

alone. Moreover, the region was created by volcanic activity. Although that was millions of years ago, how sure can we be that the waste facility won't be torn apart by another eruption?

Many alternatives have been suggested for nuclear waste storage. Why not just send the waste into the sun? Well, maybe that's not such a good idea, since on launch some rockets do crash back down on the Earth. Some scientists have proposed that the waste be put in vessels and sunk under the oceans, in a region where the movement of the Earth's crustal plates will subduct the material, eventually burying it hundreds of miles deep. Yet just the fact that scientists make such suggestions seems to emphasize how severe the problem really is.

Here is the worst part. We have already generated more than enough nuclear waste to fill up Yucca Mountain. That waste won't go away. Yet you, a future president, are considering *more* nuclear power? Are you insane?

My Confession

The furor against nuclear power has been so intense that I felt compelled to reproduce the anti-nuke viewpoint in the opening of this chapter, including at least part of their passion. These are the arguments that you will hear when you are president. Yet it hardly matters whether you are pro-nuke or anti-nuke. The waste is there, and you will have to do something with it. You can't ignore this issue, and to do the right thing (and to convince the public that you're doing the right thing) you must understand the physics.

When I work out the numbers, I find the dangers of storing our waste at Yucca Mountain to be small compared to the dangers of not doing so, and significantly smaller than many other dangers we ignore. Yet the contentious debate continues. More research is demanded, but every bit of additional research seems

to raise new questions that exacerbate the public's fear and distrust. I have titled this section "My Confession" because I find it hard to stand aside and present the physics without giving my own personal evaluation. Through most of this book I've tried to present the facts, and just the facts, and let you draw the conclusions. In this section, I confess that I'll depart from that approach. I can't be evenhanded, because the facts seem to point strongly toward a particular conclusion.

I've discussed Yucca Mountain with scientists, politicians, and many concerned citizens. Most of the politicians believe the matter to be a scientific issue, and most of the scientists think it is political. Both are in favor of more research—scientists because that is what they do, and politicians because they think the research will answer the key questions. I don't think it will.

Here are some pertinent facts. The underground tunnels at Yucca Mountain are designed to hold 77,000 tons of high-level nuclear waste. Initially, the most dangerous part of this waste is not plutonium, but fission fragments such as strontium-90, an unstable nucleus created when the uranium nucleus splits. Because these fission fragments have shorter half-lives than uranium, the waste is about 1000 times more radioactive than the original ore. It takes 10,000 years for the waste (not including plutonium, which is also produced in the reactor, and which I'll discuss later) to decay back to the radioactive level of the mined uranium. Largely on the basis of this number, people have searched for a site that will remain secure for 10,000 years. After that, we are better off than if we left the uranium in the ground, so 10,000 years of safety is probably good enough, not the 100,000 years that I mentioned in the chapter introduction.

Ten thousand years still seems impossibly long. What will the world be like 10,000 years from now? Think backward to

See Chapter 13
for tips on
describing
the data
underpinning
a scientific
argument.