

China Syndrome

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The **China Syndrome** is the scientific theory that as a result of a nuclear meltdown in which molten reactor core products breach the barriers below them and flow downwards through the floor of the containment building. The origin of the phrase comes from the mistaken notion that molten material from an American reactor could melt through the crust of the Earth and reach China.^[1]

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History and usage

The large size of nuclear power plants ordered during the late 1960s raised new safety questions and created fears of a severe reactor accident that would send large quantities of radiation into the environment. In the early 1970s a contentious controversy over the performance of emergency core cooling systems in nuclear power plants, designed to prevent a core meltdown that could lead to the China Syndrome, was discussed in the popular media and in technical journals.^[2]

In 1971, nuclear physicist Ralph Lapp used the term "China syndrome" to describe the burn-through of the reactor vessel, the penetration of the concrete below it, and the emergence of a mass of hot fuel into the soil below the reactor. He based his statements on the report of a task force of nuclear physicists headed by Dr. W.K. Ergen, published in 1967.^[3] The dangers of such a hypothetical accident were popularized by the 1979 film, *The China Syndrome*.

The name refers to the idea of the nuclear material burning a hole from the United States to 'the other side of the world', *i.e.*, China.^[4] China is a metaphor, as the opposite side of the globe from a majority of the continental USA, save for Northern Montana, Central Colorado, Hawaii, and Northern Alaska is the Indian Ocean.

Scientific explanation

The 'China Syndrome' refers to the most drastically severe meltdown a nuclear reactor could possibly achieve. In this case, the reactor would reach the highest level of supercriticality for a sustained period of time, resulting in the melting of its support infrastructure. The uranium in the core would behave in a similar manner to a delta-class fire, self-sustaining temperatures in excess of 2000°C. Since these temperatures would melt all materials around it, the reactor would sink due to gravity, effectively boring a hole through the reactor compartment's floor.^[5]

The China syndrome becomes fictional in the hypothesis of it boring a hole from the United States to China, or any other part of the world (the opposite side of the earth from the USA is the Indian Ocean, except for a section of northern Montana, Hawaii and sections of Northern Alaska, central Colorado,

whose antipodes are Ile Saint-Paul, Ile Amsterdam, French Southern and Antarctic Lands, northern Namibia and Antarctica, respectively). Most obviously it is impossible because the Earth's gravity would only pull it towards the core of the planet and no further. Furthermore, were the molten reactor fuel to reach the planetary mantle, the actual environmental effect would likely be low; the radioactive material would disperse by convection throughout the mantle, which is in any case kept liquid by natural nuclear decay. However, it is likely that the uranium core would not exceed more than 10 meters of 'boring' due to natural passive safety. The surrounding ground beneath the reactor would absorb the heat and transfer its conductivity to the surrounding area, thus preventing the ground directly beneath the core from 'melting'.^{[5][6]} This manner of spreading heat convectively through the ground is proposed for use in General Atomics' Gas Turbine Modular Helium Reactor for regular operation and passive safety, which aims to eliminate the possibility of a meltdown.^[7]

See also

- List of civilian nuclear accidents
- List of military nuclear accidents
- Nuclear and radiation accidents
- Nuclear safety
- Radioactive contamination
- Radioactive waste
- Travel to the Earth's center
- We Almost Lost Detroit

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