

The New Fear: Terrorists!



**TERROR
ALERT**

Since **911** fear of terror attacks dominates the discussion. The fear of nuclear terror through small or medium sized “**nuclear bombs**” from former Soviet arsenals and fear of “**dirty bombs**” makes headline news in the media channels.

Terror as a Weapon

Terrorism is the ... deliberate targeting of Civilians in order to undermine their support for the politics of their political leaders” (Caleb Carr 2002)

Deliberate use by military forces

- o Roman Army: 1st to 3rd century
 - o Mongol Armies: 13th to 15th century
 - o German Navy: unrestricted submarine warfare in WW1
 - o German Army: occupation armies
 - o Japanese Army: Manchuria, China, Philippines, ...
 - o Spanish Army: Civil War in Spain
 - o British Air Force: Bomb War against cities in WW2
 - o US Air Force: Bomb War against civilian targets Germany & Japan in WW2,
Hiroshima & Nagasaki
Vietnam
 - o Israeli Army: Palestine population
 - o Yugoslav Army: Muslims, Croats, Albanians
 - o Indonesian Army: East Timor
- And many examples more

Guerilla

Guerilla: civilian fighters against occupying forces:

- o Spanish Guerilla (little war) against Napoleonic troops
- o Russian partisans against German Armies
- o French Resistance against German Armies
- o Kuomintang & Red Army against Japanese Occupation
- o American Revolution against British Rule
- o Mau-Mau Uprising against British Colonial Rule in Kenya
- o Vietminh against French Colonial Forces in Vietnam
- o Front de Libération Nationale – FLN fighters against French Colonial Forces in Algeria
- o Vietcong against US occupation in South Vietnam
- o East Timor against Indonesian occupation

Strictly against military occupation forces and collaborators

Against occupation and colonial forces including civilians (settlers, farmers)

Second category often depicted as terrorist acts against legal government institutions!

Terrorist Movements

Terrorist actions target mainly civilian population and structures avoiding military & government installations

- o Assassins in 9th-13th century middle east
- o Anarchist terror in 19th century Europe
- o Ku Klux Klan in the US
- o IRA in Ireland and Great Britain
- o Irgun Zvai Leumi & Lehi movement in Israel
- o Al Fatah in Israel, Jordan, Palestine
- o Red Army Fraction in Germany
- o Red Brigades in Italy
- o Euskadi Ta Askatsuna in Spain
- o Shining Path in Peru
- o Zapatista movement in Mexico/US
- o Oklahoma City bombing
- o Unibomber (Ted Kaczynski)
- o Right to life movements
- o Islamic Al Qaeda



Timothy McVeigh
Osama bin Laden



Delhi on nuke terror alert!
Al-Queda's Suitcase nuclear bomb made with stolen nuke equipments from Iraq and expertise from Pakistan!

Sudhir Chadda, Special Correspondent
October 12, 2004

Awareness in US population

Confusion in US about differences between guerilla & terrorist!
Ignorance and confusion also about geographical location, historic reason,
historic, economic, and sociological background of terrorist attacks.



IN FROM 'PRESS GANG' CNN KOURNIKOVA DEFEATED DURING SOCIAL HIT WITH F

“Terrorists” Attacks

"one man's terrorist is another man's freedom fighter".

Conventional weapon based attack more likely;
But a successful nuclear attack would provide high visibility and ensure long term impact.

Logistical problems include:

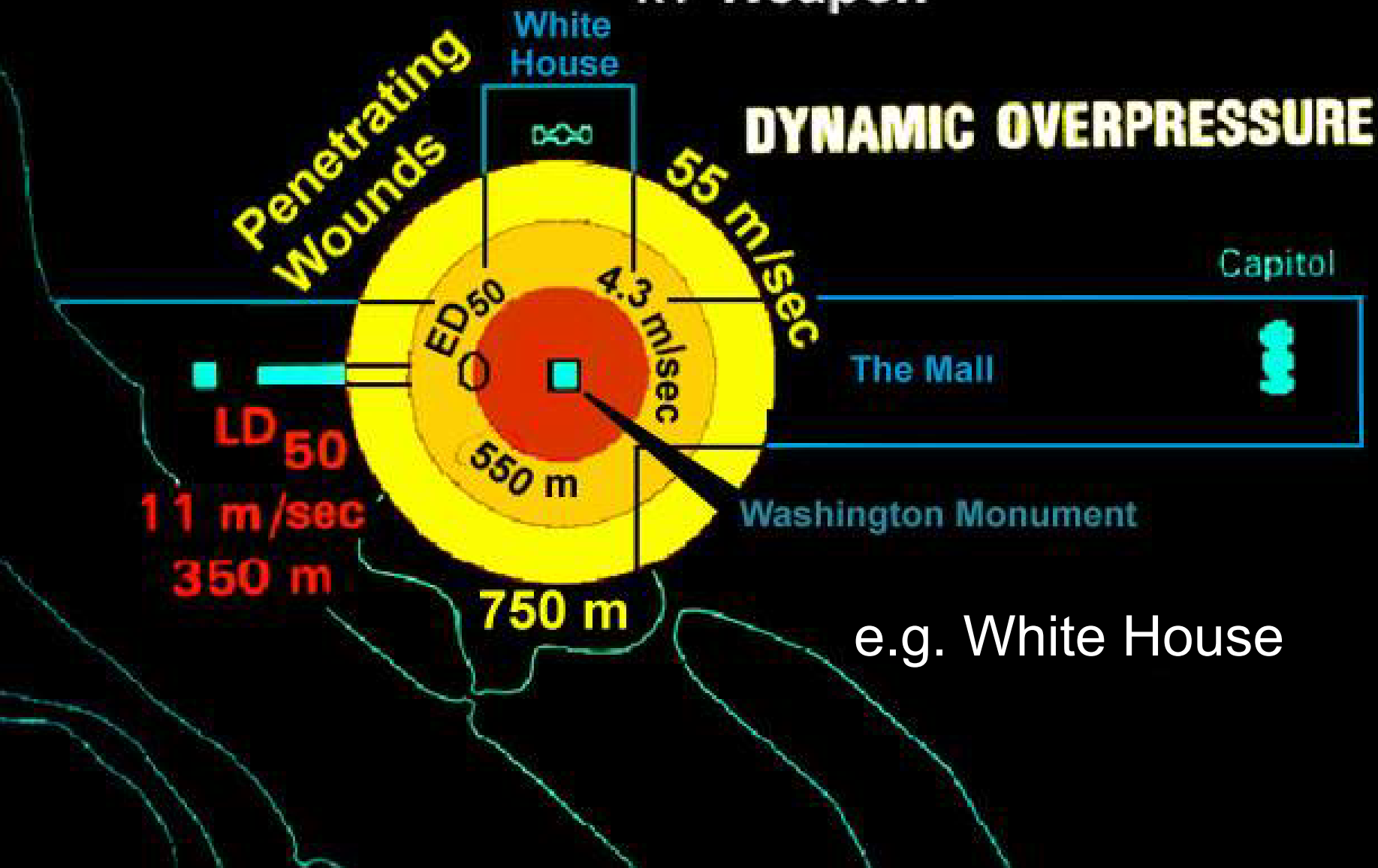
Generating nuclear material (^{235}U , ^{239}Pu); huge industrial effort requires breeder reactor and diffusion or centrifugal based separation facilities (~10-20 years)

Provision of nuclear bomb material (^{235}U , ^{239}Pu); only possible from stockpiles of exiting nuclear powers (Israel, Pakistan, North Korea) or leftover supplies from former nuclear powers (Kazakhstan, Uzbekistan, Ukraine). Not inconceivable!



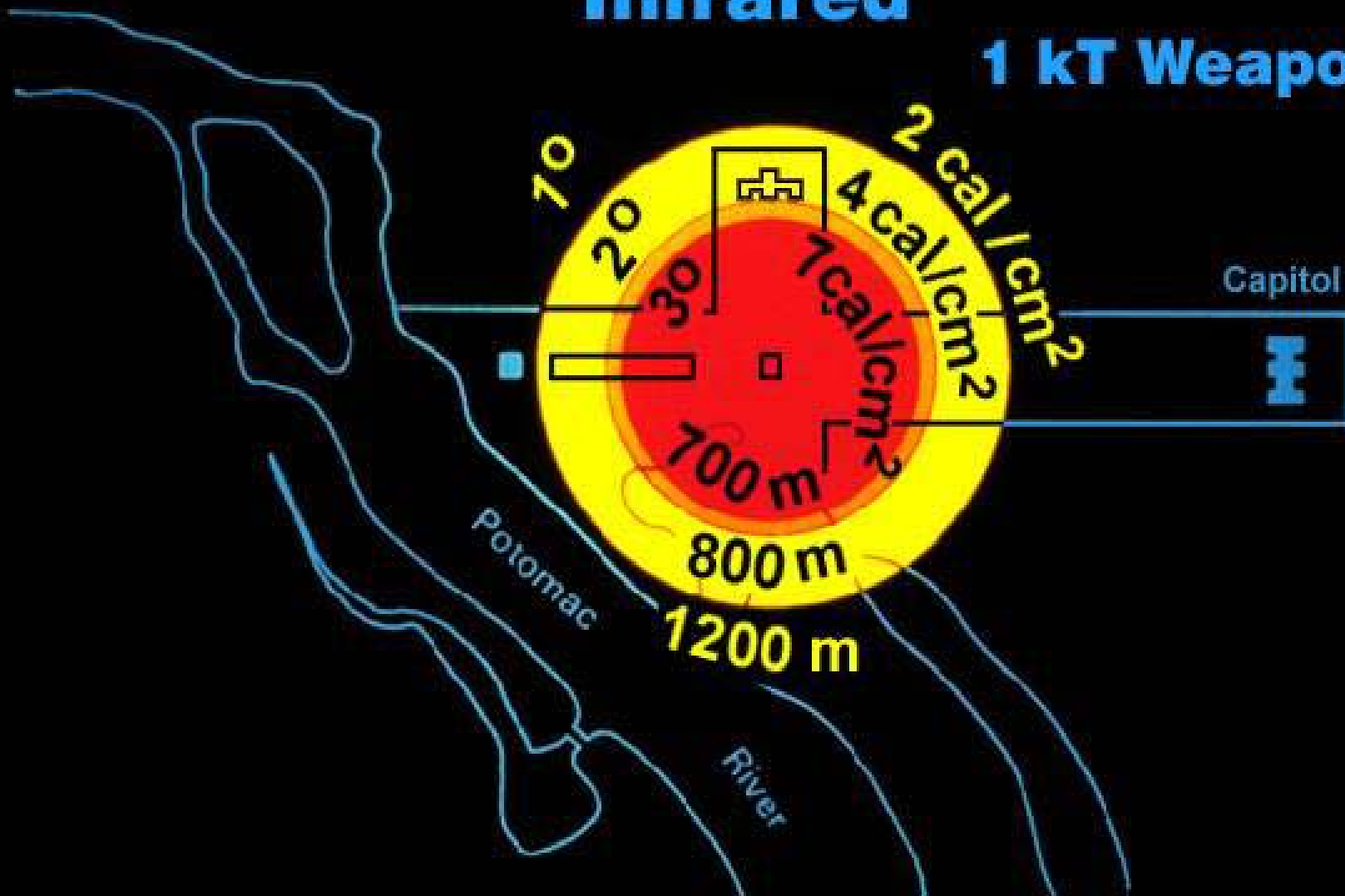
Preferred Target - High Visibility Object

1 kT Weapon



Effective Range for Thermal Energy Infrared

1 kT Weapon



Radiation effects would be limited to 10-20 km circle

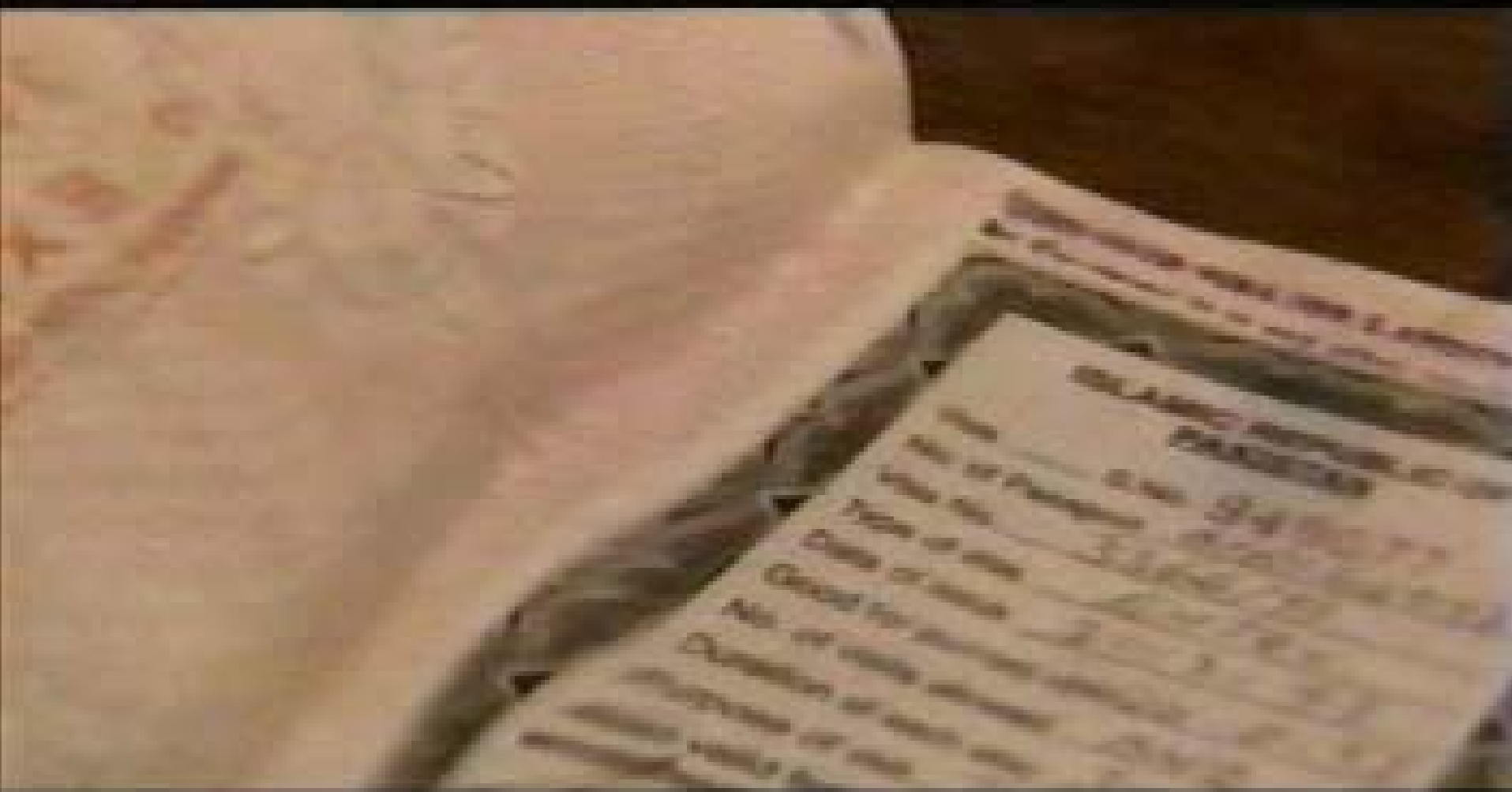




DIRTY BOMB

Classical version seeks to enhance the production of long-term radioactivity by adding “seed material” for neutron capture, e.g. $^{59}\text{Co}(n,\gamma)^{60}\text{Co}$ – cobalt bomb.

The theorized **cobalt bomb** is, on the contrary, a radioactively “dirty” bomb having a cobalt tamper. Instead of generating additional explosive force from fission of the uranium, the cobalt is transmuted into ^{60}Co , which has a half-life of 5.26 y and produces energetic (and thus penetrating) γ rays. The half-life of ^{60}Co is just long enough so that airborne particles will settle and coat the earth's surface before significant decay has occurred, thus making it impractical to hide in shelters.



The New “Radiological” Version

The radiological dirty bomb would contain a small or medium amount of explosives (10 to 50 pounds [4.5 - 23 kg] of TNT, for example) with a small amount of low-level radioactive material (say a sample of ^{137}Cs or ^{60}Co from a university lab or more likely from a hospital radiology department).

To contaminate an area of $10,000\text{m}^2$ (circle of ~ 60 m radius) with ~ 1 Ci/ m^2 (<1 rad dose for by-passer) from material transported in a regular suitcase you need an initial source of $\sim 10,000$ Ci radioactive material in your explosive device. If the material is ^{60}Co this activity corresponds to $\sim 90\text{g}$ of pure ^{60}Co . The dose rate is ~ 20 rad/s (depending how the carrier would hold the suitcase). For 1 h hike from terrorist headquarter to e.g. Times Square in New York the carrier would receive a lethal dose of 72000 rad. Major Pb shielding required for 1.076 and 1.33 MeV γ radiation from ^{60}Co radioactive decay. (A regular laboratory ^{60}Co source has an activity of $<10^{-5}$ Ci.) An “effective” dirty bomb provides substantial logistical problems on the delivery side!

Identification of possible sources for larger amounts of radioactive material

Categorization of danger in terms of **Activity/D**angerous activity **A/D** activity: number of decays per time

radionuclide	TBq	Ci
⁶⁰ Co	0.03	0.8
¹³⁷ Cs	0.10	3.0
¹⁹² Ir	0.08	2.0
²⁴¹ Am	0.06	2.0

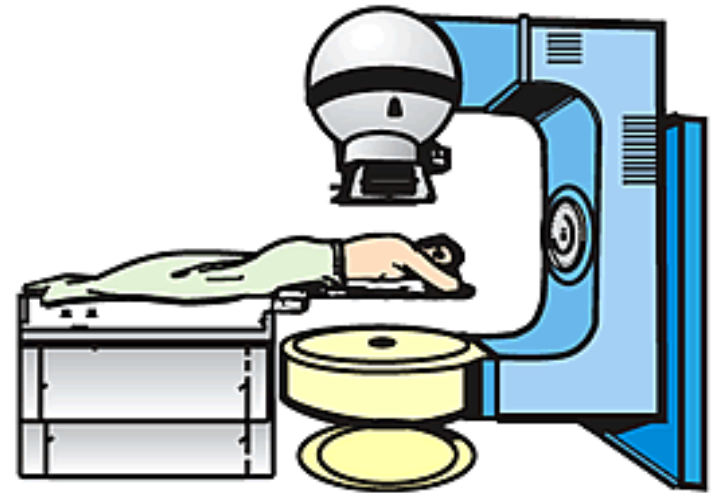
IAEA category of
Dangerous Activity

Category	Practice	Activity ratio (A/D)
1	Radioisotope thermoelectric generators; irradiators; teletherapy; gamma knife	$A/D \geq 1,000$
2	Gamma radiography; brachytherapy (high/medium dose rate)	$1,000 > A/D \geq 10$
3	Fixed industrial gauges (e.g., level, dredger, conveyor gauges); well logging	$10 > A/D \geq 1$
4	Brachytherapy (low-dose rate except eye plaques and permanent implants); thickness/fill-level gauges; portable gauges, static eliminators, bone densitometers	$1 > A/D \geq 0.01$
5	Brachytherapy (eye plaques and permanent implants); x-ray fluorescence devices; electron capture devices	$0.01 > A/D \geq \text{exempt/D}$

Highest risk is in “unprotected” medical facilities

Medical Sources

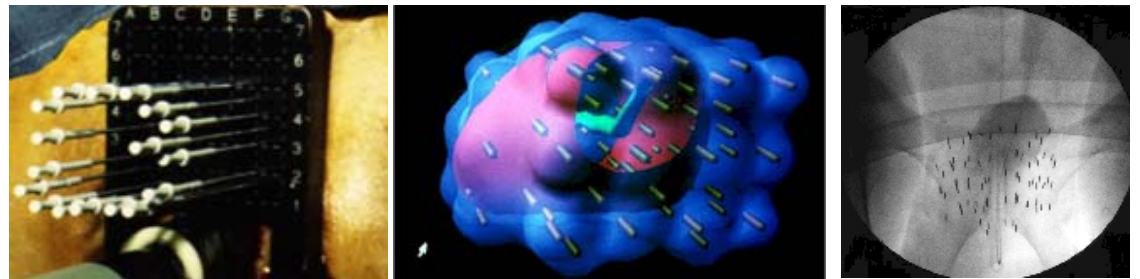
Sources are mainly designed for the radiation treatment of cancer patients



Theletherapy units

More than 10,000 medical sources of ^{60}Co ($T_{1/2} \approx 5\text{y}$), $\sim 100 \text{ TBq} \approx 3000\text{Ci}$ each. Each capsule contains 10,000 pellets with each pellet 100 GBq

Third world countries prefer the less expensive ^{137}Cs sources ($T_{1/2} \approx 30\text{y}$) which comes as highly dispersible CsCl salt. Each unit contains $\sim 100 \text{ TBq} \approx 3000\text{Ci}$.



Brachytherapy units

Brachytherapy sources are more abundant but have lower individual radioactivity: ^{226}Ra , ^{137}Cs , and ^{192}Ir , with typical activity levels of 0.1-1.0GBq

Example for careless handling: Goiania, Brazil

A radiotherapy unit had been abandoned in a clinic which was being demolished. The unit had a source consisted of 1,375 curies of cesium-137 in the form of cesium chloride salt, sealed within two nested stainless steel containers to form a 5-cm diameter capsule. Two individuals dismantled the unit and extracted the source. Both began vomiting on 13 September. The unit material was sold to a junkyard, a blue glow from the source container was observed that night; a number of people came to view the capsule. On 21 September the source material was removed and distributed among several people, some of whom spread it on their skin. Around 23 September junkyard employees were exposed while further dismantling parts of the unit. ...



Dirty Bomb Scenario #1 (~2500 Ci)



Dirty Bomb Scenario #2 (~2500 Ci)

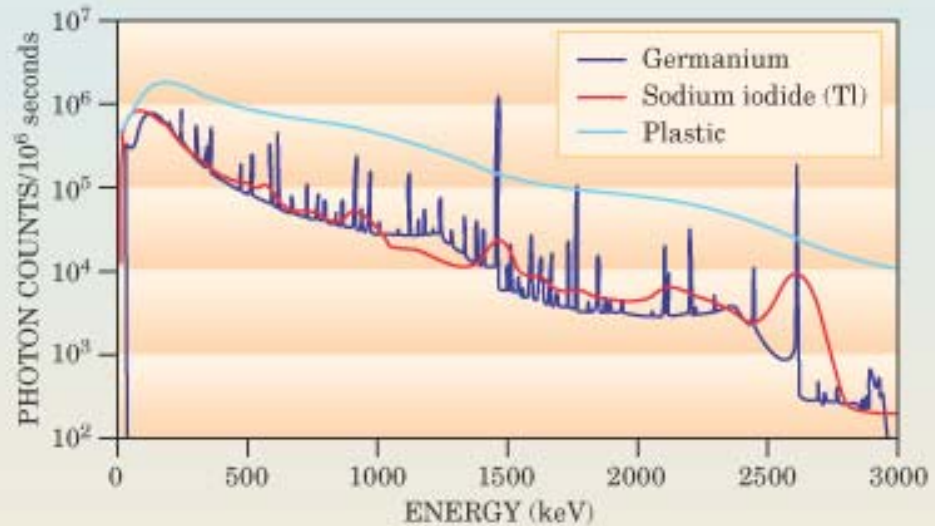


Requirements for being prepared for possible Al Qaeda dirty bomb threats

- Identification and localization for high activity radioactive sources (IAEA)
- Risk and threat assessment studies (IAEA + national agencies)
- Enhanced security requirements for high activity source storage against theft
- Enhanced security for international transport of radioactive material
- International legal agreements
- training of radiation control personal



Monitoring Radioactivity



Problem with on-line radioactivity monitoring device is the number of false alarms due to natural activities and medical activities (patients after treatment)

Efficiency of 10^{-4} limits the detection to activities in the milli-Curie range



Shortcomings and Limitations

