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Atomic Pile: Why the United Nations overstates the threat of Nuclear Terrorism

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CRiL Research Seminar

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23 January 2013

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Approach

- Background
- What is nuclear terrorism?
- What does the UN say about the threat it poses?
- Is this an overstatement?
- Why?
- Questions.

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Background

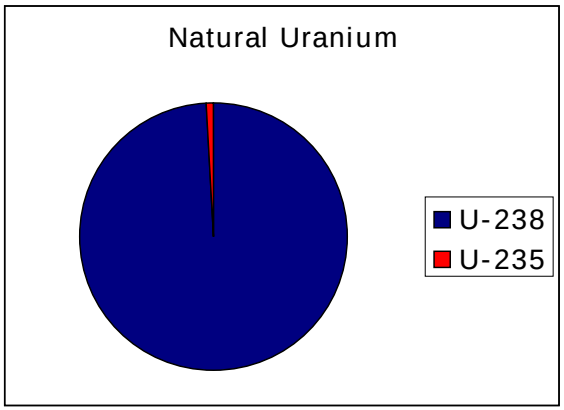
The science is conceptually quite ‘simple’

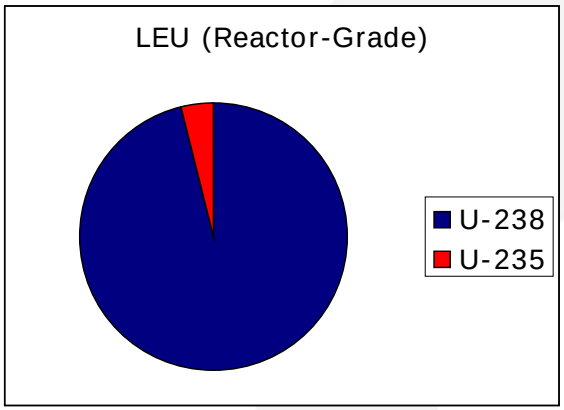
Uranium is found in many places across the world. In its natural form (Uranium 238), it is stable.

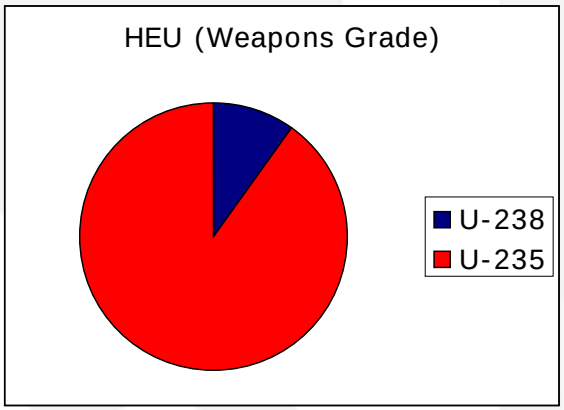
> U-238 represents about 99.3% of all natural uranium and, frankly, is rubbish for making a bomb.
>
> 0.7% of natural uranium is U-235 which is the good stuff.

Luckily for bomb-makers and power-plant operators, U-238 can be enriched to U-235, which is fissionable.

It is the same science for both processes, but whereas uranium for reactors is enriched to between 3-4% U-235 (Low Enriched Uranium, LEU), that which goes into weapons is enriched to around 90% U-235 (Highly Enriched Uranium, HEU)







Once you have HEU, you can make a bomb.

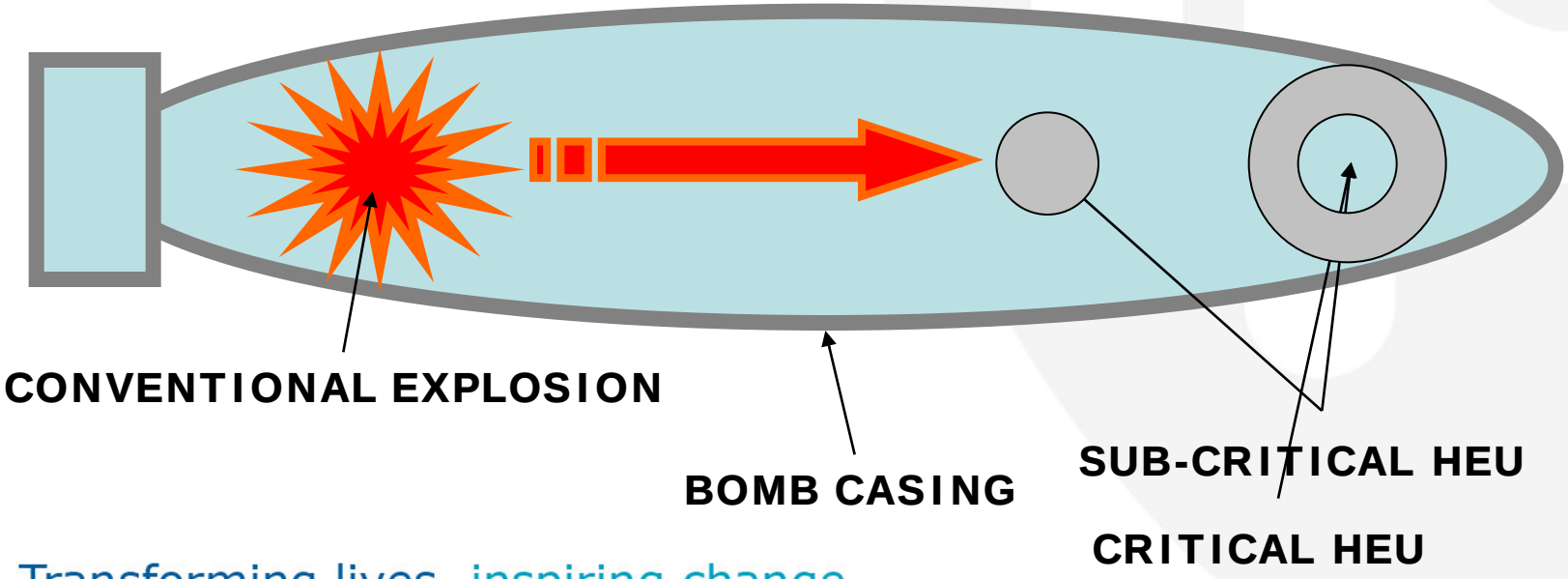
BUT, if you have more than about 50kg of HEU in the same place, it will start to react, and then explode.

Most basic bombs are of the fission type (there are some 2-stage thermonuclear designs, but they are may to complicated to explain here)

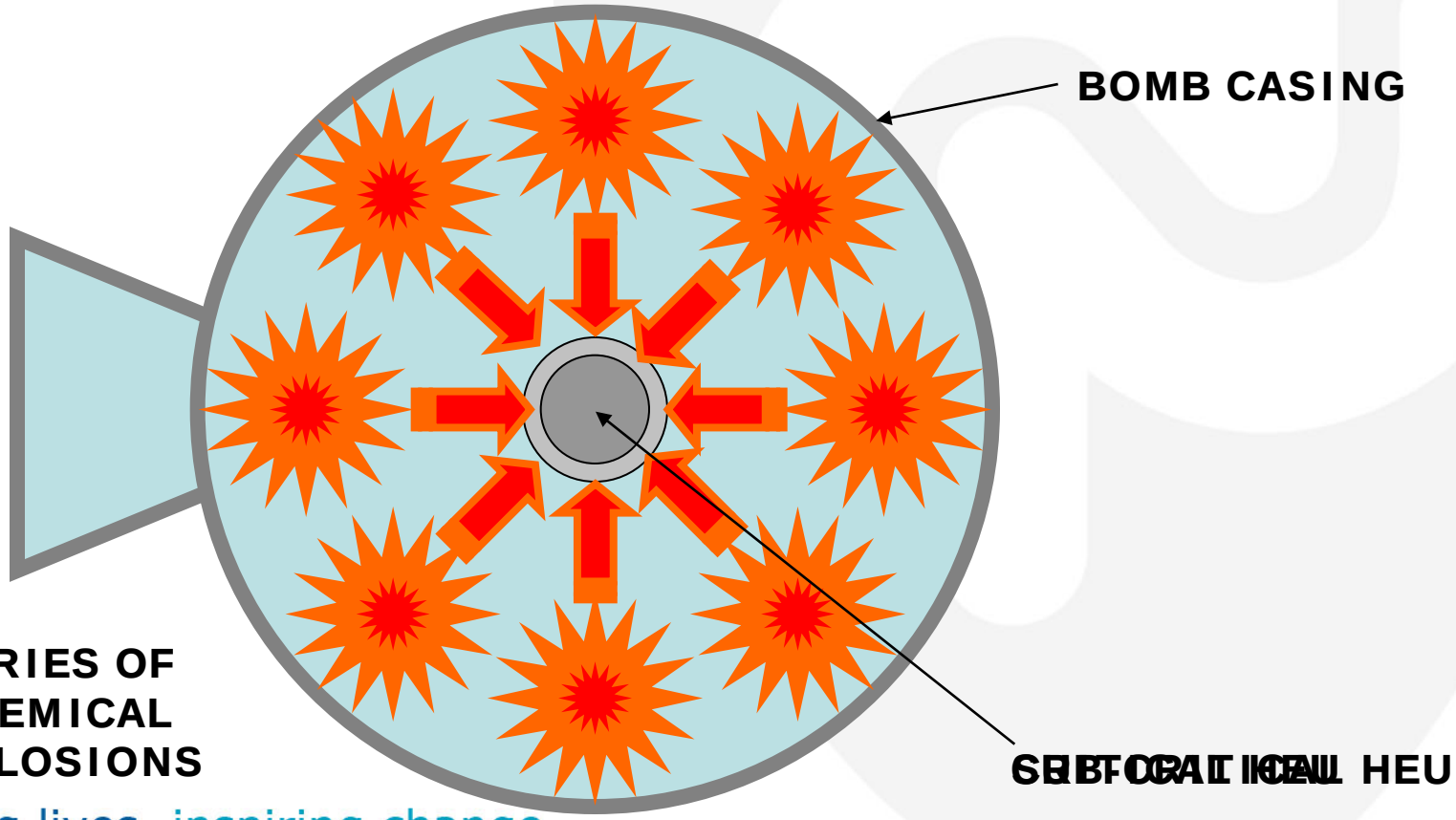
The basic designs are “Gun-type” and “implosion-type”…

In the Gun-type bomb, two pieces of sub-critical HEU (HEU which is too small to start an explosion) are held apart in the bomb case.

A conventional (chemical) explosion is triggered which pushes one piece of HEU into the other at high speed, at which point the chain reaction starts, and the bomb explodes.



The principle in implosion-type bombs is the same, but the design means that the sub-critical piece of HEU is compressed into criticality. It is a lot more cumbersome than the Gun-type design.



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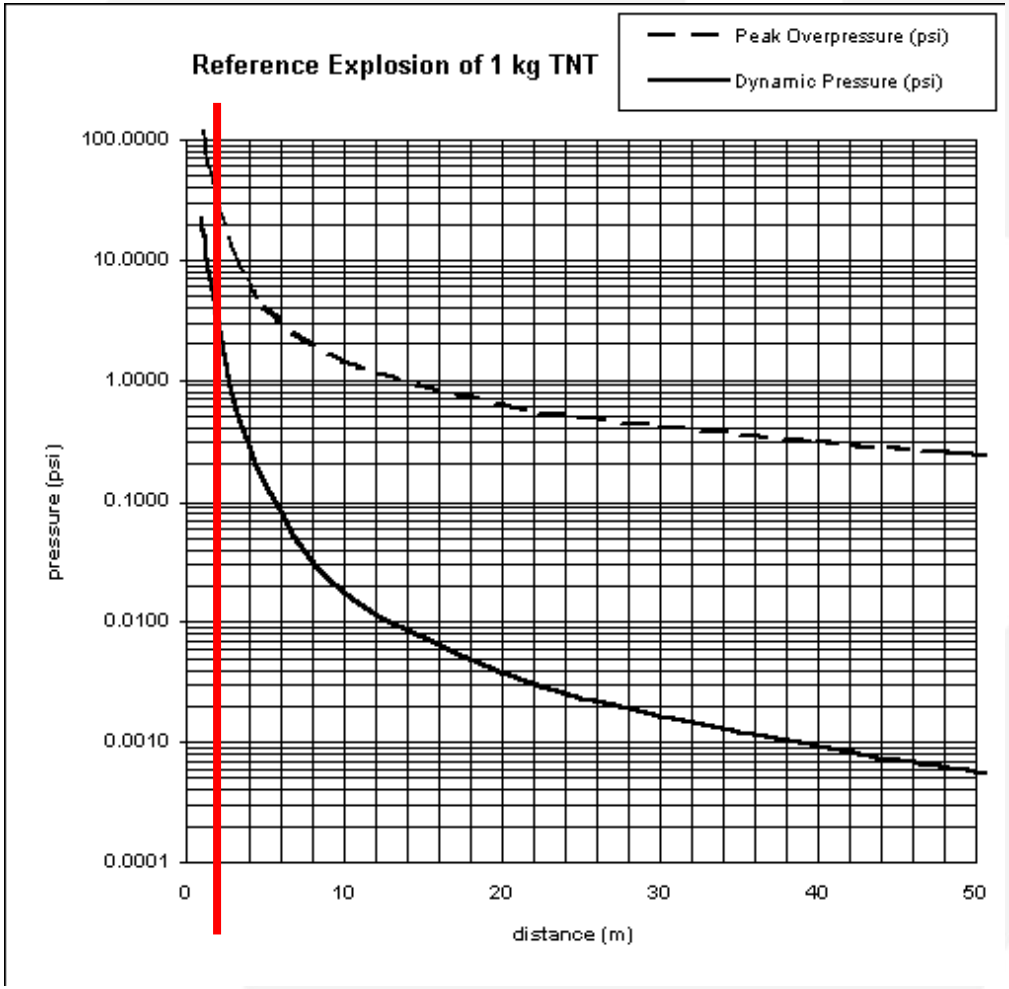
1kg TNT used as scale for most explosions.

The pressure wave quickly dies off, the further you are away from the explosion*

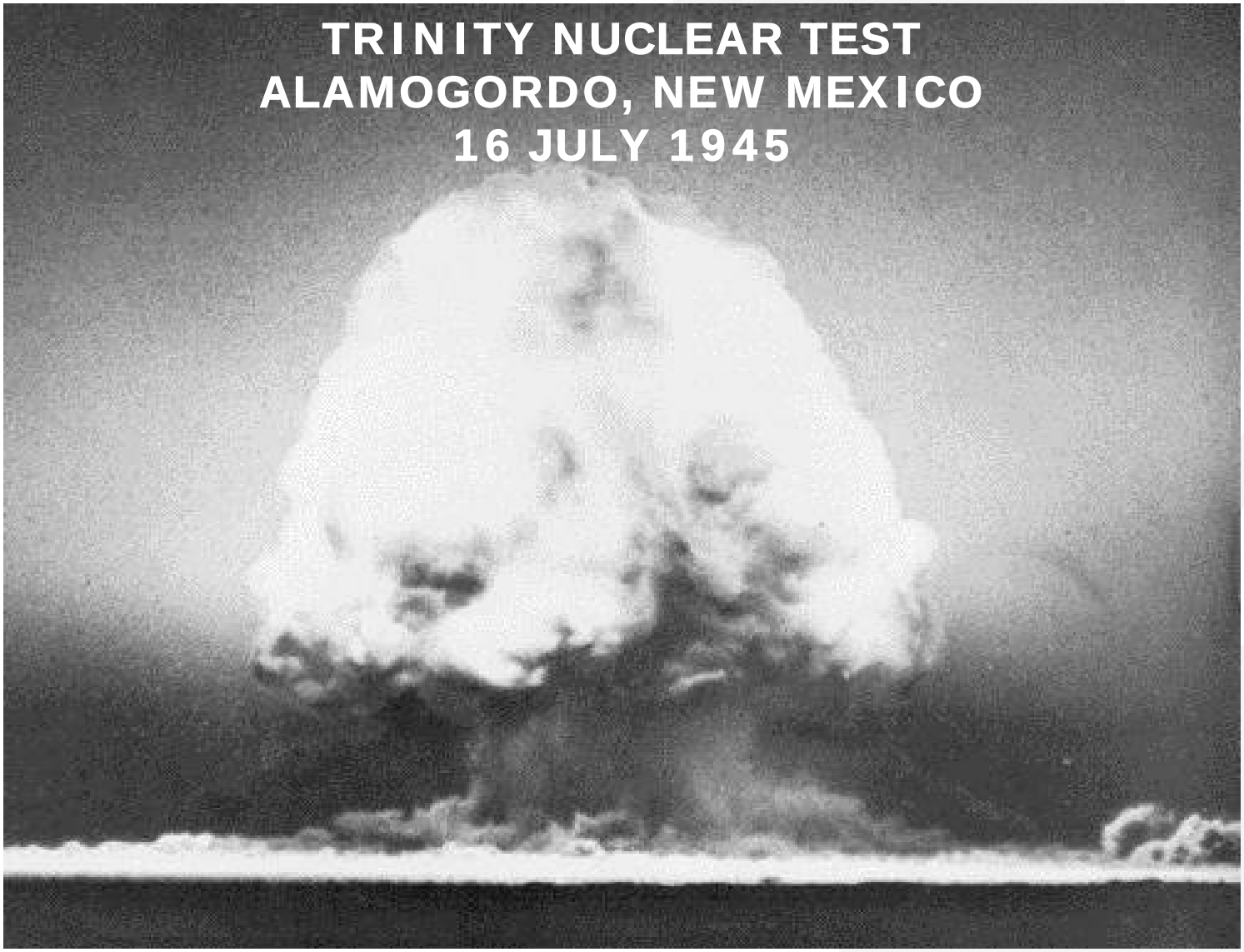
Even so, 20psi (the peak overpressure felt 1m from the explosion), is equivalent to over 880kg on a piece of A4 paper



On 16th July 1945, US Government scientists, working under the direction of J Robert Oppenheimer, detonated an implosion-design plutonium bomb which had the explosive power of 20,000,000 kg of TNT (20kt – kilotons)

If you were to stand 1m from the point of explosion, you would feel the equivalent of 400 million psi. this is equivalent to 280m tons per square metre. Luckily, the pressure wave wouldn't matter, as the radioactive fireball would have killed you immediately.

The most powerful nuclear weapon ever developed was the Soviet Union's RDS-220 "Tsar Bomba" hydrogen bomb, with a 1961 test-yield of 50 megatons (50,000kt, or 2,500 times more powerful than Trinity) – it had the capacity for 100mt, but was too expensive


TRINITY NUCLEAR TEST
ALAMOGORDO, NEW MEXICO
16 JULY 1945

The largest US bomb was the Mk41/B41 3-stage thermonuclear device, with a yield of ‘only’ 25mt in the late 1960s

The downside of these huge weapons was partly their size (the RDS-220 was 8 metres long, and the B41 weighed 4,800 kg) and partly their cost (some estimates put the cost of Trinity as $2bn - $25bn today)

The trend in the 1960s and 1970s moved away from small numbers of massive warheads, to larger numbers of smaller warheads, which were cheaper, lighter, more targetable (and got round the SALT I Treaty provisions, which only covered missiles, not warheads)

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NUCLEAR WEAPON STATES

Country	1st test
USA	1942
USSR/Russia*	1949
UK	1952
China	1964
France	1969

Defined in the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) 1968 as those countries which are allowed to possess nuclear weapons

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NUCLEAR ARMED STATES (NON-NPT)

Country	1st Test / Status
India	1974
Israel	1979 (Refuses to admit or deny)
Pakistan	1998
North Korea	2010
Iran	Denies weapons programme
Syria	Accused by US and Israel only
South Africa	Dismantled nuclear weapons in 1994

States which “which have developed nuclear weapons outside the framework of the treaty” (McDonnell, 2013:62)

At the peak of the Cold War, there were close to 80,000 nuclear warheads controlled by the nuclear states (almost 95% by USA/USSR)*.

Estimated total explosive power was around 40,000mt or two million times more than the Trinity test.

The Strategic Arms Limitation Treaties SALT 1 (1972) and SALT II (1979) cut the numbers being produced by the US and USSR.

The Strategic Arms Reduction Treaties START I (1991) and START II (2000) and Strategic Offensive Reduction Treaty SORT (2002) aimed to reduce the number of strategic operational warheads to under 1,700-2,200 on each side (though both also have non-deployed non-strategic weapons)

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At present (updated 18 December 2012)*, the Federation of American Scientists claims there are 4,100 operational strategic and c200 operational non-strategic warheads globally.

This is A Good Thing (it is also 700 fewer strategic warheads than this time last year)

The FAS also say that there are still 17,500 weapons in existence, but the extra ones are in storage etc. Even if the figure of 17,500 is a little high, it still means that almost 65,000 warheads have been removed from use.

This is also A Good Thing

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BUT…

Where have they all gone?

Some have been dismantled, several thousand are (in the language of the FAS, “awaiting dismantlement”) and the plutonium and (HEU) from Russia is being bought by the United States.

Partly to fuel its own atomic programme, but also to keep the substances from “falling into the wrong hands”

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What is Nuclear Terrorism?

Direct Air Attack:

In November 1972, a Southern Airways Dakota DC-9 was hijacked and a demand of $2 million was made. The hijackers circled the Oak Right National Laboratory in Tennessee and threatened to crash the DC-9 into the nuclear reactor there unless they received the money.*

Bombing:

Between 1973 and 1975, there were attacks on at least three nuclear reactors.

On 18 January 1982, a small group operating under the banner of the *Organisation of Arab Armed Struggle* and led by Ilyich Ramirez Sanchez,** launched an attack on an incomplete reactor on the Rhone valley in central France. The attack, using an ex-Soviet RPG-7 Rocket Launcher, failed.***

Pakistan has had nuclear weapons for over a decade, although the programme has been going since the 1970s.

Has c60 nuclear warheads, although the numbers are secret (but estimates put it as high as 200).

The US (and others) fear that the rise of the Taliban in the North-West Frontier / Swat area of Pakistan puts the nuclear missiles at risk.

How will the world react to Taliban-controlled weapons?

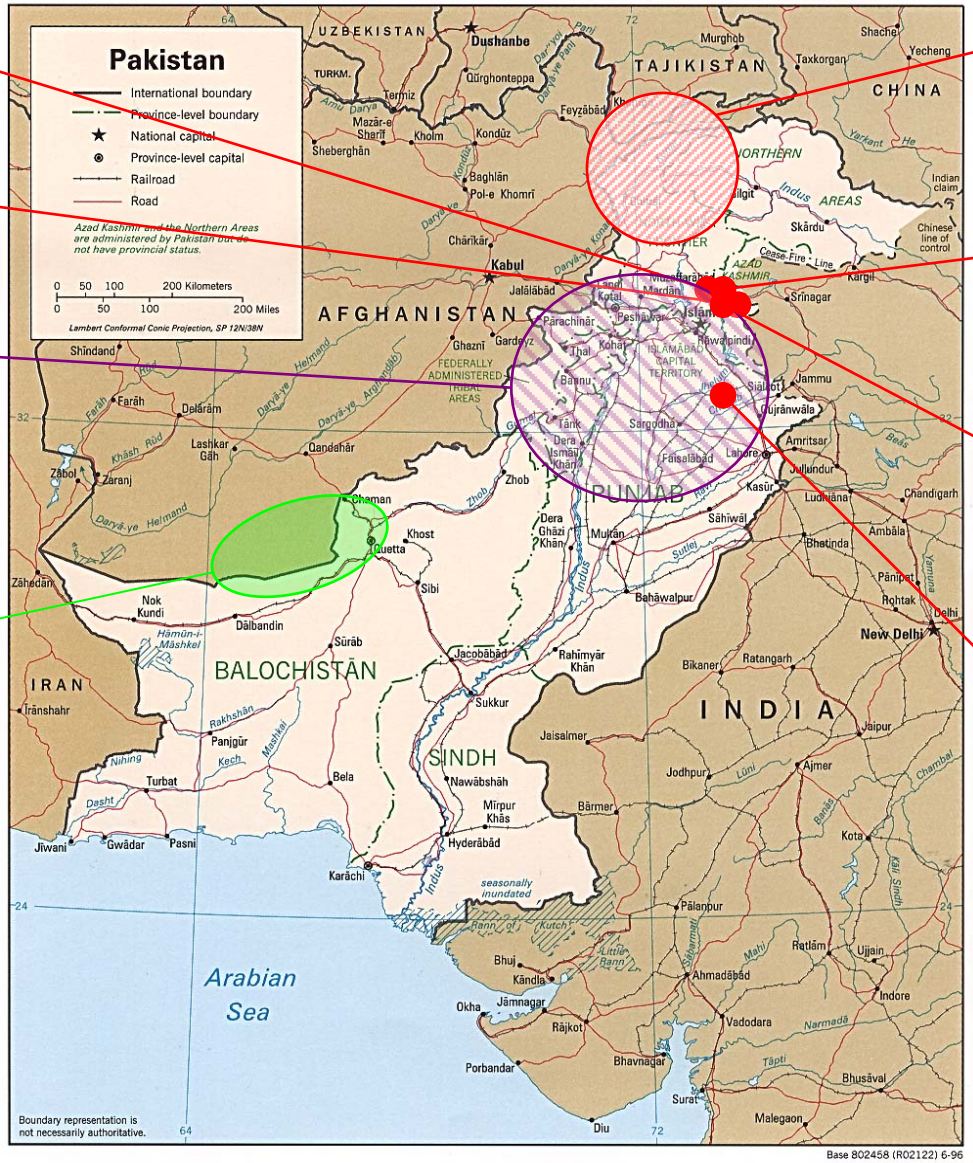
US has not ruled out a pre-emptive military strike against the missile locations…

Plutonium Separation

HEU Production

WEAPONS LOCATION?

1998 Nuclear Weapons Tests
5 x Ras Koh Hills;
1 x Kharan



SWAT REGION (TALIBAN CONTROLLED)

Pakistan Institute for Nuclear Science and Technology

Production of Shaheen Missiles

Weapons-Grade Plutonium Production

Dr Abdul Qadeer Khan (AQ Khan) founded Pakistan's nuclear programme in 1976

In 2004, he admitted selling secrets about nuclear weapons technology to governments in Iran, Libya and North Korea.

There were allegations a the time that his actions were sanctioned by the Pakistan government, but they strenuously denied this.

He was released from house arrest in 2009, but is still forbidden to talk to foreign journalists.

Most reports like to deal with the threat of full-blown Nuclear terrorism alongside other WMD – Chemical, Biological and Radiological.

This allows for reports like the December 2008 “World at Risk” report from the Commission on the Prevention of WMD Proliferation and Terrorism to say things like

> “[we] believe that unless the world community acts decisively and with great urgency, it is more likely than not that a weapon of mass destruction will be used in a terrorist attack somewhere in the world by the end of 2013.” (p. xv)

They do admit, however that:

> “[we] further believe that terrorists are more likely to be able to obtain and use a biological weapon than a nuclear weapon” (p. xv)

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What does the UN say about the threat it poses?

1986

Report of the International Task Force on the Prevention of Nuclear Terrorism

> "... the interest of terrorists and, as the case may be, their sponsors in acquiring nuclear weapons should be regarded as technically, politically and psychologically plausible"

2005

Porter Goss, Director, Central Intelligence Agency (Testimony before the US Senate Select Committee on Intelligence):

> “There is sufficient material unaccounted for [in Russia], so that it would be possible for those with know-how to construct a nuclear weapon.”

UN General Assembly adopts (by consensus) the International Convention for the Suppression of Acts of Nuclear Terrorism. Convention makes it an offence for a person who:

> “possesses radioactive material or makes or possesses a device with the intent to cause death or serious bodily injury or to cause substantial damage to property or to the environment”

2007

George F Russell, Jr, EastWest Institute:

> “There is no counter-terrorism goal more important for protecting people than the fight to prevent nuclear terrorism”

Paul Cornish, Chatham House:

> “The risk of terrorist use of nuclear weapons, as traditionally calculated, could scarcely be higher. For Western governments the risk is of such a magnitude that worst-case analysis seems not only unavoidable but also appropriate”

2012

US President Barack Obama (speech to Nunn-Luger Cooperative Threat Reduction Symposium:

> "I continue to believe that nuclear terrorism remains one of the greatest threats to global security… That's why working to prevent nuclear terrorism is going to remain one of my top national security priorities as long as I have the privilege of being President of the United States"

Seoul Communiqué, 2012 Seoul Nuclear Security Summit:

> "Nuclear terrorism continues to be one of the most challenging threats to international security"

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Is this an overstatement?

Yes.

1. Science.

   Creation and storage of a nuclear bomb takes specialist knowledge. Some terrorist groups may have access to this knowledge.

Yes.

2. Access

   Purchase of enriched radioactive material takes:

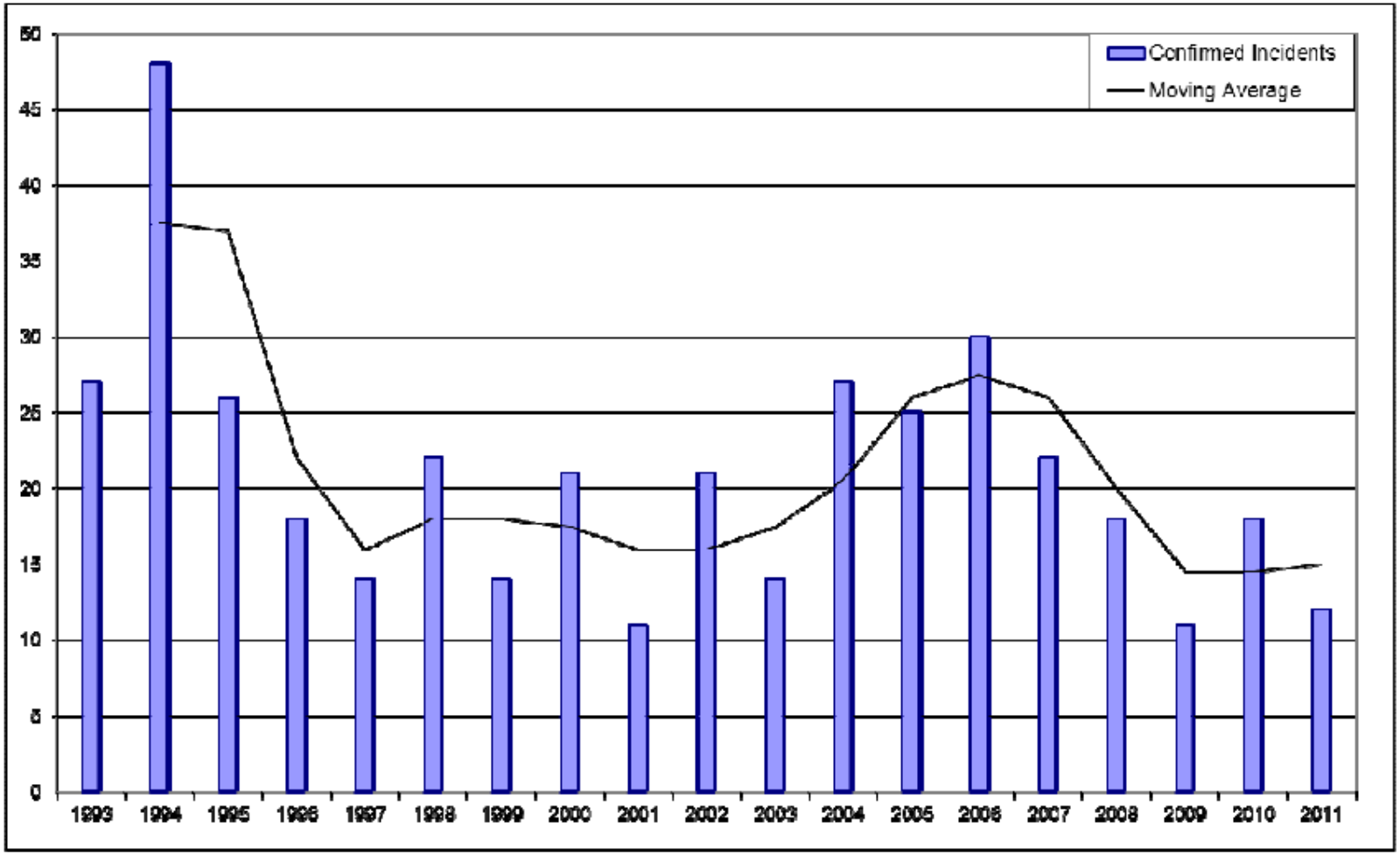
   a) Large sums of money. Some terrorist groups have access to the kinds of funds needed. The IAEA says there was one reported incidence of attempted sale of HEU in 2011

   b) Enough enriched radioactive material to achieve criticality. In history, not enough of this type of material has been lost or stolen

Illicit Trafficking Database (ITDB) set up by the IAEA in 1995 to:

> "record and analyse incidents of illicit trafficking in nuclear and other radioactive material. It incorporates all incidents in which nuclear and other radioactive material out of regulatory control"

Incidences reported to ITDB involving unauthorized possession of radioactive material and related criminal activities, 1993-2011.



Yes.

3. Impact

   Even if there was a nuclear detonation, however spectacular it might be, it would not destroy a city, let alone a civilisation.

   Joe Cirincione (President of the Ploughshares Fund) claimed the nuclear stockpile could “destroy the world, several times over” (Mueller, 2010:18)

   Physicist John McPhee pointed out, however, that:

   “the largest bomb that has ever been exploded anywhere was sixty megatons, and that is $^{1}/_{1000}$ of the force of an earthquake, $^{1}/_{1000}$ of the force of a hurricane” (1974:5)

4. International Treaties and Conventions

UN Treaty on Non-Proliferation of Nuclear Weapons 1968

Not strictly speaking a Treaty relating to Nuclear Terrorism, but one which nevertheless relates to the spread of nuclear weapons.

Article 1:

> Each nuclear-weapon State Party to the Treaty undertakes not to transfer to any recipient whatsoever nuclear weapons or other nuclear explosive devices or control over such weapons or explosive devices directly, or indirectly…

Designed to halt the spread of nuclear weapons to countries which had not yet developed them, which at the time was the whole world bar the UK, US, USSR, and China.

UN Convention on Physical Protection of Nuclear Material 1980

Didn't enter into force until 1987 as many countries delayed in ratification. Scope is mainly the security during the transport of nuclear material

Preamble:

> DESIRING to avert the potential dangers posed by the unlawful taking and use of nuclear material;
>
> CONVINCED that offences relating to nuclear material are a matter of grave concern and that there is an urgent need to adopt appropriate and effective measures to ensure the prevention, detection and punishment of such offences

Annexes give the level of protection each type of material needs (over 5kg of U-235 warrants the highest level protection)

UN Convention for the Suppression of Act of Nuclear Terrorism 2005 has had a further attempt at clarifying the situation.

Art 1.2 of the Convention defined “nuclear material” as:

> “Plutonium, except that with isotopic concentration exceeding 80% in P^{238}; U^{233}; uranium enriched in the isotope 235 or 233; uranium containing the mixture of isotopes as occurring in nature other than in the form of ore or ore residue; or any material containing one or more of the foregoing.”

It is a “prosecute or extradite” Convention, as are most of the UN Counter Terrorism Conventions

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Why do they do it?

Fear is useful as a way of building political support.

Professor Phillip Morrison, Cornell University, 1946

> “We have a chance to build a working peace on the novelty and terror of the atomic bomb”

Professor Paul Boyer, University of Wisconsin-Madison, 1985

> “The strategy of manipulating fear to build support for political resolution of the atomic menace helped fix certain basic perceptions about the bomb”

Diversion from more likely, but less dramatic types of terrorism?.

“Rogue States” – how likely are Iran, North Korea, Syria(?) to:

a) Develop

b) Test and

c) Use in anger

“Radiological Terrorism”

In 1996, “Chechen rebels left a substantial quantity of caesium-137 wrapped in conventional explosive, in Izmailovo Park in Moscow. The device was not detonated.”*

Since no nuclear power stations exist in Chechnya, it is most likely that this radioactive material was stolen, either from the closest reactor, in Armenia, or elsewhere in the Former Soviet Union

Radiological Terrorism can be (wrongly) thought of as nuclear terrorism-lite

The “dirty bomb” (radiological dispersal device / RDD) is effectively a conventional bomb, of whatever size you choose to make it (from a waistcoat to a truck), packed around with radioactive material.

Not a new idea – Hitler had plans to drop a radiological bomb on Manhattan in 1944, but didn’t have the delivery vehicle capability

Radioactive material is available very easily from:

- CD player
- DVD player
- PC/Laptop
- Air conditioning units
- Smoke detectors

The death toll from an RDD will initially be no larger than that from the same size conventional bomb, but radioactive particles will be released into the atmosphere, heightening the risks of various types of cancer in the population.

- “the pure terror weapon”

Can also use radioactive material for assassinations – Polonium-210 and Alexander Litvinenko.

The US-based Health Physics Society has created a Dispersal Devices Subcommittee specifically to deal with the threat.

They list 3 types of RDD:

A high energy radioactive source strapped to the bottom of a park bench, or left in a busy public location.

Low probability; significant health risk to small numbers; easy detection & remediation; low psychosocial impact.

A radioactive liquid dispersed from a moving vehicle or into a body of water

Low probability; low/moderate health impact; hard to detect; can be significant psychosocial impact.

A conventional explosive used to disperse radioactive material across a target area also known as a Dirty Bomb

High probability; low health impact (after initial explosion); easy detection, significant psychosocial impact.

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Summary

The SIS (MI6) states that they assist the Government in:

Working to strengthen the international non-proliferation regime, and to dissuade states from acquiring, developing and contributing to the spread of Chemical, Biological, Radiological and Nuclear Weapons (CBRN). This includes their means of delivery and related material or expertise.

Working to detect attempts by proliferator states and terrorists to develop or acquire CBRN weapons and their means of delivery.

Recommendation: Dis-aggregate WMD.

CBRN weapons do not pose, and never have, the same risks as each other.

They would also not generate the same magnitude of event.

Nuclear Weapons are dangerous, expensive, complicated and the material contained within them should be secure from theft, accident and act of nature.

Nuclear Terrorism is one of the bogeymen of 21st Century – beloved of alarmists, politicians, Bond villains and the like.

In reality, full-on nuclear terrorism will not occur.

Is there a risk? Yes, an infinitesimally small risk, but one of great magnitude.

Radiological terrorism, via RDD is not unlikely. Higher risk, lower impact.

Focus on nuclear terrorism is a mistake, and I would argue that the UN should shift its focus onto RDD instead.

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