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NUCLEAR REACTION: WHY DO AMERICANS FEAR NUCLEAR POWER

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NARRATOR: No technology in history has generated more passion.

PROTESTERS: Hey, hey! Ho, ho! We say the nukes have got to go! Hey, hey! Ho, ho! We say the nukes have got to go! Hey, hey! Ho, ho!

NARRATOR: No technology in history has evoked such suspicion and fear.

MARY OSBORN: It is the most evil, most health-degrading type of energy that there is. It's just the stupidest way I ever heard of to just boil water to generate electricity.

NARRATOR: America's nuclear power industry is failing; crippled by public opposition, mounting costs and a politically intractable nuclear waste problem. Its critics have already declared victory.

ERIC EPSTEIN: Nuclear power's dead. There will not be another nuclear power plant built here ever. I mean, there, there, it's nothing that we really have to argue about. Nuclear power is unsafe, it's uneconomical and it's opposed by an overwhelming majority of Americans. The citizens distrust the technology. Wall Street distrusts the economic gamble. Nuclear power is dead. It's over. It's that simple.

NARRATOR: If the critics are right, the final resting place for the waste from four decades of commercial nuclear power may well be here, buried under a remote stretch of the Nevada desert called Yucca Mountain.

I'm Richard Rhodes. I spent 15 years studying the history of nuclear energy. I wrote about it in my book, "The Making of the Atomic Bomb." I find it extraordinary that half a century after the discovery of this new source of energy, I am standing on what may become its burial ground.

How did it happen that the nation that first harnessed this awesome new source of power is about to abandon it? What is it about this technology that stirs our passions?

Atomic energy burst upon the world 52 years ago in the New Mexican desert. In July, 1945, scientists in the top-secret Manhattan Project prepared to test an atomic bomb. They knew they were unleashing a force of mythic proportions. Physicist Robert Oppenheimer paid homage in the words of a Hindu God: "Now I am become death, the destroyer of worlds." A few weeks later, the world learned about atomic energy when the U.S. bombed Hiroshima and Nagasaki.

I remember the awe I felt as a boy when I heard about the destruction these new bombs caused. They shocked the world and ended a long and terrible war. Once discovered, this astonishing new technology could not be forgotten. The atomic age had begun.

But instead of destruction, scientists dreamed of harnessing the power of the nucleus, offering

humankind a source of limitless energy. By 1951, American scientists had taken the same nuclear power that had destroyed Hiroshima and Nagasaki and used it to turn the lights on.

ALBERT REYNOLDS, Professor of Nuclear Engineering, University of Virginia: It was a very exciting field. We thought it would be the leading method of making electricity throughout the world. You have a very small amount of space, 12 feet tall and 12 feet in diameter, and you produce enough electricity to run a large city in that small space. So the energy source is extremely concentrated, which is one of its great benefits.

NARRATOR: The source of nuclear fission is uranium, a naturally occurring metal. Before the war, scientists discovered that a small fraction of the uranium atoms found in nature --less than 1 percent -- have a special property. When they're hit by neutrons, they split, releasing more neutrons that in turn can split other uranium atoms. Each split, or fission, releases large amounts of energy.

By fabricating thumb-sized uranium pellets, loading the pellets into fuel rods and assembling the rods into a core, scientists were able to produce a self-sustaining chain reaction that yielded enormous quantities of heat. The core's energy heats water, producing steam that drives turbines which generate electricity. Proponents argued it was a dream form of clean energy that would be too cheap to meter.

NEWSREEL ANNOUNCER: This new type of power reactor supplied city-wide the kind of energy which will someday power man's factories.

NARRATOR: But this rosy view of a nuclear future always had to compete with darker images, from terrible explosions and the end of civilization to nightmarish mutations induced by radiation run amok.

ACTOR: ["The Beginning of the End"] Do not panic! Do not panic!

NARRATOR: By the 1970s nuclear power had become a political target. Its leading critic was Ralph Nader.

RALPH NADER: The Atomic Energy Commission is licensing unsafe reactors operating near major metropolitan areas and that they clearly have been aware of this lack of safety. The press wasn't critical. The Congress bought into the Atomic Energy Commission party line. There was a huge taxpayer-funded propaganda for how good nuclear power was, going right into the high schools and elementary schools in our country with travelling road shows. The scientific community was part of the industry itself and there was no outside critique. There was no government critique. And there was secrecy above it all.

NARRATOR: Then, in 1979, came Three Mile Island.

WALTER CRONKITE, CBS News: [March 30, 1979] Good evening. The world has never known a day quite like today. It faced the considerable uncertainties and dangers of the worst nuclear power plant accident of the atomic age.

NARRATOR: It seemed to confirm our worst fears, that in trying to exploit nuclear fission, we had opened a Pandora's box. A series of technical and human errors led to a partial meltdown of one Three Mile Island reactor. The accident riveted America. Nothing would ever be the same.

While no one was injured or killed in the accident, the experience helped forge a generation of

hardened anti-nuclear activists like Eric Epstein and Mary Osborn. They're convinced beyond doubt that nuclear energy is dangerous, that it kills people in an invisible and insidious way. They want to wipe it off the face of earth.

ERIC EPSTEIN, Three Mile Island Alert: I don't trust these people. These people got away with murder. They killed people. And you know, radiation is difficult to pin down. It's not like I put a gun to your head and shoot you. You know, with radiation it's going to be difficult to determine, you know, if a certain disease was caused by it.

NARRATOR: Since Three Mile Island researchers have studied public attitudes extensively. They've found that people's doubts about nuclear power have increased with time.

HANK JENKINS-SMITH, Director, Institute for Public Policy, University of New Mexico: [to focus group] Let's go back now to your word association, associated with nuclear power, and I want to just go around the table and we'll start with Leo and go that way. What's your first image?

1st FOCUS GROUP MEMBER: Disaster.

HANK JENKINS-SMITH: Disaster? David what's your first image?

2nd FOCUS GROUP MEMBER: The first image I had was trouble.

HANK JENKINS-SMITH: Trouble?

3rd FOCUS GROUP MEMBER: Disgusting.

4th FOCUS GROUP MEMBER: My first thought was dangerous.

5th FOCUS GROUP MEMBER: The first thing I thought of was radiation.

HANK JENKINS-SMITH: Radiation. I'm going to read to you a list--

NARRATOR: Strong nuclear reactions. Like this focus group, many people fear radiation. But scientists like John Moulder, who work with radiation every day, feel differently. If we knew what they knew, they argue, we might feel less afraid. Biologists measure radiation in small units called millirems. Whether or not it's dangerous, depends on the dose.

JOHN MOULDER, Ph.D., Radiation Biologist: A sufficiently large dose of ionizing radiation_ and here we're talking of millions of millirem_ will actually kill you on the spot, within seconds. Getting down to somewhat more reasonable doses, hundreds of thousands of millirems, these can also kill people. It takes a while, typically, 7 to 21 days. There were people in the Chernobyl accident, some of the firefighters, who got doses in this range, 200,000 to maybe 600,000 or higher millirem. And they died as a result of this. This is called "acute radiation poisoning." Once you get below roughly 200,000 millirem, this doesn't happen. People do not get acutely sick as a result of radiation exposure. What they are, however, is at an increased risk of some time in the future developing cancer.

NARRATOR: Much of what's known about the effects of radiation was learned in the aftermath of Hiroshima and Nagasaki. In one of the largest studies ever conducted, 50,000 Japanese bomb survivors were followed up for 50 years to see if their cancer rates increased and whether they

passed on genetic mutations to their children. Much to the scientists' surprise, there was no increase in inherited mutations. Despite the science fiction films, this fear proved unfounded. Cancer rates did increase, though, especially among those exposed to more than 10,000 millirems.

JOHN MOULDER: Of those 50,000 people, about 5,000 of them developed cancer. Based on what we know of the rest of the Japanese population, you would have expected about 4,500 of them. So we have 5,000 cancers over 50 years where we would expect 4,500. So we assume that those extra 500 cancers were induced by the radiation.

Not surprisingly, some of the citizens living near Three Mile Island see parallels with Hiroshima.

JOYCE CORRARDI, Concerned Mothers and Women: At the time of the accident, we left the area and when we got to my mother's home, my son went into the bathroom and threw up. He had thrown up a vile, green slime. There was no other way to explain it but that-- no food, just heavy, thick mucous. And it was the color of a commercial cleanser. Approximately six months later, some doctors came in who dealt with the victims from Hiroshima and Nagasaki in Japan. I told them the story about my son and he said, "Well, that's a classic case of radiation sickness poisoning."

NARRATOR: But Moulder is skeptical because the dose at Three Mile Island was so much lower than Hiroshima.

JOHN MOULDER: In the case of Three Mile Island, it makes no sense whatsoever. We have a very good idea what the doses to the population were around Three Mile Island. Most of the population got something in the neighborhood of 2 to 10 millirem. To get radiation sickness, you need 200,000 millirem.

NARRATOR: But could the authorities have lied about the amount of radiation that was released?

JOHN MOULDER: There is no way in a technological society you could conceal radiation exposures that high. A dose high enough to cause radiation sickness would, for example, have fogged common photographic film for hundreds of miles. Any photographer would have noticed it. Any hospital that did X-rays would have noticed it. Any dental studio would have noticed it.

NARRATOR: The Environmental Protection Agency, the Nuclear Regulatory Commission, the state boards of health all concluded that extremely small amounts of radiation were released.

Small compared to what? Certainly, compared with Hiroshima, but also compared to the radiation we get from nature. The average American, myself included, gets about 350 millirems of radiation each year, most of it unavoidable. Cosmic rays shower down on us from outer space, giving us about 30 millirems per year. If you live at higher altitudes, like Denver, you get 60 millirems.

Then there are the rocks beneath our feet. Since the beginning of time, radioactive elements in the Earth's crust have been decaying, giving off radiation. Because our building materials come out of the ground, they're slightly radioactive, giving us about 10 millrems a year. Some materials like granite give more. New York's Grand Central Station, for example, emits hundreds of millirems per year. We get about 50 to 80 millirems each year from medical sources like CAT scans and X-rays. And another 30 millirems or so comes from within our bodies.

JOHN MOULDER: So when we eat food, a certain part of the molecules in that food, the hydrogen and the potassium, even the oxygen, are very mildly radioactive. So all of us, and all animals and

plants, are mildly radioactive and this has nothing to do with any man-made source of radiation. They always were and they always will be.

NARRATOR: But there's one source larger than all these combined. It came to light at this nuclear facility, thanks to the efforts of this man, Stanley Watras. A few years after the Three Mile Island accident, Watras, an engineer, was helping bring eastern Pennsylvania's Limerick reactor on line. Watras showed us what happened next.

STANLEY WATRAS: All the alarms went off. Sirens went off. Red lights went off. It came out on a digital display that I was highly contaminated throughout my entire body. So, obviously, that kind of set me back.

NARRATOR: Watras was decontaminated and went home. The next day it happened again. It happened for 2 weeks.

TECHNICIAN: You again?

STANLEY WATRAS: Yeah. Same old, same old.

TECHNICIAN: Come on over here. Let's see what we've got.

STANLEY WATRAS: Okay.

NARRATOR: Watras didn't seem to be picking up radiation in the plant, so eventually he persuaded the health physicists to check out his home.

STANLEY WATRAS: They took air samples, little grab samples. It was the standard norm back in 1984. They took these samples down to the chemistry lab and they found out that it was that the place was highly contaminated with background radon radiation.

NARRATOR: Radon-- it had long been known as a danger faced by uranium miners. It's a gas produced by decaying uranium in the soil. But no one suspected that significant amounts built up in houses. Ironically, Watras had been carrying radiation from his house to the Limerick plant, not the other way around. While few homes have as much as Watras's, radon collects in all our basements, sticks to all our furnace filters and air vents. How does this source compare with what we get from a nuclear power plant?

JOHN MOULDER, Medical College of Wisconsin: Well, a typical house in the United States, the annual dose from radon is about 200 millirem, compared to, for the average person in the United States, the dose they get from nuclear power is a small fraction of a millirem. The annual dose from radon is hundreds of times bigger, probably thousands of times bigger. What dose would somebody get if they were living 24 hours a day, 365 days a year, at the closest part of the boundary fence? That's not very realistic, but that's beside the point. They would get a couple of millirem per year. It'd be very small compared to the background radiation.

NARRATOR: And ironically, the area around Three Mile Island is exceptionally high in radon radiation, four times the national average, yielding 800 millirems per year. This fact leads nuclear physicist Bernard Cohen to a startling conclusion.

BERNARD COHEN, Professor of Physics, University of Pittsburgh: As a result, people living in

that area get more radiation from radon in their home everyday than they got in total from the Three Mile Island accident.

NARRATOR: Many Pennsylvanians, like Linda Braasch, have been actively monitoring radiation from Three Mile Island since 1979. But have they had their own houses tested for radon?

LINDA BRAASCH: I have not had my house tested and perhaps I will some day, but I don't look at it as_ it's not a_ it's not a man-made_ it's not a man-made thing. Radon is part of_ seeps in through_ it's in the dirt. It's in the_ it seeps in through our homes. And we've been building homes for many, many, many, many, many, years and my_ and my_ you know, where's my thinking wrong here?

NARRATOR: Can human cells tell the difference between a millirem of radiation from a man-made source and one of nature's millirems?

JOHN MOULDER: No, there is no logic to that. A millirem of penetrating radiation will do the same amount of damage, essentially, no matter what the source of it is. There is no logic worrying about radiation from a nuclear power plant five miles away and not worrying about the radon in your basement.

NARRATOR: Nuclear critics concede that a normally operating plant may not pose a major threat. Their biggest fear is what happens if something goes wrong.

ACTOR: ["The China Syndrome"] Oh my God! It's that pump.

NARRATOR: From the beginning Hollywood exploited our dread of a nuclear apocalypse. Films like "The China Syndrome" have left the impression that nuclear reactors might cause devastation on the scale of Hiroshima.

ACTOR: ["The China Syndrome"] I may be wrong, but I would say you're probably lucky to be alive. For that matter, I think we might say the same for the rest of southern California.

NEIL TODREAS, Professor of Nuclear Engineering, Massachusetts Institute of Technology: Yeah, well, first, you couldn't_ you couldn't have an explosion like a bomb, like a nuclear explosion. What you really have is a situation where you lose the cooling to the core. And you have the melting of the fuel.

NARRATOR: If nuclear reactors can't blow up like atomic bombs_ and no one I spoke to says otherwise_ the next worst imaginable scenario is a loss of the water that cools the core. When Western reactors lose this water that moderates or slows the neutrons, the nuclear reaction shuts down. That's the good news. The bad news is that the heat from decaying fission products can't be shut off and might melt the fuel rods.

The worst meltdown in history happened in 1986 at Chernobyl in the Ukraine. Critics and champions alike were appalled.

CHARLES TILL, Argonne National Laboratory West: Chernobyl was a very large plant. It had been operating long enough that it had a large inventory of radioactive materials in it. It was open to the atmosphere for days, on fire, with plumes of material, radioactive, going up into the air.

NARRATOR: Tens of thousands of people were exposed to high levels of radiation, some of them up

to 50,000 millirems.

RALPH NADER, Consumer Advocate: There's nothing deadlier than a long-lasting, highly toxic ingredient that does not challenge your sensory perceptions because you can't see it, smell it, taste it or otherwise defend yourself against it. And you can see that around Chernobyl now. You've got all these villages and towns that have been abandoned, with the creaking doors swinging in the wind and abandoned buildings.

NARRATOR: Western utilities say it's unfair to condemn their industry because of what happened at Chernobyl. Unlike Western reactors, Chernobyl used graphite, not water, as a moderator, so the reactor didn't shut down but ran away, setting the graphite on fire. The resulting explosion spread radioactive fallout far and wide

ALBERT REYNOLDS: The Soviet Union, at the time they built these Chernobyl-type reactors, they simply_ they're so large that they couldn't afford to contain them. Our reactors are much smaller. The pressurized-water, the boiling-water reactors, the light-water reactors are very small, and they're all contained. They have to be contained in order to get licensed.

NARRATOR: By "contained" Reynolds means that the cores of Americans reactors are shielded within massive steel and concrete domes. Even if an accident occurred, the argument goes, the radioactive material would be confined inside the plant. But what about a fire?

ALBERT REYNOLDS: No they couldn't catch fire and even if they_ some of the fuel melted, that fuel cannot get out of the containment into the environment.

NEIL TODREAS: The worst accident that I can see in Western reactor is a couple, two to five fatalities, maybe, of people inside associated with the plant. I can't see the general public outside the exclusion zone.

NARRATOR: Whether you're convinced that a Chernobyl-type accident could or couldn't happen in America, one thing is certain: Chernobyl gave us a worst-case demonstration of just how bad a nuclear catastrophe can be. After Chernobyl, we don't have to rely on Hollywood to fuel our fears. We can examine the real thing.

The accident was economically devastating. Thousands of people had to abandon their homes and have a slightly increased risk of cancer. Some children contracted a rare thyroid tumor. Fortunately, it's curable. Despite these tragedies, some scientists argue that the evidence from Chernobyl is reassuring.

CHARLES TILL: That's as bad as accident can be in a nuclear plant and worse than any accident in a modern nuclear plant could possibly be. The point I'm_ the point is that that reactor was on fire for days and days and days and yet the number of identifiable deaths from it are really only a handful.

NARRATOR: The actual death toll from Chernobyl is surprisingly low. Thirty-one firefighters died in the accident. So far, leukemia and adult cancers have not measurably increased. Terrible as Chernobyl was, there have many more deadly industrial accidents in this century, like the Bhopal chemical plant accident in India that killed thousands.

Supporters of nuclear power nuclear complain that if the chemical industry were held to the nuclear standard, it wouldn't survive. Even in America, more than a thousand people have been killed in

chemical plant accidents during the past 40 years. Nuclear executives say their safety record is much better.

JIM HOWARD, CEO, Northern States Power Company: In this country no one has been injured or killed in a nuclear accident involving radiation exposure. No one. But people aren't really good at assessing risk. And somehow we've decided that nuclear power is very, very risky_ is a very risky business.

NARRATOR: A non-nuclear steam explosion at a U.S. nuclear facility killed four people in 1986. But Howard is right. In America there have been no deaths or injuries from nuclear accidents in commercial power plants. Physicist Bernard Cohen blames the media for singling out nuclear.

BERNARD COHEN, Professor of Physics, Universtiy of Pittsburgh: The media don't pay any attention to risk analyses. They just say this is radioactivity. They call it "deadly radioactivity." I don't know why they call it "deadly." It's not killing hardly anybody, if anybody. Nobody talks about "deadly electricity," which-- although over 1,000 people a year die from electrocution in the United States. Nobody talks about "deadly natural gas," although I believe it's 5,000 people a year die from asphyxiation from natural gas, things of that sort.

NARRATOR: Have environmental groups unfairly targeted nuclear energy?

BILL MAGAVERN, Public Citizen's Critical Mass Energy Project: Well you'll find, actually, that Public Citizen and other allied groups have been very active critics of the chemical industry and the aviation industry and the coal industry. So I don't know why you're trying to distinguish among them. We are safety watchdogs and we're trying to improve health and safety for the American people. And the nuclear industry's record is nothing to shout about.

INTERVIEWER: But still, you're not trying to shut the chemical industry or the aviation industry down, are you?

BILL MAGAVERN: Ah, no, we're not.

NARRATOR: The record shows that some of these industries, coal for example, are environmentally unfriendly. Burning coal generates air pollution, acid rain, greenhouse gases and cancer-causing chemicals, but little protest or fear. If you think the difference is radiation, think again. Since coal contains radium, a coal plant actually emits much more radioactivity than a nuclear plant. A nuclear plant's cooling towers emit only steam_ water vapor.

Dr. BERNARD COHEN: The health effects of coal burning are thousands of times worse than the health effects of nuclear power, according to anybody's analysis, not my analysis necessarily. But they never report it. I've never seen that in print.

NARRATOR: Scientists like Cohen, who rank risks according to cold statistical danger, seem to come up with a completely different picture than the public, which assesses risks more personally. What Cohen is doing is called "risk analysis"_ determining statistically how dangerous various technologies actually are. What ordinary people engage in is risk perception_ intuitively deciding how dangerous technologies seem.

Where do our perceptions come from? Why do we perceive this technology to be dangerous rather

than safe?

HANK JENKINS-SMITH: [to focus group] What was the source of the knowledge that you have, the ideas that you have, the impressions that you've gotten about nuclear waste and nuclear power?

1st FOCUS GROUP MEMBER: Oh, I think that the very little that I know I probably heard on the news.

HANK JENKINS-SMITH: Okay.

1st FOCUS GROUP MEMBER: I don't know very much.

2nd FOCUS GROUP MEMBER: I've heard stuff on the news and read it in the paper and watched T.V. programs based on what could happen, you know, in Hollywood.

3rd FOCUS GROUP MEMBER: Television news, newspaper, public television.

NARRATOR: Scientists like Hank Jenkins-Smith have done extensive studies of the ways ordinary people think about nuclear power.

HANK JENKINS-SMITH, Director, Institute for Public Policy, University of New Mexico: Most of what we know as a population about nuclear power and nuclear stuff in general is an amalgam of images of nuclear war, in some cases the potential benefits, the technologies that can be harnessed, the energy that can be produced, but mostly images that are quite negative. Think about popular culture, which is one of the great deliverers of information about most concepts right now.

INTERCOM: ["The Simpsons"] Problem in sector 7G.

MONTGOMERY BURNS: 7G? Good God!

HANK JENKINS-SMITH: These bits and pieces of popular mythology feed the way that people understand facts about these things.

HOMER SIMPSON: Huh? Noise!

HANK JENKINS-SMITH: Most times, if you ask people, they'll say they really don't know a whole lot. But they still have a point of reference and that is sort of all these vague linkages to awful events.

HOMER SIMPSON: Oh, it's my problem! We're doomed!

INTERCOM: Section 7G is now being isolated.

HANK JENKINS-SMITH: It's got enormous implications. It creates this dread association, the fear that the worst can happen.

NARRATOR: Researchers say ordinary people use rules of thumb to measure risk. People tend to find technologies like nuclear power especially scary because of qualities that have nothing to do with how dangerous they are. First there's the dread factor, the fear of a catastrophic disaster. Second, say scientists like psychiatrist Robert DuPont, an expert in fears and phobias, there's the issue of

who's in control.

ROBERT DuPONT: If you feel like you're in charge, you have the feeling that you can stop the risk, you can help yourself. It's the difference between driving a car and being a passenger in an airplane. When you're driving a car, you perceive your ability to stop or swerve or stay out of a situation, whereas when you're the passenger in 14C, then you've got to depend on the air traffic control system and the mechanics at American Airlines and the pilot and everybody else who is going to keep you up there. So you get more afraid.

Now, of course, the paradox here is that in the modern world, when someone else is controlling the risk, we're actually safer than when we control the risk because when someone else is controlling the risk, there are social institutions in place to reduce the risk. To fly an airplane, you actually have to have training. To drive an automobile you don't. So that you're actually much safer when somebody else is controlling the risk. But the perception, the psychology, is the opposite. So what happens with nuclear power_ it's them, it's not me. It's somebody doing it to me that makes it unacceptable.

NARRATOR: DuPont, who was attacked in the 1980s by anti-nuclear groups for expressing these views, identifies two other important reasons we fear nuclear power. It's unfamiliar. Remote, exotic technologies are much scarier than technologies we encounter everyday.

Finally, there's need. Since most Americans know that the U.S. has ample supplies of coal and gas, they have little incentive to confront their nuclear fears. With air travel, which can't easily be replaced, people make great efforts to overcome their anxieties.

ROBERT DuPONT: On all four counts, nuclear power generates fear. It's a cataclysmic accident that people are concerned about. It's controlled by "them," the utilities or the government or the scientists or whoever it is that is perceived as the bad guys. It's unfamiliar to most people and most people feel they don't really need nuclear power, that they can get their power from coal or oil or windmills or some other basis. They don't really need the the nuclear power.

NARRATOR: What's true for Americans is also true for Italians, Germans and Swedes. But it's not true

everywhere. There are countries where nuclear power is accepted, even popular-- parts of Asia and especially in France. France runs on nuclear power. Seventy-five percent of French electricity is nuclear-generated. I visited the village of Civaux in southwestern France, the site of France's latest and most modern nuclear plant. to find out what local people like Madame Schoumacher thought of nuclear energy. I asked her if she was afraid.

YVETTE SCHOUMACHER: [subtitles] No, I'm not afraid of nuclear (energy). I think there is a lot more risk getting into my car in the morning or for those living under a dam or those who work in very dangerous occupations.

NARRATOR: This is Rene Barc, the village schoolteacher. Is he afraid that the nuclear reactors half a mile away will put his students in danger?

RENE BARC: [subtitles] No, I am not afraid. I visited the site several times during construction. I heard the explanations, saw the models, the films about the plans. They explained that it was a very advanced technology with a high degree of safety. So I'm not afraid.

NARRATOR: Everyone we spoke to in the village seemed unconcerned, from the baker_

JAQUES RAMBAULT: [subtitles] No, it doesn't scare me.

NARRATOR: _to the village hairdresser.

NATHALIE GAULF: [subtitles] No, I'm not at all afraid of nuclear energy. It was here before I came here. Since I moved here, it shows that I am not afraid.

NARRATOR: Since the technology is the same, why are the attitudes so different?

RALPH NADER: They're not well informed at all. They can't get the information from their government. There's the administrative state that's very, very secretive. And the industry and the government are almost indistinguishable, number one. Number two, they have no right to go to court to open it up. The courts don't have the influence in France against administrative agencies, the way our courts do. They don't have a tort law system the way we do. They don't have a Freedom of Information law the way we do. When it comes to nuclear power, they might as well be a totalitarian society. They're as closed on nuclear power as any_ as the Soviet Union was.

NARRATOR: But are the French really so brainwashed or is there another explanation? Certainly, since the early '70s, there's been little public opposition to nuclear power. To the contrary.

CLAUDE MANDILL, Director General, Ministry of Industry: Three years ago we thought possibly it would be necessary to have a new unit. There was a fight between several sites, not to avoid the plant, but to have it. There were a lot of members of parliament which_who came to see the minister_ "I want the plant." French people like big industrial projects and nuclear plants are one of the most often visited plants in France. During summer its the place where you go to bring family, you see?

NARRATOR: More than 6 million French people have taken tours, like the one I took of Civaux, which explained in exhaustive detail how everything worked.

TOUR GUIDE: [subtitles] We are going to continue the tour and go into the reactor building.

NARRATOR: Unlike Nader, I thought the French knew much more about nuclear power than Americans, not less. But I noticed a more striking difference: Unlike Americans, the French seem to trust their experts.

CLAUDE MANDILL: For a long time in the families, the good thing for a child was not to become a lawyer, it was to become an engineer or a scientist. French people like their engineers and their scientists. And they are confident. They rely on them.

NARRATOR: While French citizens have no more control over nuclear power than Americans, polls show they trust the people who do. That's an important difference. But more important even than familiarity and trust, it seems to me, is the fourth attribute: need. The French have few energy resources. After the 1973 oil crisis, they concluded that their future as a modern nation depended on nuclear energy.

JEAN-PIERRE CHAUSAUDE, Electricité de France: In France we have no oil, no gas, no coal, no choice. And for the French people, it was very positive to develop national energy with nuclear energy. And when we built these plants, we explained much. We developed many, many

presentations_

1st ACTOR: [television commercial] [subtitles] Plug in his nuclear toaster.

2nd ACTOR: You mean electric.

1st ACTOR: Nuclear.

2nd ACTOR: Electric.

1st ACTOR: Nuclear

JEAN-PIERRE CHAUSAUDE: --to explain to the French that it was very important for France.

NARRATOR: If fear is less in France, so is cost. France's centralized political system allows standardization and control unimaginable in the U.S. The French selected just one American reactor model and charged one agency, EDF, to run the system for the nation. But America's decentralized system meant that from the start it was a messy and expensive free-for-all, many different designs managed by many different utilities. Ironically, in American hands, the energythat some dreamed would be too cheap to meter has ended up one of the most expensive ways to generate electric power.

BILL MAGAVERN, Public Citizen's Critical Mass Energy Project: And what we have coming in this country is more competition in the electricity market and a lot of these nuclear reactors cannot compete. Some of the existing ones will be able to compete and will keep running for a while, but they'll reach the end of their lifespans. Some of them will not be able to compete and will shut down well before the end of their projected lifespans. And building a new reactor is just a complete fantasy in this country.

RALPH NADER: What do you say about a technology that wants to persist on the public dole because it can't meet a market test? I don't know anybody in Wall Street and I don't know anybody in the electric utility industry who wants to build any more nuclear plants.

NARRATOR: Nuclear physicists like Charles Till argue that's short-term thinking.

Dr. CHARLES TILL, Argonne National Laboratory West: The exciting thing about nuclear power is its ability to handle mankind's needs in the future. It's not whether today in the 20% of electricity that it produces in this nation, whether it can produce it for two and a half cents a kilowatt hour or four cents a kilowatt hour where, you know, coal may be three and a half cents or whatever. That isn't the argument at all.

NARRATOR: Fossil fuels like coal, oil and gas, says Till, may be cheaper now, but as supplies decline that will change. Fossil fuels also produce pollution and greenhouse gases, so that many environmental groups oppose their use as well.

INTERVIEWER: So where do we get our electricity from?

RALPH NADER: We get it from solar. You want me to give you a book that shows how realistic solar is? You've got wind power. You've got biomass. You've got photovoltaics. You've got tidal. You've got

all kinds of technologies now moving toward commercial viability.

NARRATOR: Can the sun and wind satisfy our energy needs?

Dr. CHARLES TILL: Energy has to be produced for modern society on a huge scale. The only way you can do that is with energy sources that have concentrated energy in them_ coal, oil, natural gas and the quintessential example of it is nuclear, where the energy is so concentrated. I mean you have something to work with. With solar your main problem is gathering it.

NARRATOR: Few seem to share Till's long-term vision. From Main Street to Wall Street, nuclear energy is perceived to be a risky proposition. And since America for now has ample supplies of cheap fossil fuels, it's a risk Americans don't have to face. That still leaves the 109 nuclear plants currently in service that produce 20 percent of our electricity. Anti-nuclear groups want these plants shut down because of what may be the biggest nuclear issue of all: nuclear waste.

On this surreal parking lot a few hundred yards from the Prairie Island reactor near Minneapolis sit five dry casks filled with nuclear waste. Inside each cask are 40 intensely radioactive spent-fuel assemblies that have been removed from the core. I don't keel over and die because nine and a half inches of stainless steel block the gamma rays.

TECHNICIAN: As you see right here, right on the cask, it's about 3 millirem per hour and a cross-country airline flight is going to give you about 5 millirem and a chest X-ray is about 30 or 50 millirems.

INTERVIEWER: Oh.

NARRATOR: A few feet away the level drops off to

background. Of all the materials inside the casks, the one that probably causes most fear is plutonium, a substance that remains radioactive for hundreds of thousands of years. Plutonium has attained legendary status as the most toxic substance in the world.

WALTER CRONKITE: Plutonium is the most deadliest substance known to man. A tiny amount on the skin will kill.

NARRATOR: The truth is less dramatic. The radiation given off by plutonium can't penetrate human skin. It can even be stopped by a thin sheet of paper. While plutonium is dangerous to ingest, it's nowhere near the most toxic substance known to man. It is, however, a highly concentrated form of energy. There's as much energy available in one gram of plutonium as in one ton of oil. So outside the United States, in France, Japan and many other countries, they don't regard plutonium as waste. They recycle the plutonium and unused uranium and fabricate new fuel elements. By recycling the plutonium, they not only reduce the volume of the waste, they also get energy.

The U.S. is different. In the '70s, because of fears that reactor plutonium might fall into the wrong hands, the U.S. government decided not to reprocess plutonium, but treat it as waste. That means it's going to be around for a very long time.

RICHARD STALLINGS: When you make that decision that you are not going to recycle, then no longer are you dealing with a potential resource, but you're dealing with a waste product and a waste product that has a tremendous half-life. I mean, we're talking about a product that's not going to be

just around for a few hundred years, but thousands of years.

NARRATOR: Richard Stallings was appointed in 1993 as the federal nuclear waste negotiator. It was his job to try to find a community willing to take the high-level waste from nuclear power plants on a temporary basis until the government established a permanent repository. He found it hard going.

RICHARD STALLINGS: It was a very hard sell. When people are terrified, they're not concerned about facts. The perception was anything nuclear just scared people to death. Their thought is that it's some kind of green, oozy stuff that's spewing poison, that you get near it and you'll die within minutes or hours.

NARRATOR: Stallings discovered that public fear of

nuclear waste knows no bounds. Nobody wants this stuff in their back yards or traveling on their roads. The nuclear industry claims their transportation casks will survive any conceivable accident. They've hit them with trains, dropped them from the air, onto metal spikes, submersed them under water and burned them for hours. The containers survived intact. But somehow these demonstrations don't seem to make people feel safe.

Nevertheless, the waste has to go somewhere, even if the nuclear industry shut down tomorrow. That's one point both sides agree on.

RALPH NADER: This is, of course, the conundrum of conundrums because while you can stop nuclear power, what do you do with the waste that's available? Do you keep it next to the reactor, do you put it in a temporary repository or do you put it in a permanent?

NARRATOR: The Federal Government wants to send all the high-level waste from all the plants to Nevada, a state that has no nuclear power. In Las Vegas, people are mad as hell. Business leaders worry that the stigma will drive tourists away. Citizens worry about the dangers the waste might pose now and for thousands of years to come.

1st NEVADAN: How many deaths can we expect over the duration of this project?

2nd NEVADAN: We don't want to be scapegoats again.

3rd NEVADAN: We want to bring other people's nuclear waste into our state. How come they can't keep it?

NARRATOR: The proposed permanent repository is here at Yucca mountain, some 80 miles from Las Vegas. The Department of Energy has been tunneling for more than two years. It's quick to say that this is just a scientific investigation to see if the site is suitable. To dig and characterize this exploratory tunnel will cost $2 billion. To build the repository itself may cost 10 times as much. The repository, if it's built, will accommodate hundreds of casks of high-level waste, including plutonium, in a labyrinth of rock tunnels. The plan is to seal it up and leave it forever. Yucca mountain is a graveyard.

Nevadans want reassurance that the waste will be safe not only this year, but for the tens of thousands of years it remains radioactive. The government is not finding it easy to reassure people.

RICHARD STALLINGS, Former Federal Nuclear Waste Negotiator: I mean, you can't find any

engineer that's going to sign onto a document that this hole in the ground is going to be safe for 10,000 years or safe for even 200 years. I mean, that's impossible to do.

NARRATOR: Research shows that people are even more opposed to living near a nuclear waste dump than a nuclear reactor. The difference isn't the risk, it's the lack of benefit.

HANK JENKINS-SMITH, Director, Institute for Public Policy, University of New Mexico: In the United States, of course, we don't reprocess. We don't reuse, recycle, however you want to describe it, that nuclear waste. What we've done is we've isolated all the bad attributes and packaged them up as nuclear waste and, you know, there's not much in the way of redeeming value in there to warm people up to it.

NARRATOR: In France, people worry about waste as well. A few years ago, when they discovered the strength of such attitudes, France redesigned its high-level waste policy. Research showed that what bothered people most was the idea of a permanent geological site, like Yucca mountain, where waste would be abandoned. People felt much safer with the concept of an underground laboratory, where waste is not only carefully monitored, but where research goes forward on how to transmute it to a safer form. Remarkably, redefining the site completely changes people's attitudes toward the same waste.

HANK JENKINS-SMITH: [to focus group] Now, if that kind of a strategy were opted for in the United States, would that seem more attractive than a place that's primarily a disposal facility where we permanently cork it up? Or what's_ what's your sense about that? What's your reaction to it? Darlene?

1st FOCUS GROUP MEMBER: I think it would be a great idea for the simple reason that it would be carefully watched.

HANK JENKINS-SMITH: Shannon, what about you?

2nd FOCUS GROUP MEMBER: Oh, yeah, because it means somebody is doing something with it, instead of just leaving it in the ground and forgetting about and waiting till something happens years down the road.

HANK JENKINS-SMITH: The research laboratory idea actually is a high-prestige kind of an entity. It brings in top-level scientific jobs. It creates the prospect that this dreadful stuff might actually be turned into something useful. Things that are seen as waste right now could be seen as the most valuable of resources in the future. I mean, we weren't using molybdenum much 150 years ago. It was in the way. Wood chips now that we use regularly as building material were a waste product not so long ago. I mean, as technologies change and as different uses are found or as other resources are used up, things that are now of no value could be of tremendous value.

NARRATOR: But U.S. policy makers don't want a laboratory. They want a graveyard. They're determined that Yucca mountain will open sometime after 2010.

RICHARD STALLINGS: And, essentially, it says to this nation that we're as smart as we're going to get on nuclear materials. Noone's going to get any smarter. And the fact that there might be other things we can do with this material was completely lost. And so we just put it in a hole in the ground and thought somehow we could walk away from it and our problems would be solved.

NARRATOR: These children are visiting a teaching reactor in Virginia where it's possible to see a nuclear core glowing at the bottom of a containment pool. For them it's like a museum visit, a curiosity. If current trends continue, by the time they're middle aged, nuclear power may be largely phased out in the U.S., though it will almost certainly continue to thrive in France and in Asia.

Throughout history our species has encountered and mastered powerful natural forces, balancing promise and risk. In this century, when we unlocked nuclear energy, we built weapons capable of destroying the world because we thought we needed them. We haven't needed nuclear power in America, so we enjoy the luxury of investing it with our nuclear fears. Civilizations run on energy. What will our descendants make of our decision to reject this awesome source? Will they applaud us for having the courage to say no or will they condemn us for surrendering to our fears?

ANNOUNCER: So what do you think about nuclear power? Join in the discussion at FRONTLINE's nuclear web site at www.pbs.org. Check out Hollywood's radiation nightmares and dig deeper, take the nuclear phobia survey, tour the best of the nuclear web and much more at www.pbs.org. And let us know what you thought about tonight's program by fax at (617) 254-0243, by e-mail, frontline@pbs.org, or by the U.S. mail [DEAR FRONTLINE, 125 Western Ave., Boston, MA 02134].

Next time on FRONTLINE, the story of a warrior breed, the culture they thrive in and what happens when it clashes with the sexual politics of the '90s. "The Navy Blues," a FRONTLINE investigation.

NUCLEAR REACTION

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