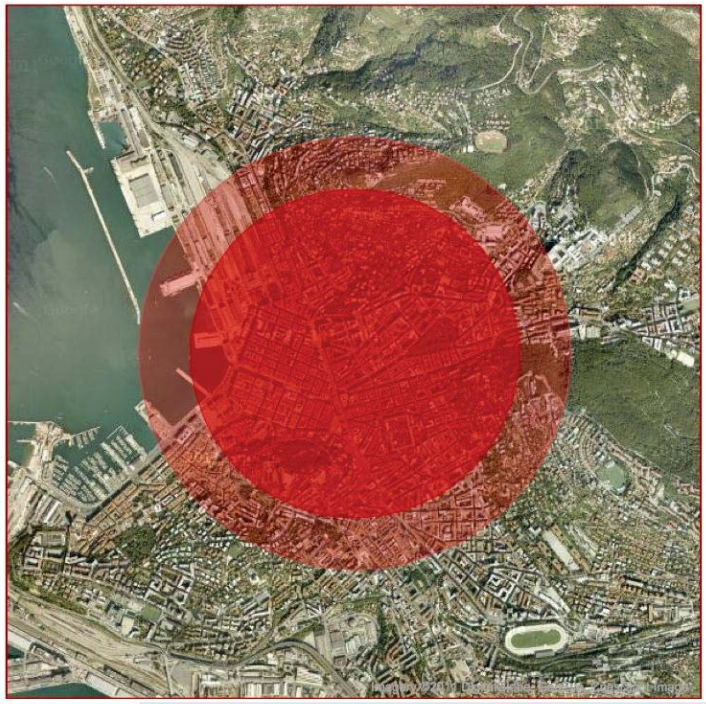
1500m: Area would be ravaged by radiation and fires.

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

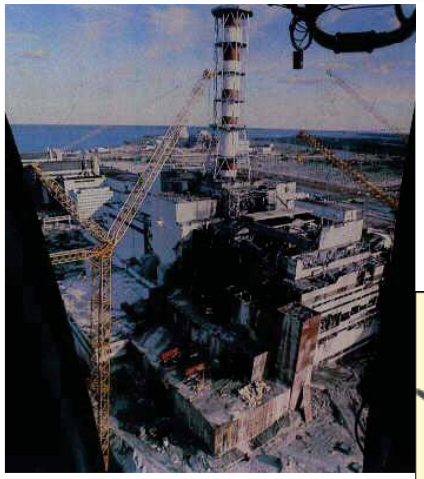
MAP AREA	CERTAIN MASS FIRES	PROBABLE MASS FIRES	FIREBALL HEIGHT
41 km2 16 mile2 6.4 km X 6.4 km 4.0 mile X 4.0 mile	7 km2 3 mile2 radius 1.52 km radius 0.95 mile	13 km2 5 mile2 radius 2.00 km radius 1.25 mile	169 meter 555 feet

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

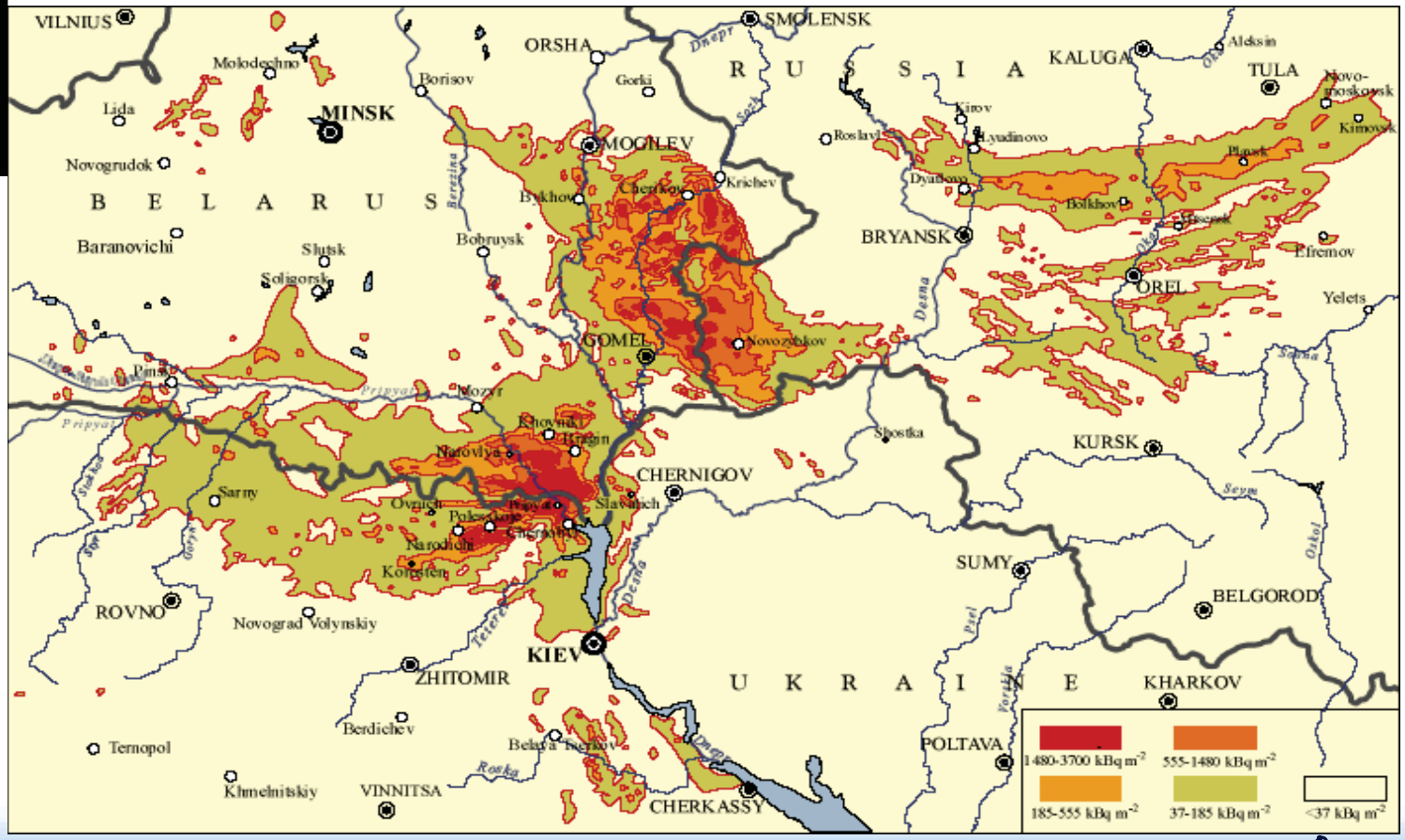
Two Ways Sabotage may lead to undesired consequences

- **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 of mitigation systems
  - *Examples: disabling primary cooling system (initiating event), backup cooling capability (mitigating systems), and allowing material to overheat*

Undesired Consequences

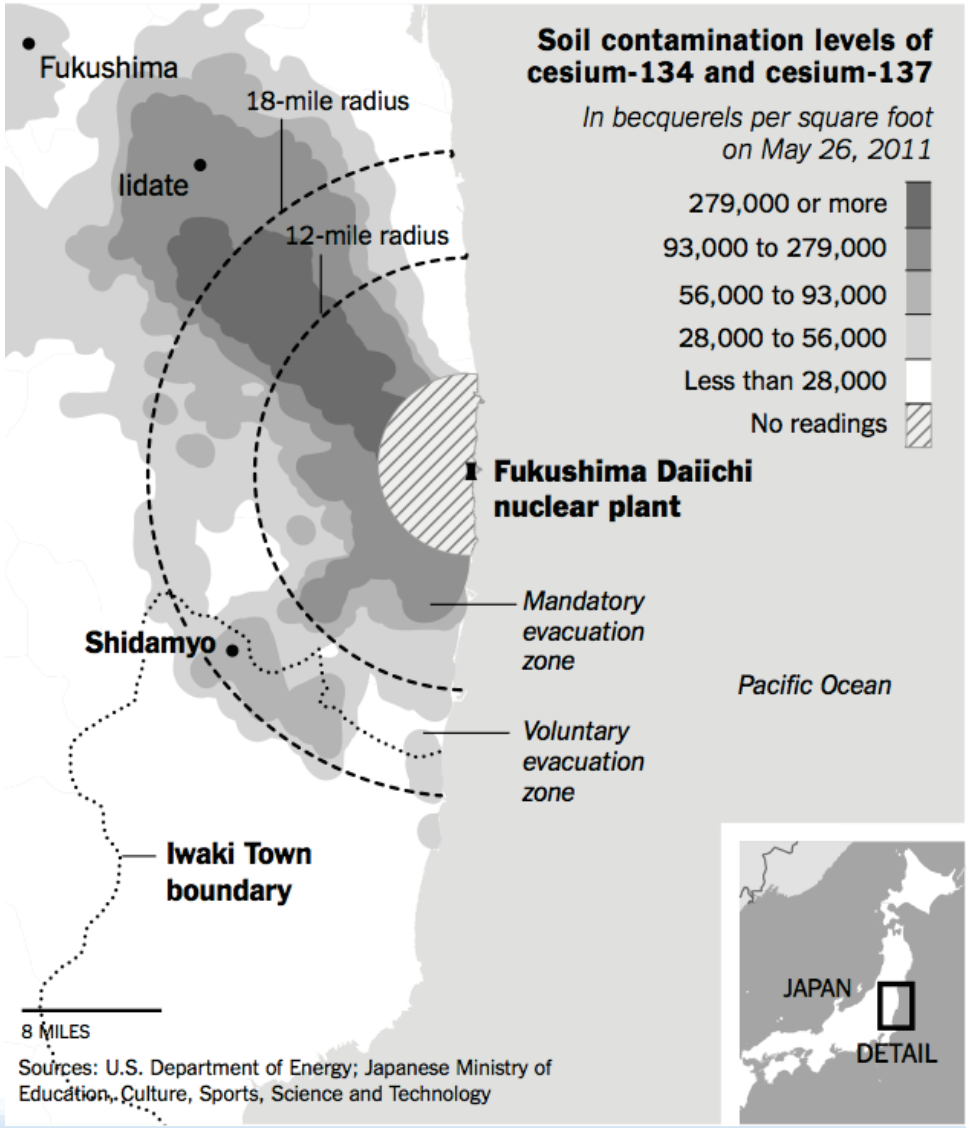


- Chernobyl accident illustrates potential consequences



Undesired Consequences

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



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

Defining Threats

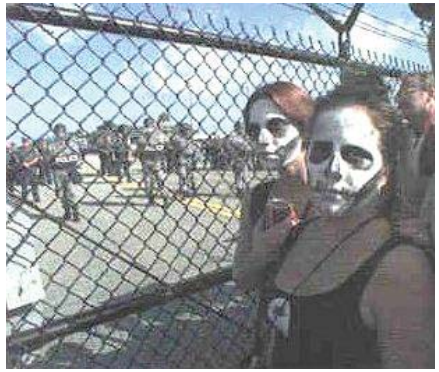
- **Threat**
  - An entity with motivation, intention and capability to commit a malicious act
  - Examples: A person or group with intent and means to steal nuclear or other radioactive materials; sabotage nuclear facilities; use nuclear or other radioactive materials in attacks against populations or critical facilities

- **Threat Assessment**

  An evaluation of the existing threats, usually including intelligence assessments, which describe the motivation, intentions, and capabilities of these threats to commit malicious acts

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

- **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 insiders
  - Skills
  - Funding
  - Support structure

Large Terrorist Attacks - Examples

- 1995 Tokio subway, WMD Sarin Attack by Aum Shinrikyo cult - 13 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, 100s 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 govt buildings damaged ->80 dead

Large Terrorist Attacks – In Numbers

Member State	Religiously-inspired	Separatist	Left-wing	Right-wing	Single-issue	Not specified	Total 2011
Denmark	0	0	4	0	0	0	4
France	0	85	0	0	0	0	85
Germany	0	0	1	0	0	0	1
Greece	0	0	6	0	0	0	6
Italy	0	0	5	0	0	0	5
Spain	0	25	21	1	0	0	47
United Kingdom	-	-	-	-	-	26	26
Total	0	110	37	1	0	26	174

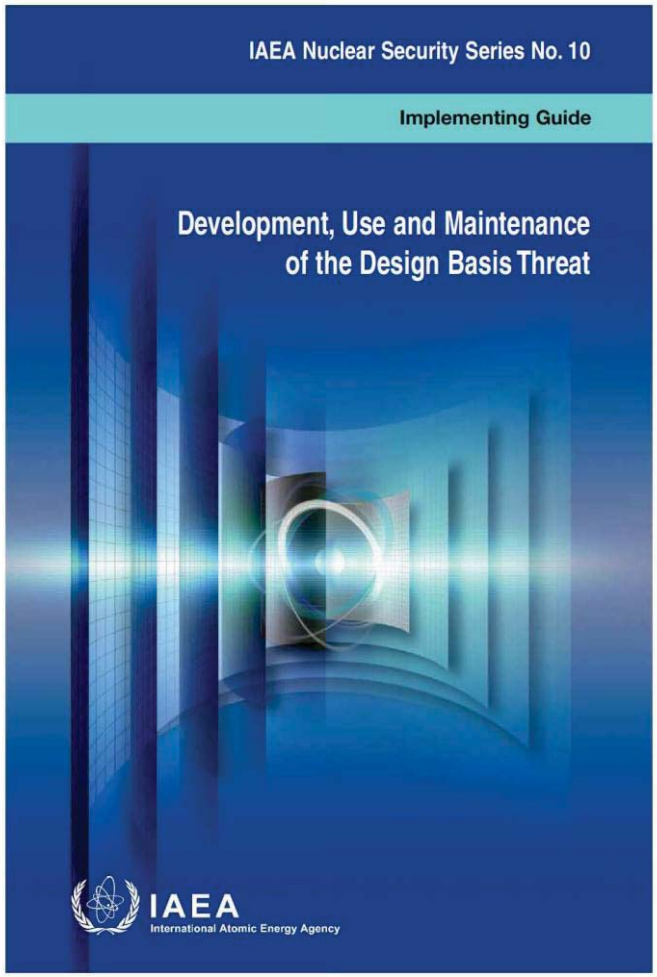
The European Union (EU) Terrorism Situation and Trend Report (TE-SAT) 2012

Incidents at Nuclear Facilities – Some examples

- 2002 and 2007: US - Al Qaeda member claims that attacks on NPPs 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
- **June 2012: Sweden – Explosive materials found in a truck at Ringhals nuclear power plant**
- **August 2012: USA – Three protesters breached security fences and vandalized the Y-12 Oak Ridge facility**

Development, Use and Maintenance of the Design Basis Threat

IAEA Nuclear Security Series No. 10 (2009)

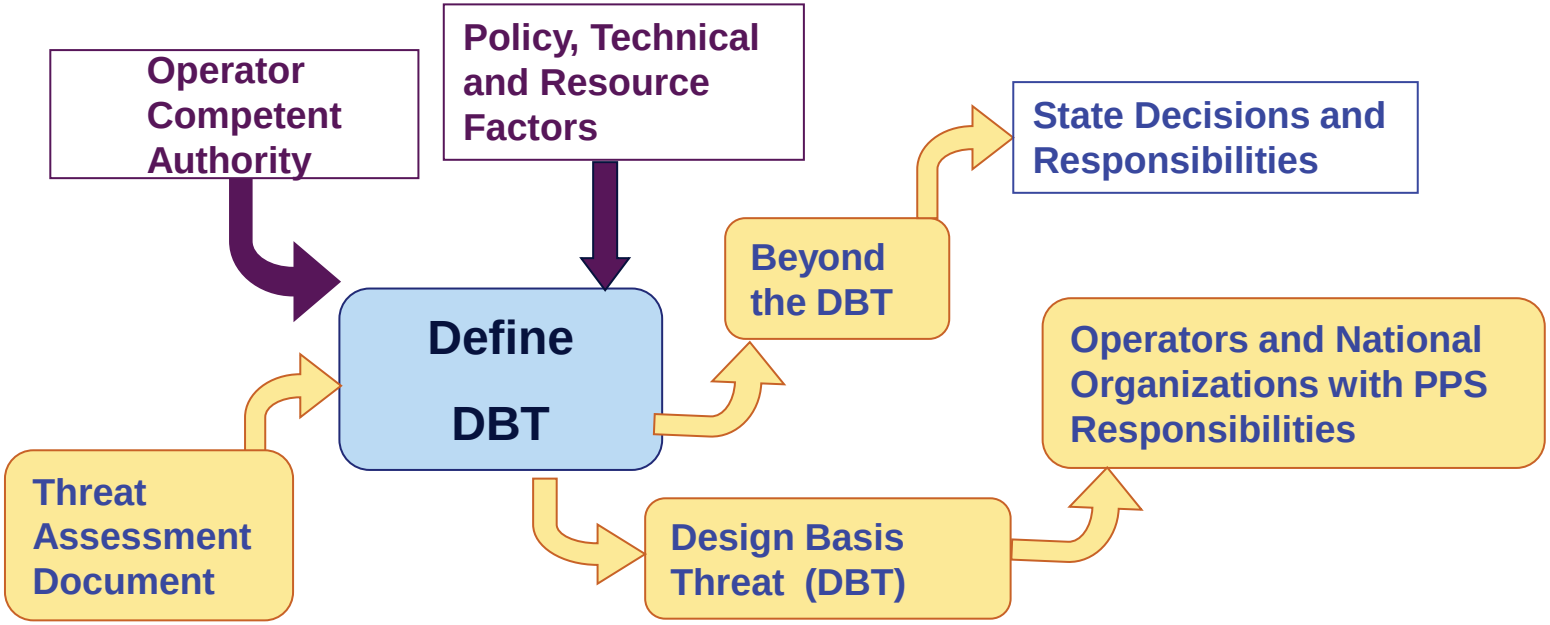


Design Basis Threat (DBT)

Definition:

- A description of the attributes and characteristics of potential insider and outsider adversaries who might attempt a malicious act, such as an unauthorized removal of nuclear material or sabotage, **against which a physical protection system is designed and evaluated**.

Define DBT

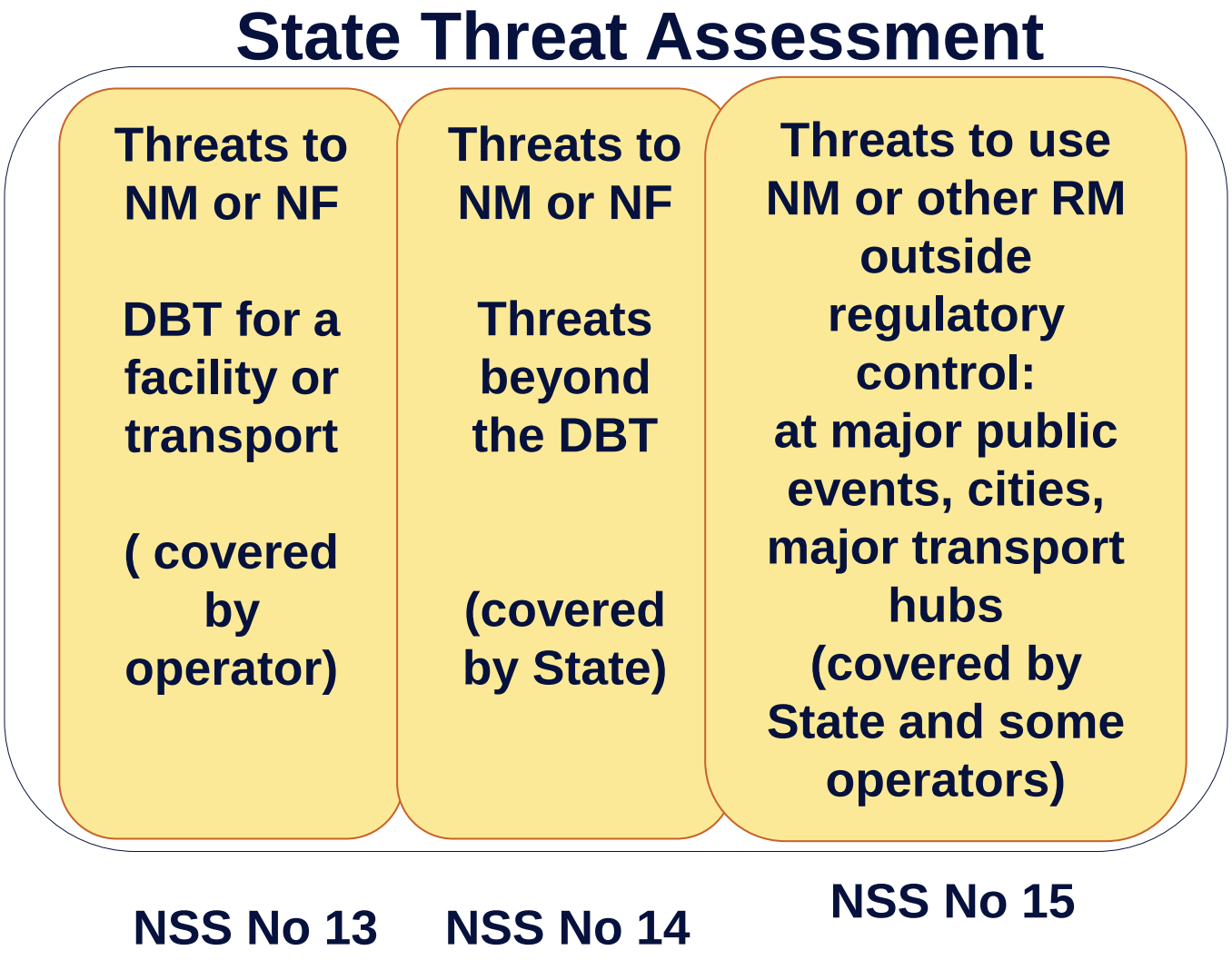


Competent authority uses threat assessment as basis for creating a DBT to be issued to operators

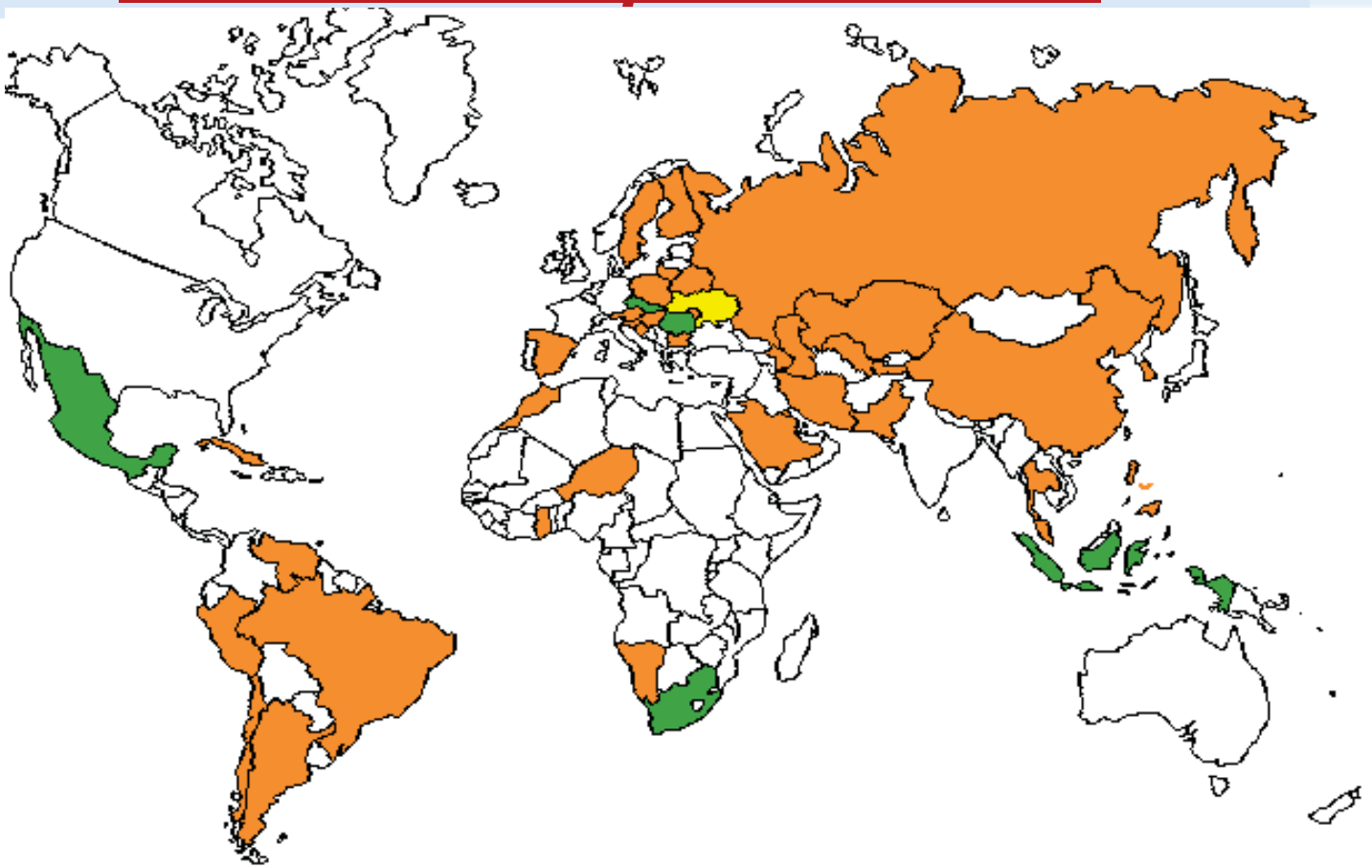
Threat Assessment Matrix

	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			

State Threat Assessment and DBT



DBT Workshops 1999-2012



Once	**Argentina, Armenia, Bangladesh, Belarus, Brazil, Bulgaria, Chile, China, Cuba, Czech Republic, Finland, Georgia, Ghana, Hungary, Iran, Jordan, Kazakhstan, Korea, Kuwait, Lithuania, Macedonia, Moldova, Morocco, Namibia, Niger, Nigeria, Pakistan, Peru, Philippines, Poland, Russian Federation, Saudi Arabia, Serbia and Montenegro, Slovenia, Spain, Sweden, Thailand, Uzbekistan , Venezuela**
Twice	**Indonesia, Mexico, Romania, Slovakia, South Africa**
Thrice	**Ukraine**

Some useful links

General IAEA website: 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) 2012: https://www.europol.europa.eu/sites/default/files/publications/europoltsat.pdf


Thank you for your attention!