



BRIEF ANALYSIS

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Dispelling the Myths About Nuclear Power

by Larry Foulke and H. Sterling Burnett

The manifest benefits of nuclear technology — from radiological medical screening and treatments, to smoke detectors, to electric power generation — have not dispelled the common belief that it is unduly hazardous. Of the many areas in which nuclear technology has been applied, perhaps none has been more damaged by the fear of radiation than nuclear power. Traditionally, nuclear power critics have focused on two potential threats to human health: 1) the risk that dangerous levels of radiation will escape from a plant due to equipment failure or human error, and 2) the risk posed to human health from spent nuclear fuel, often misleadingly called nuclear waste. Since September 11, 2001, alarm has also been raised about a third risk: a terrorist assault on a nuclear power plant. The actual risk from any of these sources is quite small.

The Truth about Three Mile Island. On March 28, 1979, the coolant water level in Pennsylvania's Three Mile Island (TMI) No. 2 reactor dropped, uncovering the top of the fuel core. More than one-third of the fuel melted. Inadequate instrumentation and training hampered operators' ability to respond to the accident. This combination of mechanical failure and human error resulted in the United States' worst nuclear power accident. No new nuclear plants have been licensed in America since TMI.

The events at TMI were serious. However, rather than proving nuclear power plants are inordinately dangerous, TMI showed that redundant safety measures built into the reactor worked.

- Despite the melted fuel, the integrity of the reactor vessel was maintained and the containment building confined the radioactive material as designed.
- The small amount of radiation released into the atmosphere was equal to about one X-ray per person for those living within 10 miles of the plant.
- The maximum dose received by any single individual was equal only to what the average U.S. resident experiences as normal background radiation each year.

Terrorist Attacks Judged Unlikely to Cause a Radiation Release

1. Truck bomb that explodes beside a critical structure.
2. Suicide attack by a small aircraft loaded with explosives.
3. Frontal assault with small arms.
4. Attack with rockets or medium artillery.
5. Sabotage of the power lines to and from the plant.
6. Infiltration and sabotage from within.
7. Suicide crash of a hijacked commercial airliner into the reactor building.
8. Suicide crash of a hijacked commercial airliner into spent-fuel storage.

Source: Gerald E. Marsh and George S. Stanford, "Terrorism and Nuclear Power: What Are the Risks?" National Center for Public Policy Research, National Policy Analysis No. 374, November 2001.

Between 1981 and 2002, none of the more than dozen studies examining the health effects of the TMI accident found any injuries, deaths or discernable health effects from the small amount of radiation released.

With more than 50 years' experience with nuclear power in the United States, no deaths or negative health effects have been conclusively linked to radiation leaks from nuclear plants or spent fuel. In addition, the U.S. Navy has operated nuclear-powered vessels for 50

years. Despite the fact that hundreds of thousands of Navy personnel have served in close quarters with nuclear power plants and radioactive material, there have been no radiation-caused deaths.

The Truth about Nuclear Waste. The second concern often raised about nuclear power is disposal of spent (used) fuel from reactors. Radiation per se is not dangerous — as with so much in life, it is the dose that makes the poison. Enriched uranium, containing the fissionable isotope U-235, is a relatively harmless nuclear fuel — human skin blocks the alpha particles it emits. However, fission transforms a small amount of the enriched uranium into extremely radioactive isotopes. This ash inside the used fuel rods emits radiation that could be fatal to a person exposed to it for just a few minutes.

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Currently, used nuclear fuel is handled in two ways: isolated storage or reuse.

Secure Storage. The nation's commercial reactors have accumulated more than 50,000 tons of radioactive waste, mostly spent fuel rods. These rods are temporarily stored at 131 sites in 40 states — including operating nuclear power stations, laboratories and military bases — within 75 miles of 161 million Americans. While safe for the present, this situation is hardly ideal since the used fuel must be protected long past the useful life of the plants themselves. In addition, the nation's commercial reactor sites are quickly running out of storage space.

To ensure proper long-term storage of high-level nuclear waste, the 1982 Nuclear Waste Policy Act (amended in 1988) required the U.S. Department of Energy (DOE) to develop and maintain an underground storage facility. The DOE required the site chosen for the facility to meet strict criteria, including the ability to safely contain 77,000 metric tons of material for up to 10,000 years. To pay for storage, a tax was levied on the nuclear power industry. The DOE has spent 26 years and \$8 billion studying storage sites and technologies. It has determined that Yucca Mountain, Nevada, is a satisfactory storage place. The science behind Yucca Mountain is solid. Only politics, not science, delays the safe storage of the country's accumulated spent fuel in a single, isolated, geologically stable facility.

Environmentally Friendly Recycling. More than 70 percent of France's electricity comes from nuclear power, compared with a bit more than 20 percent in the United States. Yet France and a number of other countries with nuclear facilities have largely resolved the problem of storing spent fuel by recycling and reusing it. One kilogram of natural uranium contains as much energy as 38.5 tons of coal, but less than three percent of the uranium's energy is utilized in conventional reactors. However, uranium recycling produces a small amount of plutonium — which with concerted effort could be transformed into a rather poor bomb-grade material. Thus, to prevent proliferation, during the height of the cold war the United States decided to forgo nuclear fuel recycling. However, France has not found it difficult to secure its plutonium.

The Truth about Terrorism and Nuclear Power. The specter of a terrorist assault on nuclear facilities

has been raised in the aftermath of 9/11. There are two potential targets at a typical reactor site: the reactor itself and the spent-fuel storage site. Nuclear physicists Gerald E. Marsh and George Stanford, recently retired from the Argonne National Laboratory, examined various modes of attack against one or the other of these targets. [See the table.] They found that the chance of a dangerous radiation leak from any of these scenarios is very small; the radiation would be contained within the facility and technicians or automatic devices would safely power-down the reactor.

Nuclear facilities are heavily reinforced. The fuel is surrounded by a nine-inch steel reactor vessel. The reactor vessel is then surrounded by a containment vessel, made of several feet of concrete and steel. Thus, even if a large airliner crashed directly into the nuclear containment cask or rockets were fired at the reactor container, or a truck bomb was exploded beside it, the reactor vessel is unlikely to be breached and no radioactive material would be released. Beefed up security measures — more armed guards (within and outside the facilities), traffic barriers, guard towers and new security clearance procedures — now make nuclear plants among the most secure places on earth. A security breach would result in an inconvenient shutdown, rather than a radiation leak.

Though it would also be difficult, a precise strike on a spent fuel storage site could release a modest amount of radiation into the atmosphere. However, even that danger would largely disappear if the government would either make Yucca Mountain operational or recycle spent fuel.

Conclusion. Nuclear energy is relatively clean, generating far less waste per unit of energy than any other major source and, based on the number of lives lost or people made ill, it is also far safer for human health. The benefits of nuclear energy are real, while the risks are mostly hypothetical. When decisions are made concerning future sources of electric power in the United States, facts, not fear, should be the basis for appraising the nuclear industry's place in the mix.

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