A DEFENSE TACTIC TO MITIGATE A NUCLEAR ATTACK DESTRUCTION

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ABSTRACT: The paper proposes a solution to a nuclear threat in civilian areas. A nuclear bomb is typically made of upto 25 kg enriched uranium and the explosion is measured in equivalent of TNT.A TNT explosion releases an energy of 4680 joules per gram. Every apartment building in the national capital territory consumes 8400 liters water a day. This water when recycled and fed to an aquifier makes enough enthalpy to absorb the explosion energy.

Keywords: Uranium, Trinitrotoulene, Aquifier.

INTRODUCTION: In 1841, Eugene-Melchior Peligot first isolated the uranium metal and the nuclear reactor fuel element Uranium-235 has 92 protons and 143 neutrons[1]. The radioactive decay of uranium-235 atom when bombarded by a neutron, produces electricity and initiates a chain reaction[1]. The fission of a uranium-235 nucleus releases an energy of 200 million electron volts per unit mass[1].An electron volt is the energy acquired by an electron when accelerated by a 1-volt battery[1].In a nuclear explosion, the number of fissions is 10 raised to the power of 24, more than the sand grains in the entire world[1]. The naturally available uranium isotope U-238(99.28 percent) is processed to make U-235[1]. The half-life times of U-238 and U-235 are 4.47 billion years and 700 million years respectively [1].

LITERATURE SURVEY: A Nuclear explosion results in a shock wave causing a sudden change in the ambient pressure [2]. People exposed to the blasts would have severe lung and ear drum damage, as well as get exposed to flying debris[2].People in the direct line of sight of the explosion would be exposed to a thermal pulse and killed instantly[2]. People would suffer severe radiation sickness, chromosomal damage, marrow and intestine destruction, and hemorrhaging [2].The next generation impact would be hereditary illness and birth defects[2]. The nine country nuclear club has about 27000 operational nuclear weapons among them [2].Only, any 50 of the nuclear weapons could kill 200 million people[2].The yield of a nuclear explosion is expressed in terms of TNT (2,4,6-trinitrotoulene) explosives [2]. The atomic bomb that destroyed Hiroshima in August 1945, had the explosive force of 20,000 tons of TNT[2]. The burst temperature reached over a million degree Celsius, it ignited the surrounding air, forming a fireball some 840 feet in diameter [2].The nuclear proliferation raises concerns over illegal transfer of nuclear technology to terrorist groups from the so called 'rogue' scientists of Pakistan viz. AQ Khan[3]. The hundred and odd terrorist groups try to acquire nuclear weapons as a psychological impact on the concerned society, calling it, 'a religious duty'[3]. Four faces of nuclear terrorism viz the theft and detonation of an intact nuclear weapon, the theft or purchase of fissile material to fabricate and detonate a crude nuclear weapon, the attack on or sabotage of nuclear installations, and the dispersal of highly radioactive material by conventional explosives or other means[3].Pakistan's sympathy to radical Islam may offer nuclear assistance to terrorist organizations espousing an intensely anti-Western ideology[3]. Normally, nuclear weapons use Uranium enrichments in the neighbourhood of 90percent or higher[4].Typically, 10 to 25 kg of enriched uranium is needed to make a bomb[4].The bomb dropped at Nagasaki was made of Plutonium, and Plutonium is extracted by chemical separation of U^{235} spent fuel [4].Any nuclear weapon yield is below 17kiloton/kg of fissile material, with an approaching efficiency of 40 percent[4].U^{235}

has a nominal critical mass of 10-11 kg with 2.52 neutrons produced per fission, given 17 cm to be the mean free path in the material of density 19g/cm^3[4].The time between successive fission reactions in an atomic bomb is 10^{-8} seconds[4].A nuclear bomb is made of implosion method and the implosion shock wave has a speed of 5000m/s[4].

METHODOLOGY and DISCUSSION: A TNT explosion releases an energy of 4680 joules per gram[5]. Explosion is an accumulation of energy from a chemical explosive as energy from initial exploding site activates the neighbouring material [5]. The two activation mechanisms are viz mechanical shock pressure forces (detonation) and energy transfer by thermal process (deflagaration)[5]. Explosion products are formed both in direct explosion reaction and by reaction with surrounding atmosphere [5].Direct products include carbondioxide, carbonmonoxide, watervapour, molecular nitrogen and small amounts of ionized gases [5].The blast wave generated by an explosion damages the air to the extent air acts as an ideal gas[5].The molar heat capacity values of air, C_p, is around 29.2 J/mol-K for the entire temperature range and the limiting air pressure is 10 bar[5].For a given damage, the optimum burst height of an explosion is 400-800 metres above the ground[5]. This blast wave is generated when the atmosphere surrounding the explosion is pushed back, as by the gases generated in a chemical explosive [5].The spherical shock wave after a nuclear explosion travels with an average Mach number 2[5].A nuclear explosion causes a deflagaration vapour –cloud explosion in the unconfined atmosphere and appears to be a low intensity shock wave[5]. Unusually heavy rainfall of twenty centimeters per hour corresponds to liquid water content of ten grams per stere (cubic meter)[3].This increases density over that for air at the same pressure and temperature of about one percent, and a transmission factor 1.003 correspondingly[5].

Evaporation from vegetation, moist surfaces on land and oceans forms clouds to return water to land in the form of precipitation. Precipitation includes rain, snow and hails. This cycle of evaporation and precipitation is called Hydrologic cycle[6].The rain water infiltrates into ground, as much as 25mm/hr in forests to a few millimeters per hour in clayey soils and zero in paved areas[6]. Underground water occurs in unsaturated zones and saturated zones. Saturated zone supplies water to wells and springs, and is recharged by percolation of water through unsaturated zone[6].The unsaturated zone is divided into soil zone, intermediate zone and capillary fringe[6].The soil zone extends to a depth of two meters and the intermediate zone varies in thickness from place to place[6].The capillary fringe is a result of attraction between water and rocks[6].The soil characteristics (volume) of interest are porosity(55 %) ,specific yield(40%) and soil retention (15%).The annual rate of movement(meters) of water below the land surface is 4.12 percent [6]. Saturated geologic formations that store and yield freshwater in usable quantities are called AQUIFIERS[7].Effective porosity and ground water movement are the major detrimants of an aquifier [7]. World water inventory in the form of soil moisture and ground water are 0.07 km^3 * 10^6 and 60 km^3*10^6 respectively [7]. One acre foot of water per year is the demand of a single-family home[7].

The solution proposed in the paper is, 'Artificial recharge of an aquifier using pit method'. Infiltration rates in clayey soils is in the range of 0.15 to 0.3meters per day[7].The pit depth could be 8.1meters for a duration of 30 days recharge[7].The present apartment model construction in delhi is 14 floors with six flats each floor. A single family consumes 25 liters of water each member in the bathroom. Thus, the bathroom water consumption of an apartment building is 14*6*4*25 =8400 liters per day. This water could be recycled in the building itself and then fed to the pit for artificial recharge of an aquifier. The enthalpy of superheated steam at stagnation pressure, 10 bar, is 2828.3 KJ/Kg [8].The nuclear yield of the bomb discussed in the paper is 17 *10^6*25*0.4*4.680 =795MJ. Neglecting the sensible heat required to superheat, the total heat content of 8400 liters is 23.76 MJ. Thus, to neutralize a nuclear explosion,given the soil porosity and specific yield, the 72.7 days of pit recharge is needed. Owing to the transmission factor of 1.003, the shock waves could could be contained in a given region.

CONCLUSION: Pit recharge of an aquifier proposes a solution to the destruction of nuclear attack. The pit method improves the ground water level and thus makes an arrangement to accommodate for the exothermic heat produced in a nuclear explosion. The superheated vapour produced makes the atmosphere excessively moist that shock wave propogation decreases, however, to be quantified. It also paves a way for water conservation and to improve underground water levels. No matter the technological destruction, humanity finds always finds a way to survival.

REFERENCES:

1. Charles D.Ferguson, ’Nuclear Energy- What everyone needs to know’, Oxford University press, ISBN 978-0-19-975945-3, pg 1-52.

2.Joseph M. Siracusa, Nuclear Weapons- A Very Short Introduction, Oxford University Press (2008), ISBN 978-0-19-922954-3.

3.Charles D. Fergusson, William C.Potter,Amy Sands,Leonard S.Spector,Fred L.Wehling, ’The Four Faces of Nuclear Terrorism’, Monterey Institute of International Studies,ISBN1-885350-09-0.

4. David Bodansky,’Nuclear Energy,principles,Practices and Prospects’,Springer, ISBN 0-387-20778-3.

5.Gilbert F.Kinney,Kenneth J.Graham,’Explosive Shocks in Air’,Springer,ISBN 978-3-642-86682-1.

6. Ralph C.Heath, ’Basic Ground-Water Hydrology’,U S Geological survey- water supply paper 2220, 1987.

7. ‘Handbook of Ground Water Development’, Roscoe Moss Company, A Wiley-Interscience Publication, ISBN 0-471-85611-8.

8. ASME Steam Tables Compact Edition, www.asme.org,ISBN: 0-7918-0254-x