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It’s MAD

If It Happened Here: The Impact of a Nuclear Bomb on Adelaide

One should pity any hypothetical alien scientists studying humanity from afar. After all, it is highly likely that all such research would lead to is utter confusion. We discuss rationality yet frequently act without it. We espouse peace but declare war. We pursue innovation to improve lives, before our militaries harness that technology to devise new methods of destruction. To the unaccustomed observer, we must seem to be an almost extraordinarily contradictory species. Possibly quite mad.

If What Happened, Exactly?

At 8:15am local time, on August 6th, 1945, an atomic bomb was dropped over Hiroshima (Imperial War Museums, 2025). ‘Little Boy’ exploded approximately at a height of around 600 metres (Ibid.). This was the world’s first use of a nuclear weapon in warfare, and it was devastating (CTBTO, 2011). The bomb, employed a highly-enriched uranium core, had an approximately 15 kiloton yield, equivalent to around 15,000 tonnes of TNT (United States Deparment of Energy, n.d.). The fireball achieved its maximum size, a diameter of 274.32 metres, in roughly one second (National Park Service, 2023). Temperatures on the surface at the hypocentre reached between 3,000 and 4,000 degrees Celsius (Hiroshima Peace Memorial Museum, 2025). In the fireball’s centre, it exceeded 1,000,000°C (City of Hiroshima, n.d.). Looking at the flash of light directly, with the naked eye, would be blinding (Ibid.). The mushroom cloud climbed to 60,000 feet within ten minutes, stretching higher into the sky than the plane which released it was flying (Atomic Archive, 2024). An estimated 80,000 individuals died from the blast, heat, and radiation in under a minute, while it is estimated that 140,000 had perished by the close of 1945 (Op. cit.). Over 90% of the once-bustling city, Japan’s seventh-largest at the time, was razed (World Nuclear Association, 2024). This was the ‘prompt and utter destruction’ which had been threatened at Potsdam (United States Department of State, n.d.). Three days later, Nagasaki would suffer from nuclear destruction – with a 21 kiloton plutonium-bomb detonated nearly 500 metres above ground (Op. cit). Due to surrounding hills, the blast’s effects were somewhat mitigated. Nonetheless, 40,000 departed this life instantly

Figure 1: Aftermath of the atomic bomb in Hiroshima (Anon., 1945).

Figure 2: Aftermath of the atomic bomb in Nagasaki (Yamahata, 1945).

(United States Deparment of Energy, n.d.). In the ensuing years, atomic survivors suffered from increased incidences of leukaemia and solid cancers, including those afflicting the thyroid, breasts, and lungs (World Nuclear Association, 2024). That was the legacy of radiation.

We are now 80 years on.

Since World War Two, world powers have been refining their nuclear capabilities. Presently, there are nine nations in possession of nuclear weapons (International Campagin to Abolish Nuclear Weapons, 2025) – adherents to the principal of Mutually Assured Destruction (MAD). An apt acronym. The ruin witnessed in Hiroshima and Nagasaki was a product of nuclear fission (Op. cit). Subsequently, the first thermonuclear warheads were tested by the United States in 1952 (Encyclopaedia Britannica, 2025). Globally, there are over 12,000 nuclear weapons (International Campagin to Abolish Nuclear Weapons, 2025). The B-83 is currently the largest in the US' arsenal, with a maximum yield of 1.2 megatons, is 60 times larger than 'Fat Man', used on Nagasaki (Phelan, 2022). For scale, the largest nuclear weapon ever tested – the Tsar Bomba – had a 50 megaton yield (Ibid.). That is power equivalent to 3,500 times that of the bomb deployed over Hiroshima (Ibid.).

The Science Behind Nuclear Weapons

Nuclear weapons can be broadly divided into the two aforementioned categories (Encyclopaedia Britannica, 2025) – those deriving their energy from nuclear fission (atomic bombs), and those which use nuclear fusion (thermonuclear or hydrogen bombs). Thermonuclear weapons have the capacity to cause significantly more destruction than atomic bombs, with the ability to be hundreds or thousands of times more powerful than a fission weapon (Ibid.).

Fission

Nuclear fission refers to the 'subdivision of a heavy atomic nucleus' (Encyclopaedia Britannica, 2025). For instance, as in Hiroshima and Nagasaki, uranium or plutonium (World Nuclear Association, 2024). The splitting of a heavier nucleus into two lighter nuclei of similar size to one another is accompanied by the release of tremendous amounts of energy (Op. cit.). This process can 'be induced by the excitation of the nucleus with a variety of particles' (Ibid.), such as neutrons, alpha particles (essentially the nucleus of a Helium-4 isotope, He^{2+}), or deuterons (the nucleus of deuterium, comprised of one proton and one neutron) (Ibid.). Gamma rays, a form of electromagnetic radiation (EMR) are also able to induce excitation. In addition to the energy released, neutrons and radioactive products are emitted through this process (Ibid.). This allows for a chain reaction, whereby the neutrons released from one instance of nuclear fission can create nuclear fission in another nucleus of fissionable material in the vicinity (Ibid.).

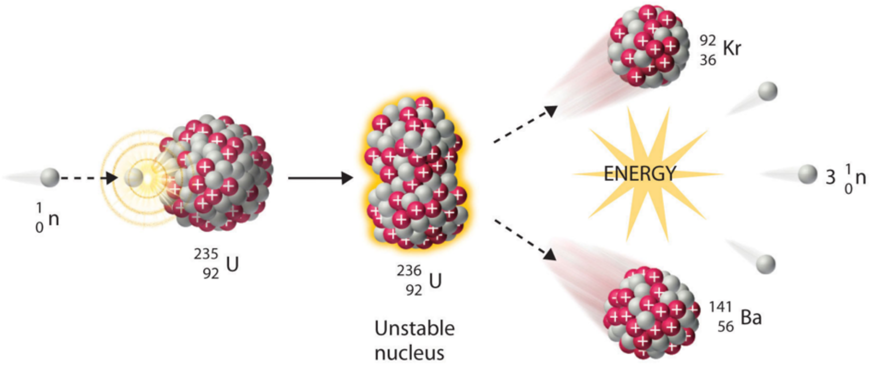

Figure 3: The process of nuclear fission (Science Ready, 2025).

Fusion

Where fission is the division of a nucleus, fusion is almost the opposite concept. It is, in fact, the energy generation method used by the Sun and stars (Encyclopaedia Britannica, 2025). In this process, two nuclei of a light element – such as hydrogen – combine to create a heavier nucleus (Ibid.). Commonly used materials for fusion are hydrogen isotopes deuterium and tritium (Ibid.). Under extremely high temperatures, the kinetic energy present allows the two nuclei to overcome 'long-range' electrostatic repulsive force, subsequently permitting the 'short-range' strong force to fuse the nuclei together (Ibid.). To allow for the necessary temperatures to induce such a reaction, fission is first used. The energy generated from this then facilitates the nuclear fusion process. This effectively creates a basic two-stage nuclear device, capable of producing enormous amounts of energy and radiation (Ibid.). The aforementioned Tsar Bomba was a thermonuclear device (Phelan, 2022).

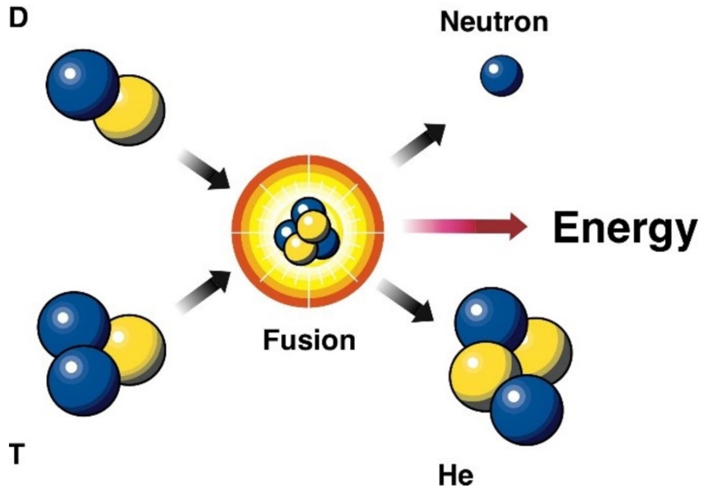

Figure 4: The process of nuclear fusion (United States Department of Energy, n.d.).

What if it Happened Here?

There are numerous variables which affect the destructiveness and impact of a nuclear weapon. The device's yield, the height of its burst, environmental factors, and target characteristics (Op. cit). For example, an air burst will reduce radioactive fallout while maximising blast radius and thermal impact (Wolfson & Dalnoki-Veress, 2022). In a ground burst, a crater is produced, and more debris is collected in the explosion, allowing for a wider spread of fallout (Ibid.). In Nagasaki, surrounding hills protected portions of the city from the blast (United States Deparment of Energy, n.d.).

To simulate the effects of what happened 80 years ago on modern-day Adelaide, we could explore two scenarios: if ‘Little Boy’ were to be dropped as in Hiroshima, or ‘Fat Man’ was used as in Nagasaki. Using software developed by Professor Alex Wellerstein of the Stevens Institute of Technology in Hoboken, New Jersey, in the Science and Technology Studies program in the School of Humanities, Arts, and Social Sciences, we could model the effects of such scenarios (Wellerstein, 2025).

Notably, roughly 1.4 million people inhabit the Greater Adelaide area (Government of South Australia, 2025). Geographically, the city itself is located on the Adelaide Plains (Ibid.). It is hemmed in to the east by the Adelaide Hills (Ibid.).

For consistency across both scenarios, we will assume that the Ground Zero area of the bombing is in the centre of Victoria Square, at the heart of Adelaide’s CBD. As per Hiroshima and Nagasaki, both explosions will be air bursts (United States Deparment of Energy, n.d.). ‘Little Boy’ will be detonated at 600m above Ground Zero, while ‘Fat Man’ will be detonated at 500m overhead, for consistency with the original events.

Little Boy

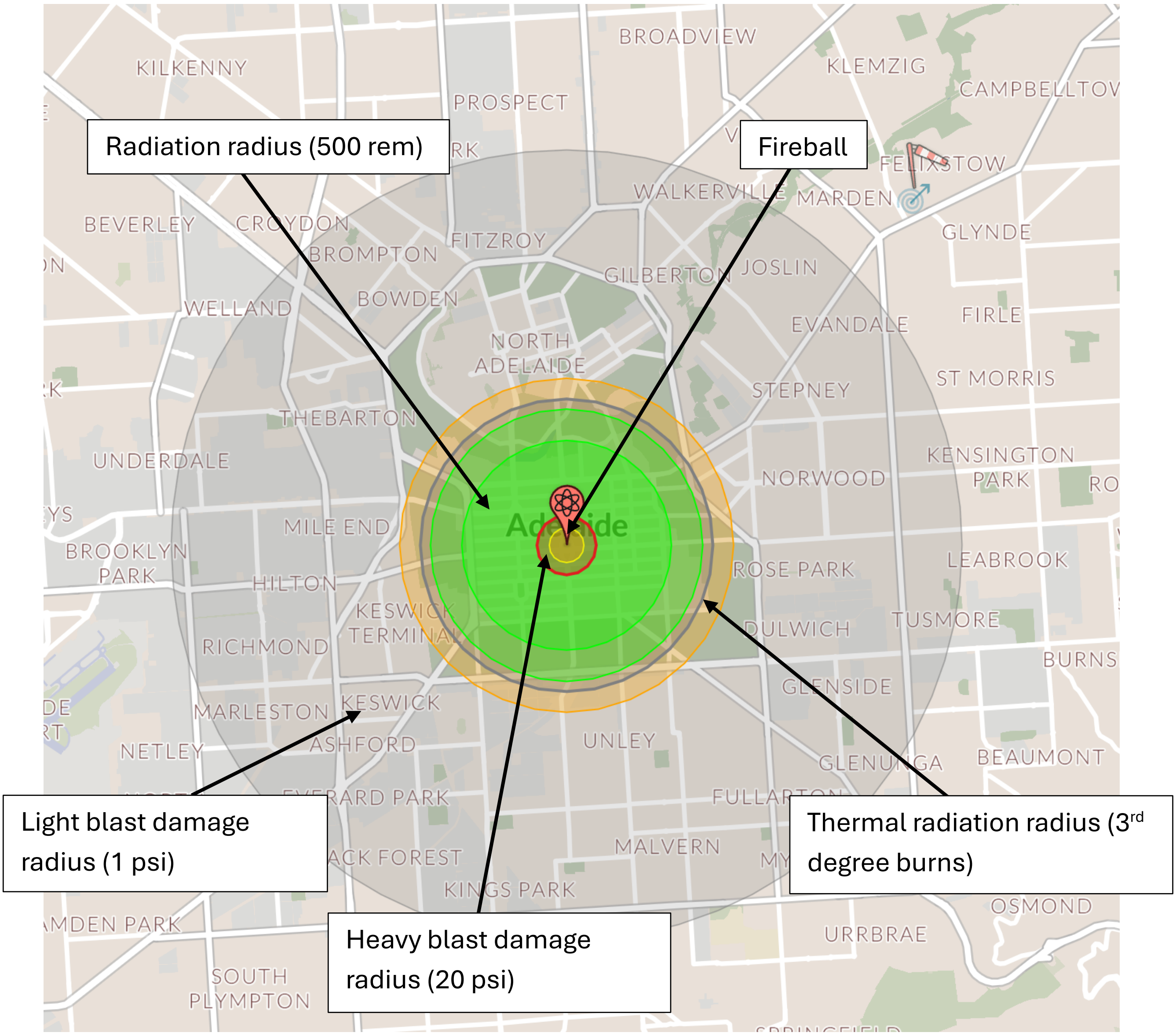

Figure 5: Annotated diagram demonstrating the impact of 'Little Boy' on Adelaide.

The bomb detonated over Hiroshima was a 15 kiloton weapon. According to this modelling, if it were to explode similarly at 600m above Victoria Square, the fireball radius would encompass a radius of 198m. In this vicinity, any human being would be instantly vaporised. The heavy blast damage radius (20 psi), wherein concrete buildings are severely damaged or destroyed, would span 339m. In a significantly urbanised area, this is likely to cause critical destruction. The radiation radius for ionising 500rem radiation extends 1.2km. This dose is likely fatal, at least within one month. As demonstrated in Figure 5, this would include almost the entirety of Adelaide's CBD, between North, East, West, and South Terrace. The thermal radiation radius could extend 1.91km, with individuals in this area suffering 3rd degree burns. The consequences of this could include devastating scarring, amputation, or even disablement. Pertinently, much critical infrastructure required for humanitarian response – including the Royal Adelaide Hospital – is located within this area. Light blast damage, such as the shattering of windows and injuries, would be felt 4.52km away in suburbs such as Tusmore, Walkerville, and Marleston. Modelling suggests initial causalties at 10,810 dead, with 42,380 injured. It is highly likely that thousands more would perish as a result of injuries with time, while cancer incidences increased amongst survivors.

Fat Man

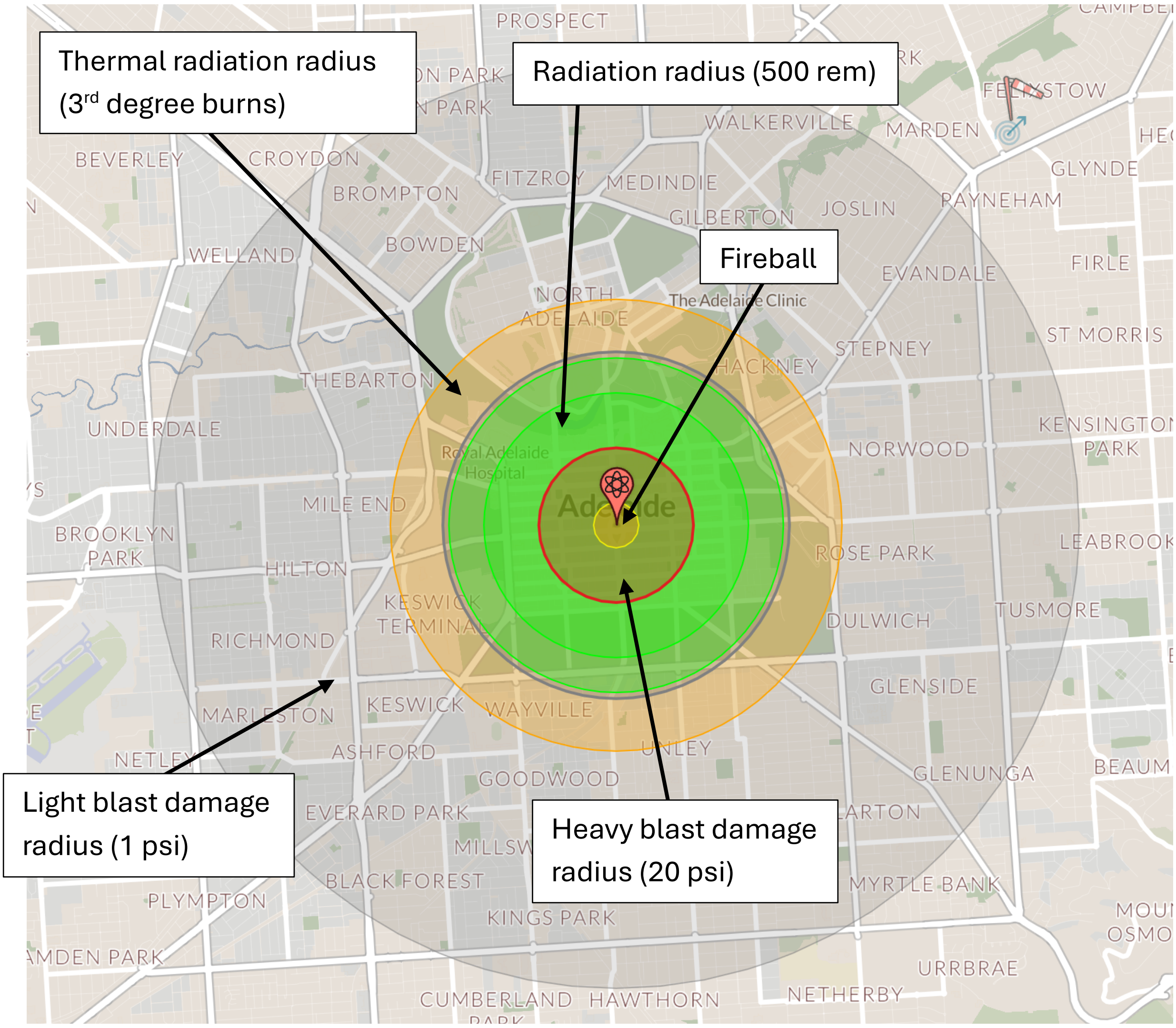

Figure 6: Annotated diagram demonstrating the impact of 'Fat Man' over Adelaide.

The bomb detonated over Nagasaki was a 21 kiloton weapon. According to this modelling, if it were to explode similarly over Victoria Square at 500m, the fireball radius would be 227m. Here, one would be instantly vaporised at temperatures reaching thousands of degrees Celsius. The heavy blast damage radius would extend to 780m, encompassing a large portion of the CBD area. The radiation radius (500 rem) would span 1.33km, including the entire CBD area and further aspects of the Adelaide Parklands. The thermal radiation radius would possess a 2.26km radius, with 3rd degree burns and severe injury in this area. The light blast damage radius extends 4.64km in this scenario, including Mrytle Bank, Glenunga, and Underdale. The immediate estimated fatalities are 11,870, with 45, 120 injuries. During subsequent months, thousands more a likely to succumb to injuries or suffer from higher incidences of cancer and radiation-related illness.

This is MAD

Nuclear weapons are indiscriminate. Their effects do not selectively target military assets over civilians. In the event of a nuclear attack, humanitarian responses would be limited by severe damage to infrastructure and the risk of contamination from radiation. In the continued development of nuclear weapons, we ought to be aware of these painful facts. We are able to ensure our own self-annihilation at the press of a button, with response in kind.

Choosing anything other than the path to peace would be MAD.

Word Count: 1500

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