Nuclear Terrorism

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Ever since the terrorist attack of 11 September 2001, chances of the use of weapons of mass destruction(WMD) by terrorists groups are not the material of Hollywood movies alone anymore. The idea of terrorists using WMD is not a new idea. After the end of the Cold War, a number of books and articles in leading journals have visualized such scenarios. Another scenario was nuclear accidents. Like conventional ammunition accidents, it is possible that nuclear ammunition may also be set off accidentally or even by terrorist sponsored sabotage.

The main threat was from suitcase-type crude fizzle yield bombs which a terrorist organization could buy in the black market from ex-Soviet Union stocks or manufacture them crudely using techno-terrorists. It is open knowledge that 3 Kg of plutonium or 3-8 Kg of highly enriched uranium can produce a one kiloton crude bomb. Even reactor-grade plutonium is considered sufficient for a crude though dangerously unsafe bomb. The internet has enough material for design. The key issue is fissile material. This is the most difficult hurdle to cross.

Another threat was the use of radiological bombs to contaminate maximum area. *Newsweek* of 8 October 2001 reported that the *Al Qaeda* has obtained Cesium 137 and Cobalt 60 and may be experimenting with "dirty" bombs or RDDSs (Radioactivity dispersal device).

The two nuclear accidents at the Three Miles Island in 1979 in US followed by the Chernobyl accident of 1986 in the former Soviet Union have left a strong public fear regarding the use of nuclear energy. In US, no nuclear utility was added from 1979; however, in 2001, the government decided to go ahead with more nuclear plants of safer design. The planners will have to address the issues of nuclear safety that will be highlighted with the generation of nuclear power and the disposal of nuclear waste.
One scenario that can be imagined is a direct attack on a nuclear facility or utility. Since 1990, India and Pakistan have an agreement on the prohibition of attack against nuclear installations and facilities. Key features are:

- Each party shall refrain from undertaking, encouraging or participating in, directly or indirectly, any action aimed at causing the destruction of, or damage to, any nuclear installation or facility in the other country.
- The term "nuclear installation or facility" includes nuclear power and research reactors, fuel fabrication, uranium enrichment, isotopes separation and reprocessing facilities as well as any other installations with fresh or irradiated nuclear fuel and materials in any form and establishments storing significant quantities of radio-active materials.
- Each Contracting Party shall inform the other on 1st January of each calendar year of the latitude and longitude of its nuclear installations and facilities and whenever there is any change.

Unfortunately, in dealing with non-state actors, no treaties are possible. Security of nuclear power plants now assumes importance to ward off unconventional attacks. Providing air defence against air power, or defence against ground attack would not be enough.

In a study which appeared in the *Current Science* in May 2001, the authors highlighted four categories of nuclear accidents as :-

Category 1: High Explosive(HE) does not burn or detonate. Fissile material unaffected.
Category 2: HE catches fire and burns. No detonation. Melting and fragmentation of fissile core into aerosol.
Category 3: HE detonates fissile material into aerosol, no nuclear yield.
Category 4: HE detonates and nuclear explosion takes place.

Category 4, being like any other bomb, did not require any study. However, Category 3 was considered the most serious and likely. Although safety measures do not allow mating till the last moment of all the links, sabotage on these lines cannot be ruled out in volatile regions like South Asia. In such an eventuality, plutonium will be oxidized to PO2. 20% or 1 Kilogram of the Plutonium would convert to aerosol of respirable size. The principle risk to human health is the inhalation of weapon grade plutonium mix which would consist of 93.8% Plutonium 239 (half life 24,400 years), 5.8% isotope Plutonium 240 (half life 6580 years) and Plutonium 241 (half life 13.2 years). Downwind casualty estimates in a typical cantonment/airbase with a population of 10-12 million in an area of 600-800 Sq Km were 5000 fatal cancer deaths. In semi-urban areas like Jalandhar or Agra, the parameters of downwind distance of 50 kms, population of 0.75 million and an area 10 Sq Km indicated 230 fatal casualties.

Regarding countermeasures against accidents, non-deployment, separate storage and disassembled warheads are recommended; against unconventional terrorists' attacks on nuclear facilities, more research for safety and countermeasures is needed.