Findings underplayed disaster, 3 sa

The accident at Three Mile Island

Twenty years ago today, equipment failures and human errors nearly caused a full meltdown at Three Mile Island II nuclear reactor. Though catastrophe was averted, debate continues on how much radiation escaped. Federal officials say releases were modest, but 2,000 people maintain the accident released enough radiation to make them sick or kill loved ones.

OUTSIDE THE REACTOR

Pump failure
Accident begins when the main feedwater pump on the non-nuclear side of the plant fails, making it impossible to reduce heat from the nuclear reactor.

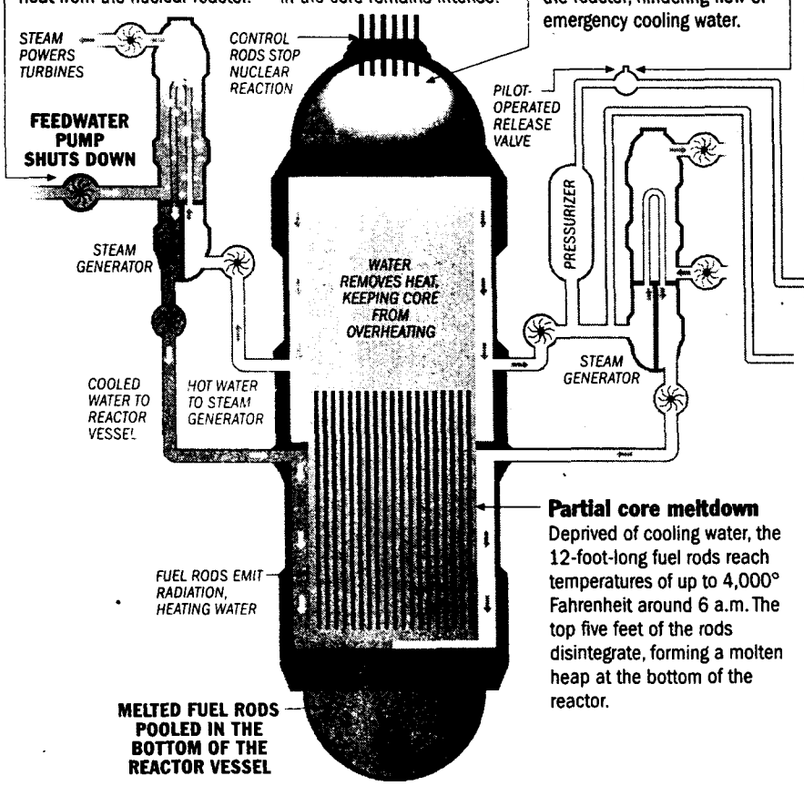
INSIDE THE REACTOR

Shutdown
Eight seconds into the accident, control rods drop automatically, shutting down the reactor. But residual heat in the core remains intense.

Hydrogen bubble
Fuel rods' metal coatings release hydrogen gas under extreme heat. The hydrogen forms a bubble at the top of the reactor, hindering flow of emergency cooling water.

IN SUPPORTING EQUIPMENT

Valve failure
A pilot-operated relief valve intended to reduce pressure inside the reactor automatically opens, but then fails to close, allowing too much cooling water to drain out.



False reading
Though water is draining from system, workers have false reading that the pressurizer is full, and stop flow of water that could have cooled the core.

Partial core meltdown
Deprived of cooling water, the 12-foot-long fuel rods reach temperatures of up to 4,000° Fahrenheit around 6 a.m. The top five feet of the rods disintegrate, forming a molten heap at the bottom of the reactor.

Disaster averted
Though some feared the hydrogen could explode, workers vented it over several days and restored cooling water to the reactor. In hindsight, observers realized that the plant came perilously close to a full meltdown, in which radioactive fuel rods bore through the floor and explode into the ground water below.

Radiation releases

The NRC believes that a modest 10 million curies of radiation escaped due to the accident, far more than normal, but not enough to cause significant health harms. The agency believes almost all releases escaped from a small "letdown pipe" that emptied into the auxiliary building and went up the vent stack.

Expert witnesses for people suing Three Mile Island's owners argue that up to 150 million curies of radiation escaped, enough to cause health harms. They argue that the NRC underestimated the release by neglecting several ways gases could escape:

1. The containment building that houses the reactor is not 100 percent leak-proof and some of the 560 million curies of radiation inside it could have escaped.

2. Radioactive gases could have escaped from a hole in a steam tube that workers patched after accident began.

3. The letdown pipe could carry far higher radiation concentrations out of the reactor, especially if pure gas, rather than water, pumped through it.

NOTE: Objects are not drawn to scale.

SOURCES: Report of the President's Commission on the Accident at Three Mile Island; Nuclear Regulatory Commission

GLOBE STAFF GRAPHIC / SEAN McNAUGHTON & SCOTT ALLEN

By Scott Allen
GLOBE STAFF

MIDDLETOWN, Pa. – The marigolds in front of Jane Lee's house died within days. White powder rained down on Clair Hoover's farm, giving him a rash. Hundreds said the air had a metallic taste on that morning 20 years ago today when the accident at the Three Mile Island II nuclear reactor began.

The official version of America's worst nuclear disaster, repeated in study after study, is that the actual radiation released was too small to hurt anyone. Scientists and lawyers explained away the strange occurrences – poison ivy causes rashes, too, after all – while symptoms such as vomiting and hair loss were laid to the stress of a brush with disaster.

But the studies never quieted a dissenting view that came up every time someone like Clair Hoover got cancer: that Three Mile Island released far more radiation than the government or industry ever acknowledged. Even when a judge in 1996 rejected all 2,100 claims that people had been hurt by the accident, skeptics said it only proved the powerful aren't listening.

Now, several expert witnesses who planned to testify in the trial say they have evidence that radiation from Three Mile Island was four to 15 times greater than the federal estimate. The witnesses, including prominent nuclear industry whistleblowers, say investigators badly underestimated releases during the chaotic first hours of the accident, and no one corrected it.

"It was very, very extensively studied, but I think somehow the big picture was lost," said David Lochbaum of the Union of Concerned Scientists in Washington, a nuclear engineer who planned to testify for the plaintiffs. "You could take a loaded revolver apart and ask toy inspectors to look at all the parts and they could sincerely say it's safe for a child of 7."

Lochbaum, along with expert witnesses Paul Blanch and Arnold Gundersen, have risked their ca-

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reers in the past to raise safety issues at nuclear facilities. This time, they say investigators overlooked several indicators of a larger release, such as a sudden drop in air pressure inside the reactor containment building that suggested radioactive gas was escaping.

Nuclear Regulatory Commission officials say the trio's argument about Three Mile Island is "a bit of a stretch," but not impossible. Unlike today's reactors, Three Mile Island II was not equipped with monitors that could measure the intense radiation from an accident. As a result, estimating releases from the accident is sort of a black art.

"This isn't like dollars and cents that you can account for every penny or something," said Lee Thonus, NRC project manager at Three Mile Island II. However, he said it is unlikely that a large release occurred, since investigators did not find unusual film exposure or other indicators of high radiation.

Attorneys for alleged victims say that a jury, not a judge or the NRC, should decide what happened. They have asked the federal appeals court in Philadelphia to revive the claims, arguing that US District Court Judge Sylvia Rambo improperly rejected testimony from about 10 expert witnesses and then said the lawsuit was not strong enough for trial.

"After she threw out the evidence that people had been injured by the accident, including part of our work, then she ruled that there wasn't enough evidence to proceed," said Steven Wing of the University of North Carolina in Chapel Hill, the only epidemiologist to publish research suggesting that radiation from the accident caused higher cancer rates.

Lochbaum, Blanch and Gundersen were accepted as witnesses, but Rambo limited the issues they could address.

Attorneys for GPU Nuclear, until recently the owner of Three Mile Island, say Rambo rightly dismissed the case after finding that many plaintiff witnesses, including Wing, were using methods that tended to produce erroneous results.

"Just because somebody thinks they have something important to say doesn't mean the judge has to let them say it," said Alfred H. Wilcox, GPU's lead attorney.

However, if Lochbaum and the other witnesses get a chance to make their case to a jury, they could make Three Mile Island even more painful for the nuclear industry than it has been. Though GPU has paid about $30 million to settle claims from the accident, never admitting any radiation-induced illnesses, the accident played a large role in the cancellation of 74 nuclear plants and the early shutdown of 13 more.

At a minimum, the fight over an event 20 years ago reflects persistent doubts about the safety of nuclear power dating to the first days of the accident when plant and government officials downplayed the danger. Not until 1982, when cameras were lowered into the damaged reactor core, did the public find out how close Three Mile Island came to a full meltdown that could have spewed radiation far and wide.

"My respect for professionals went right down the toilet after this accident," said Jane Lee, 75, whose amateur door-to-door health survey suggested high cancer levels in Lower Swatara, one of the most heavily exposed communities.

Three Mile Island, a sandbar in the Suquehanna River dominated by four 13-story cooling towers, always seemed out of place in the small town America of central Pennsylvania, where cornfields line the roads and Book of the Month Club is a big employer. Before the accident, few questioned the plant's safety, and some thought the reactors had an Atomic Age charm.

Then, at about 4 a.m. on March 28, 1979, a series of malfunctions and errors began draining the cooling water that covered the uranium fuel inside Three Mile Island II, causing it to dangerously overheat. The heat grew so intense that the protective sleeves around the fuel melted, releasing hydrogen gas that then made it more difficult to pump cooling water into the core.

Some NRC analysts feared the hydrogen bubble might explode, and Governor Dick Thornburgh ordered the evacuation of preschool children and pregnant women within five miles. But reactor operators slowly released the gas, avoiding catastrophe.

Panel calls argument a 'stretch'

After the accident, a presidential commission and an NRC "special inquiry group" concluded that only about 10 million curies of radiation escaped due to the accident, barely enough to expose most people to the equivalent of a chest X-ray.

But Lochbaum, Blanch, and Gundersen say the commission, as well as other experts who studied the area, based their conclusions on unrealistically low estimates of the radiation released at Three Mile Island. Among the errors they point to are:

- The NRC report discounted leaks in the containment building that houses the reactor. Lochbaum said that because the building was not airtight, millions of curies of radioactive gas could have escaped to the atmosphere.
- The special inquiry discounted potentially significant radiation that escaped through steam generating tubes.
- The NRC report concluded that almost all radiation escaped through a water pipe that drained into a building not designed to contain radioactivity. But the report overlooks the possibility that this "letdown pipe" contained no water for part of the accident, allowing gas to escape more rapidly.
- The official estimate of 10 million curies released to the atmosphere is based partly on estimates from a monitor that might not have been reliable.

Armed with the belief that his higher radiation levels were more accurate, Wing found a significant increase in lung cancer in areas where relative exposure was highest.

But Wing's arguments, like the rest of the plaintiff's case, never got past the pretrial stage as Rambo faulted the methods of one expert witness after another.

Damage from Three Mile Island will be measured in the health of people in central Pennsylvania, and, so far, no study aside from Wing's and amateur efforts by residents have found proof of health problems from the radiation, although one study showed extensive stress.

A forthcoming study, which followed 35,000 people within five miles of the plant for 18 years, has not found an increase in the overall cancers either, though the University of Pittsburgh researchers have not analyzed radiation-sensitive cancers.

But for some families who have lost loved ones since the accident, such reassurances do not reassure. As Alice Deimler of Middletown, whose 6-year-old son died of a rare form of cancer, told the local Patriot-News, "He was a normal, healthy boy before the accident ... I still blame" Three Mile Island.