

## WALTER CRONKITE – IMAGE #32

By the 1980s, environmentalism starkly divided Americans, with proponents of unfettered economic growth on one side and environmental activists preaching limits on the other side. An early foreshadowing of those divisions came in the brewing controversy over nuclear power. Electricity from the atom – what could be better? That was how Americans had greeted the arrival of power-generating nuclear technology in the 1950s.

By 1974, U.S. utility companies were operating 42 nuclear power plants, with a hundred more planned. Given the oil crisis, nuclear energy might have seemed a godsend. Unlike coal-driven or oil-driven plants, nuclear operations produced no air pollutants.

Environmentalists, however, publicized the dangers of nuclear power plants: 1) a reactor meltdown would be catastrophic; and 2) so would, in slow motion, the dumping of radioactive waste from the plants. The latter would generate toxic levels of radioactivity for hundreds of years. These fears seemed to be confirmed in March, 1979, when the reactor core at the Three-Mile Island nuclear plant near Harrisburg, Pennsylvania, came close to meltdown. A series of mechanical and human errors resulted in an accident that profoundly affected the utility industry. This was the most serious accident in U.S. commercial nuclear power plant operating history.

The accident began about 4 a.m. EST, on Wednesday, March 28<sup>th</sup>, 1979, when the Three-Mile Island Unit 2 reactor, near Middletown, Pennsylvania, experienced a failure in the secondary, non-nuclear section of the plant. There were two reactors at the site. Either a mechanical or an electrical failure prevented the main feedwater pumps from sending water to the steam generators that removed heat from the reactor core. This caused the plant's turbine-generator and then the reactor itself to shut down automatically. Immediately, the pressure in the primary system (the nuclear portion of the plant) began to increase. In order to control that pressure, the pilot-operated relief valve (a valve located at the top of the pressurizer) opened. The valve should have closed when the pressure fell to proper levels, but it became stuck open. Instruments in the control room, however, indicated to the plant staff that the valve was closed. As a result, the plant staff was unaware that cooling water was pouring out of the stuck-open valve.

As coolant flowed from the primary system through the valve, other instruments available to reactor operators provided inadequate information. There was no instrument that showed how much water covered the core. As a result, plant staff assumed that, as long as the pressurizer water level was high, the core was properly covered with water. As alarms rang and warning lights flashed, the operators did not realize that the plant was experiencing a loss-of-coolant accident. They took a series of actions that made conditions worse. The water escaping through the stuck valve reduced primary system pressure so much that the reactor coolant pumps had to be turned off to prevent dangerous vibrations. To prevent the pressurizer from filling up completely, the staff reduced how much emergency cooling water was being pumped in to the primary system. These actions

starved the reactor core of coolant, causing it to overheat.

Without the proper water flow, the nuclear fuel overheated to the point at which the zirconium cladding (the long metal tubes that hold the nuclear fuel pellets) ruptured and the fuel pellets began to melt. It was later found that about half of the core melted during the early stages of the accident. Although Three-Mile Island-2 suffered a severe core meltdown, consequences outside the plant – the most dangerous kind of nuclear power accident – were minimal. Unlike the accidents later at Chernobyl in the Ukraine on April 26, 1986, and at Fukushima, Japan on March 11, 2011, the containment building at TMI-2 remained intact and held almost all of the radioactive material.

Federal and state authorities were initially concerned about the small releases of radioactive gases that were measured off-site by the late morning of March 28<sup>th</sup>, 1979. They were even more concerned about the potential threat that the reactor posed to the surrounding population. They did not know that the core had melted, but they immediately took steps to try to gain control of the reactor and ensure adequate cooling to the core. The regional office of the Nuclear Regulatory Commission in King of Prussia, Pennsylvania was notified at 7:45 a.m. EST on March 28<sup>th</sup>. By 8 a.m., the NRC Headquarters in Washington, D.C., was alerted, and the NRC Operations Center in Bethesda, Maryland, was activated. The regional office promptly dispatched the first team of inspectors to the site. Other agencies, such as the Department of Energy and the Environmental Protection Agency, also mobilized their response teams. Helicopters hired by General Public Utilities Nuclear, the owner of Three-Mile Island, and the Department of Energy were sampling radioactivity in the atmosphere above the plant by midday. A team from Brookhaven National Laboratory was also sent to assist in radiation monitoring. At 9:15 a.m. EST the White House was notified. At 11:00 a.m. all non-essential personnel were ordered off the plant's premises.

By the evening of March 28<sup>th</sup> the core appeared to be adequately cooled, and the reactor appeared to be stable. New concerns, however, arose by the morning of Friday, March 30<sup>th</sup>. A significant release of radiation from the plant's auxiliary building, performed to relieve pressure on the primary system and avoid curtailing the flow of coolant to the core, caused a great deal of confusion and consternation. In an atmosphere of growing uncertainty about the condition of the plant, the governor of Pennsylvania, Richard L. Thornburgh, consulted with the NRC about evacuating the population near the plant. Eventually, he and NRC Chairman Joseph Hendrie agreed that it would be prudent for those members of society most vulnerable to radiation to evacuate the area. Thornburgh announced that he was advising pregnant women and pre-school-age children within a five-mile radius of the plant to leave the area.

Within a short time, chemical reactions in the melting fuel created a large hydrogen bubble in the dome of the pressure vessel, the container that held the reactor core. NRC officials worried that the hydrogen bubble might burn or even explode and rupture the pressure vessel. In that event, the core would fall into the containment building and perhaps cause a breach of containment. The hydrogen bubble was a source of intense scrutiny and great

anxiety, both among government authorities and the population, throughout the day on Saturday, March 31<sup>st</sup>. The crisis ended when experts determined on Sunday, April 1<sup>st</sup>, that the bubble could not burn or explode because of the absence of oxygen in the pressure vessel. Furthermore, by that time the utility had succeeded in greatly reducing the size of the bubble.

This accident significantly affected the utility industry. A combination of stuck valves, misread gauges, and poor decisions had led to the partial meltdown of the reactor core and the release of radioactive gases into the atmosphere. Although the health effects were not serious, more than 100,000 people had fled their homes. The prompt shutdown had saved the plant, but the near-catastrophe enabled environmentalists to win the battle over nuclear energy. Massive demonstrations followed the accident, culminating in a rally in New York City that attracted over 200,000 people. Anti-nuclear activists and many local citizens disputed the NRC claim that the amount of radioactivity released was not a health threat.

The accident at Three-Mile Island not only heightened public fears but also led to the immediate shutdown of several plants. In addition, a moratorium on the licensing of all new reactors was temporarily imposed, significantly slowing the industry for several years. A handful of plants with existing authorization was built in the 1980s. By the middle of that decade the construction of nuclear power plants in the United States had virtually ceased. The reactor itself at Three-Mile Island remained unusable – in fact, virtually unapproachable – more than a decade later.

The aftermath of the accident at Three-Mile Island included careful analysis of all the events in this historical incident. This led to sweeping changes involving emergency response planning, reactor operator training, human factors engineering, radiation protection, and many other areas of nuclear power plant operations. It also caused the NRC to tighten and heighten its regulatory oversight. All of these changes significantly enhanced U.S. reactor safety, which has reduced the risk to public health and safety.

Today, nuclear reactors account for 20% of all U.S. power generation. This is substantially less than that of several European nations, but the United States still places fourth in the world in nuclear power production.