The Next Nuclear Power Plant Explosion Catastrophe Bangs at Our Doors

Burnt into the headlines of our lives, preventable Fukushima explosions blast through our memories, and the Three Mile Island nuclear accident halted nuclear plant construction for years.

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Abstract

Only recently were the facts learned to prove that a Three Mile Island explosion cover up occurred. Both of these accidents shared shocking similarities, and had the government not misled the entire world, Fukushima would not – in high probability - have exploded at all. A chain of eleven nuclear reactor meltdowns and several explosions pepper the history of nuclear power plants. More importantly, research predicts the next meltdown between now and 2039 with a one in two probability of an explosion similar to Fukushima. However, emergency actions will stop this imminent explosion.

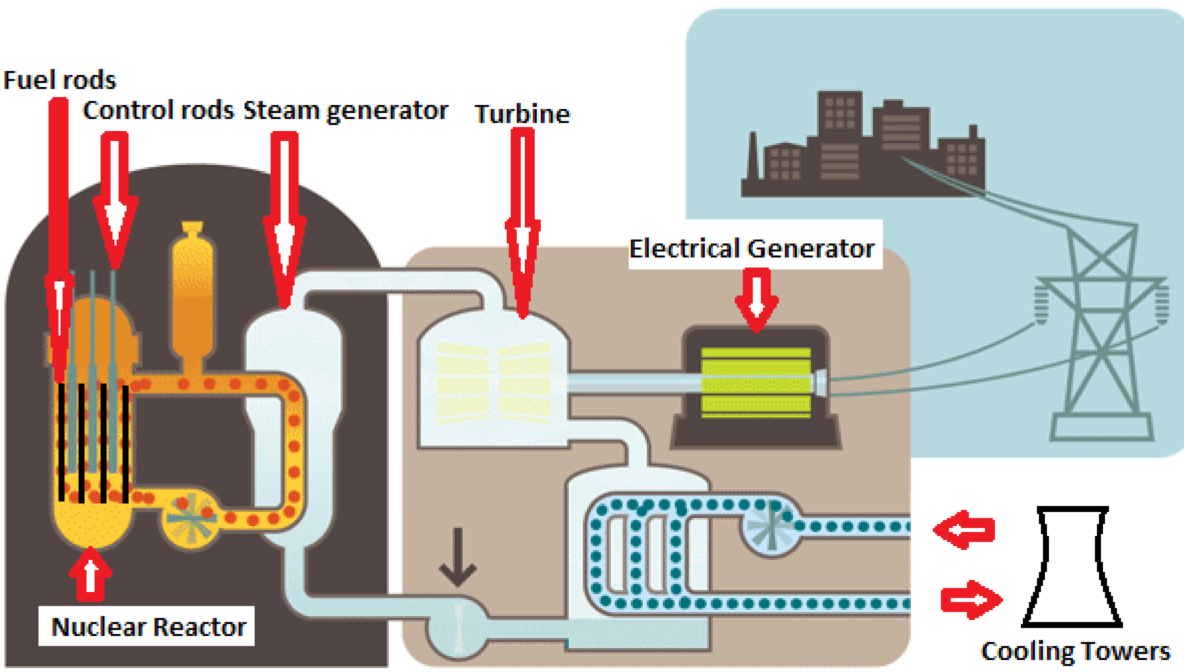

Figure 1. TMI-2 Nuclear Power Plant Design (U.S. NRC)
https://www.nrc.gov/reading-rm/basic-ref/students/animated-pwr.html

Nuclear Power

Considering one type of nuclear power reactor design, a brief conversation about nuclear power is appropriate. Basically, the bombardment of uranium oxide fuel with neutrons in a nuclear reactor shatters atoms into pieces to generate nuclear power. Referred to as nuclear fission, these bombardments release significant energy. Fission occurs in reactor fuel rods (approximately 0.4 inches diameter by 13 feet high) that typically contain fuel. As fuel rod fission occurs, coolant water flows over fuel rods and removes heat from the reactor to generate steam. Steam power, in turn, rotates generators to create electricity to power our homes and businesses. Cooling towers chill water, which then returns to the reactor, and the cycle continuously repeats to provide electrical power (Figure 1).

Energy cannot be created or destroyed. For nuclear power, nuclear energy converts to heat energy to form steam. Steam loses energy when changing to water to generated rotational energy of turbines. Turbines generate electrical energy. Even so, about two thirds of the energy is lost to the surroundings since all energy conversion processes are inefficient in accordance with the laws of physics.

That is, regardless of how energy is converted to electricity, most of the energy contributes to warming our planet. Solar, nuclear, wind and fossil fuel energy all contribute to global warming, but energy from fossil fuels exacerbates the warming problem by the addition of carbon dioxide to the air, which traps generated heat in the atmosphere.

Figure 2. Fukushima Explosions (U.S. NRC)
https://www.nrc.gov/site-https://www.nrc.gov/docs/ML1113/ML111390565.pdf

Nuclear Criticality Accidents
Nuclear reactors operate near a critical condition to maintain continuing nuclear power reactions, where controlled nuclear fission generates neutrons to shatter uranium atoms to release more neutrons, and on and on. If too many neutrons are generated and the nuclear reactions go out of control, a criticality accident occurs, which releases sudden large amounts of radiation. A criticality accident released massive energy at Chernobyl in 1986, but criticalities did not occur at Three Mile Island, Unit 2 explosions (TMI-2) in 1979 or the Fukushima explosions in 2011.

Exploding Our Reality
A major difference exists between nuclear bomb explosions and nuclear power plant explosions. For an atomic bomb, a critical mass is machined in the shape of a sphere with two separate parts, where assembled spheres are about the size of a baseball for a plutonium bomb and about the size of a softball for a uranium bomb[10]. In both cases, an uncontrolled nuclear reaction occurs when the critical mass is obtained by joining the two sections of the sphere. However, when critical mass occurs significant energy is released, and the mass automatically expands to stop nuclear explosions. To make a nuclear bomb functional for massive destruction of life, explosive forces compress the mass so that it cannot expand, which excites excess neutrons to initiate supercritical nuclear reactions and explode the radioactive mushroom cloud that is feared everywhere. For this reason, nuclear plant operations cannot result in an atomic bomb-type blast since explosive forces are unavailable to hold the fuel mass together.

The Meltdown of Uranium Oxide Metallic Fuel
To ignite nuclear accident explosions like Fukushima (Figure 2), TMI-2 or Chernobyl, the uranium oxide reactor fuel must first melt down. When coolant water stops flowing through the plants, nuclear reactions

continue to heat and melt the fuel at 5160°F. For Chernobyl, improper operations melted the fuel and exploded the plant. For Fukushima, a forty foot tsunami wave knocked out the power, and the fuel melted. For TMI-2, faulty equipment, training, and processes resulted in molten fuel.

Nuclear Plant Explosions

The Leishear Explosion Theory states that water hammers or fluid transients ignite flammable gas explosions in piping systems (Leishear, R. [1]. Chernobyl hydrogen explosions detonated directly from molten fuel and destroyed the reactor containment building. Fukushima and TMI-2 explosions detonated by water hammer, where pump startups following meltdowns created water hammers, or sudden pressure increases, to compress flammable hydrogen that was created during the meltdowns, and this compression heated flammable gases to ignite a sequence of explosions.

By ignoring TMI-2 accident data, false conclusions were reached that a fire rather than an explosion occurred inside the reactor containment building. This author believed these false claims to be true until a thorough evaluation of the Fukushima explosions revealed extraordinary similarities between Fukushima and TMI-2. A meticulous reinvestigation of TMI-2 proved that crucial information was intentionally deleted from the original TMI-2 accident investigation.

If this information had not been deleted, the water hammer explosion mechanism would have certainly been discovered during the past 42 years to prevent Fukushima explosions that fired radioactive dust around the globe (Figure 3). Unethical neglect of pertinent information during a nuclear accident investigation constitutes a cover up (Leishear, R. [2]).

In other words, a criticality, a complete reactor meltdown, and explosions ignited at Chernobyl in the absence of water hammer. No criticalities occurred at TMI-2 or Fukushima, but water hammer sparked explosions in both accidents. That is, a partial meltdown and consequent explosions ignited at TMI-2. And at Fukushima, three complete reactor meltdowns occurred, and four different reactor systems exploded. In short, the accidents differed, but water hammer detonated two out of three major nuclear plant explosions.

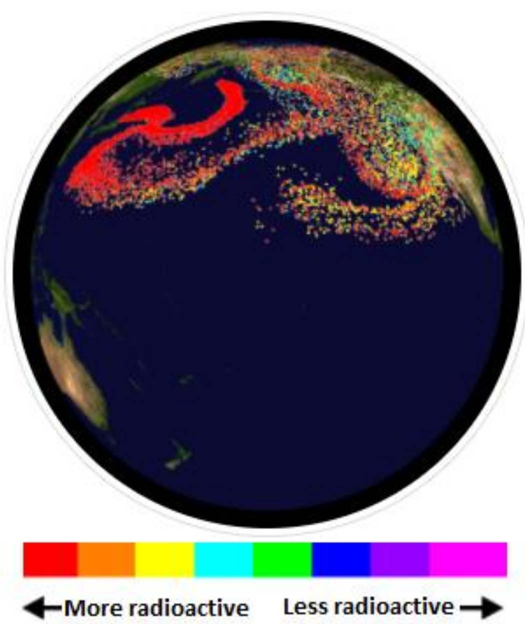

Figure 3. Radioactive Fukushima Dust Cloud (NOAA)
https://sos.noaa.gov/datasets/fukushima-radioactive-aerosol-dispersion-model/

Impending Large-scale Explosions

The facts are understood, water hammers ignite most nuclear plant explosions, and such accidents can be prevented. A mathematical analysis based on real-life explosions predicts that the next meltdown will occur before 2039; predicts a one in two probability of an explosion like Fukushima at that time; and predicts a rare explosion like the next Chernobyl-type explosion far in the future. These predictions augment the overwhelming importance of this incredibly complicated break-through understanding of why nuclear plants blow up. Additionally, experimental evidence validates the fundamental explosion and water hammer theory. Prior to each of eleven nuclear reactor meltdowns that included Fukushima and Three Mile Island, common beliefs were that reactors were so safe that nuclear accidents could not ignite explosions, and this common misconception is a common thread that ties numerous accidents together.

Small Explosions

Parallel research also proved that small explosions ignite throughout the reactor fleet due to water hammers. The U.S Nuclear Regulatory Commission (NRC) opined for decades, and even today, that water hammers alone occur in nuclear plants and that calculations cannot be performed. This author not only performed such water hammer calculations, but proved that small explosions detonated in nuclear power plants in the U.S. and abroad to crack or rip steel pipes apart (Figure 4), where water hammer ignites hydrogen and oxygen, generated during routine reactor operations. That is, explosions plague nuclear plant operations day to day as well as during accidents.

Figure 4. 2001 Hamaoka, Japan Explosion (U.S. DOE)
https://sti.srs.gov/fulltext/2006/pdcsssa2006003.pdf

Slam the Door on These Explosions

As written to a DOE Deputy Secretary of Energy, "What happens when the next explosion occurs and people are killed, knowing that explosions can be prevented" while a lethal catastrophe knocks at our doors? The DOE presently refuses to act to address this specific explosion concern, which constitutes an ongoing cover up of a radiation and explosion hazard to U.S. citizens. This article works to increase public awareness of this paramount disaster and impress the monumental need to prevent the next Fukushima. Now that power plant explosions are understood, methods to stop explosions mandate investigation and implementation. Essential future research drives explosion control to save lives and the environment. Slam the door on catastrophe – stop the next nuclear power plant explosion before it blasts into our lives!

References (More than 40 references are included in the following references)

1) Leishear, R., 2020, "The Autoignition of Nuclear Power Plant Explosions", Journal of Nuclear Engineering and Radiation Science, American Society of Mechanical Engineers.
2) Leishear, R., 2021, "Nuclear Power Plants Are Not So Safe: Fluid Transients / Water Hammers, Autoignition, Explosions, Accident Predictions and Ethics", International Journal of Philosophy.

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