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A Covenant Breached

We of this nation, desirous of helping to bring peace to the world and realizing the heavy obligations upon us arising from our possession of the means of producing the bomb and from the fact that it is part of our armament, are prepared to make our full contribution toward effective control of atomic energy.

Bernard Baruch, 1946

I have selected the Tennessee Valley Authority's Watts Bar and Sequoyah reactors as the preferred facilities for producing a future supply of tritium. . . . It is the best deal for the taxpayer.

Bill Richardson, 1998

Nuclear War in the Twenty-First Century

In the last half of the twentieth century, people worried a lot about nuclear war. For those of us who kept up with world news and lived in the potential nuclear battle zones of the Northern Hemisphere, such worries were hard to avoid. From the early 1950s through the 1980s, novels, magazines, street demonstrations, movies, and television brought these fears into focus for us. Millions of Americans watched ABC's *The Day After,* in which Jason Robards tried to run a medical clinic in Kansas in the days following an all-out nuclear war, only to join the death toll from radiation poisoning. Many of us secretly wondered in those days whether we had the courage to face a post-holocaust world.

Most of the time, though, the prospect of nuclear war in our time was not a vivid, waking fear, but more an unspoken dread. The possibility of nuclear war between the Soviet Union and the United States was seldom a topic of casual conversation, but fear of it provided a dark, unconscious background to our lives.

The strength of those fears can be measured by the relief we felt when the superpowers finally backed off from nuclear confrontation. Today, after more than a decade of disengagement between the Russians and Americans, the dread is mostly gone. Some of the twentieth-century visualizations of nuclear war now seem old fashioned, like grainy images of children ducking and covering and Nikita Khrushchev at the United Nations, pounding his shoe. These old images seem quaint, even campy.

It is human nature to celebrate escape from a life-threatening crisis. So is the tendency to dismiss the residual danger. But nuclear weapons are so destructive, and nuclear war so difficult to control once started, that it would be foolish to indulge in wishful thinking about the danger of nuclear war in the twenty-first century.

But today, for most people, the dread is simply gone. We no longer have movies or marches or TV shows to help us visualize nuclear wars of the future. If we did, though, you would see some differences from the imaginings of the past.

First and foremost there would be different candidates for the nuclear-armed combatants. For example, in one scenario you might see Pakistan and India allowing their conflict over Kashmir to escalate into a catastrophic nuclear nightmare, with tens of millions of deaths. Another plot line might start with an anonymous nuclear strike against Tel Aviv, followed by massive Israeli nuclear retaliation against Iran. Even the U.S. war against worldwide terrorism might be imagined to go nuclear. Thinking farther into the future, one would have to consider new nuclear states and new enmities. As nuclear weapons spread to more players, the combinations multiply, while the likelihood and severity of potential nuclear wars grow.

The nuclear-armed combatants in these new visualizations might be different from those in our imaginings of the past, but the nature of their conflicts will be driven by some of the same cold logic that emerged in the twentieth century nuclear standoff. Still applicable will be terms like "preemptive strike," "decapitation," and "launch on warning." Still present will be the tendency for a conflict to escalate rapidly and without control, since the ability to use whatever nuclear weapons a nation has deteriorates within hours or days of the start of a nuclear war. Still mind boggling will be the scale of death and destruction.

Eight nations are known to possess nuclear weapons today, and it is highly likely that more will acquire them in the twenty-first century. Given the tensions of the world and the unfortunate human propensity to strike out in anger against rivals, there is a good chance that at least one nuclear war will occur in the twenty-first century. If it does, there is little doubt that it would be the most destructive event in history.

If nontrivial nuclear exchanges do occur, anywhere in the world, then death and disease of civilians and armed forces due to the use of nuclear weapons will be a glaring and potent image for every human being on the planet. Cancer will continue to be a major killer, but radiation will be a suspected cause in every case. Without doubt, life will go on, but everything will be irrevocably changed.

Given this hypothesis, it is worth wondering how history will judge the people and governments that introduced nuclear technology and managed its promise and its danger. The United States will come in for the most intense scrutiny, because all paths lead from one event: the Manhattan Project. Moreover, the U.S. continued in the post–World War II period to lead in the technical development of nuclear weapons and nuclear electric power. The Soviets followed, out of fear and ambition. True, the rise of nuclear technology was probably inevitable, and in an alternate universe, its rise might have taken a different path. But in this universe, it was the United States that brought nuclear weapons into the world.

Perhaps a future of widespread nuclear conflict is inevitable, but history will judge us by what we did to avoid the worst outcomes.

This book is not about the likelihood and consequences of nuclear war in the twenty-first century, but rather about a recent, little-noted change in U.S. policy on tritium for the nuclear arsenal. In December 1998 Secretary of Energy Bill Richardson decided that the United States would produce tritium for nuclear weapons in commercial nuclear power reactors. This unheralded, seemingly innocuous decision abandoned a long-standing policy in the United States of separating civilian and military uses of nuclear energy. The new policy is bad for U.S. national security and for world security. It also turns out to be bad for the health and safety of the people who live near the power plants that are to be used for this purpose.

Tritium is an isotope* of hydrogen that is, essentially, perishable. It is the "H" in "H-bomb." The inventory of tritium in each weapon in the U.S. nuclear arsenal slowly decreases through radioactive decay, and if enough time passes, the weapon's performance will be severely degraded. Thus, a part of the job of managing the nuclear stockpile is to recharge each H-bomb periodically with fresh tritium. A steady supply of tritium is thus needed to maintain the U.S. arsenal of nuclear weapons. For the time being, this supply can come from the weapons that are being decommissioned under the terms of the nuclear arms treaties now in force between the United States and Russia. But once that temporary supply is exhausted, a new production facility for fresh tritium will be needed, since all the cold war–era facilities have, for reasons of safety, been shut down. The Department of Energy foresees such a need's occurring by 2006, though in reality no tritium will be needed for a decade or more beyond that date.

There are numerous viable options for obtaining tritium for the nuclear stockpile, but in Richardson's 1998 decision, the government chose a path that is inconsistent with the nation's interest in avoiding widespread nuclear conflict in the twenty-first century. One would assume that such a portentous policy decision would be made with agonizing attention to the costs and benefits of the change. In fact, it appears that the decision was substantially crafted at a low level in the U.S. government, that the secretary was ill prepared to address the broad issues involved, and that the White House was hardly aware of the decision or its significance.

The worrisome truth is that lapses of this sort have occurred periodically over the history of the U.S. government's management of the dangers that arise from the deployment of nuclear technology. There has been a remarkable unevenness in behavior with respect to these dangers, with periods of intense vigilance and intelligent action interspersed with mindless complacency and indirection. During the complacent periods,

* Atoms with the same number of protons but a different number of neutrons are called *isotopes* of the same element. Tritium has one proton and two neutrons, so it is an isotope of hydrogen, whose normal form has one proton and no neutrons. There is one other hydrogen isotope, deuterium, which has one proton and one neutron. The physical properties of tritium and deuterium are essentially identical to those of hydrogen except when nuclear reactions are involved.

policy often migrates to middle-level bureaucrats who operate far from public view and whose decisions are unlikely to reflect the best interests of the nation or of the world.

The United States and the world can ill afford this kind of inconsistency. We stand at a critical transition in the history of nuclear weapons. If the twentieth century is characterized as the age of the bilateral nuclear standoff, the twenty-first will very likely be the age of broad proliferation of nuclear weapons and the means to deliver them, an age when even small and regional conflicts can escalate into nuclear wars with profound and unpredictable effects on the world economy, the global environment, and international security.

But public attention to the threat of nuclear war and the spread of nuclear weapons has declined markedly since the end of the cold war. This is unfortunate, because an aware public is the best means of keeping the government focused and vigilant. This book presents the tritium story in the context of the larger trends in U.S. nuclear policy, showing how and why the new policy came to be and what it portends for the future that will judge us.

Wrong Two Ways, No Way Right

According to the U.S. government's new plan for obtaining the tritium required to recharge its nuclear weapons, three commercial nuclear reactors operated by the Tennessee Valley Authority (TVA) will make tritium during the normal course of their electricity production. Two of the reactors are at the Sequoyah nuclear power plant, and the third is at the Watts Bar plant. All three lie on the banks of the Tennessee River not far from Nashville.

The reactors are "commercial" in the sense that they are designed and licensed solely to produce electricity for commercial sale on the grid. To produce tritium the reactors will have to be modified substantially, but when they come back on line after the modifications (now scheduled for around 2006), they will still churn out kilowatts for the TVA's customers in seven southern states. What will be different is that the TVA will at that point have a new customer that once a year or so will drive special trucks up to the power plants and load up bundles of twelve-foot-long, pencil-thin rods that have been irradiated inside the reactor. Heavily

armed troops will guard the whole operation, because these rods will contain tritium bound for the hydrogen bombs of the U.S. nuclear arsenal.

The amount of tritium in modern nuclear weapons is remarkably small, just a few grams in each bomb, but it has a significant effect on explosive yield. Figure 1 is a sketch of the kind of fission weapon used in the bomb dropped on Nagasaki, with one addition: a mixture of deuterium and tritium (D-T) is present at the center. When the explosive in the weapon is set off, the plutonium sphere implodes until the fission chain reaction starts. The D-T then undergoes fusion reactions (two atoms fuse to form a helium atom), which vastly accelerate the fission reaction. Such a weapon is said to be "boosted," since the D-T multiplies the explosive yield many times over. Some of the weapons in the U.S. nuclear arsenal are much more complicated than this diagram indicates, but all are boosted, and hence all need their tritium replaced from time to time.

As noted above, using commercial reactors for producing any of the explosive ingredients of nuclear bombs represents a dramatic departure from the policies of the past. Ever since the Manhattan Project in the 1940s, nuclear materials for defense have been produced at dedicated military reactors located in deeply remote parts of the country, surrounded by layers and layers of guarded fence.

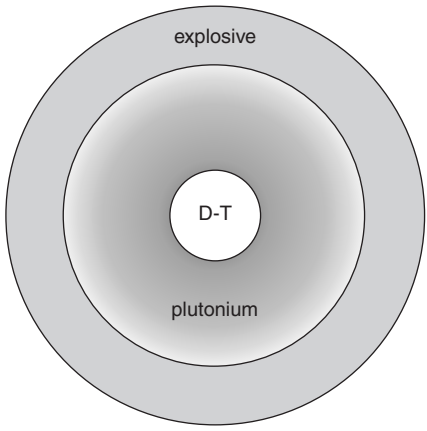

Figure 1
Conceptual drawing of a simple boosted fission weapon.

This book will show that the plan to produce materials for nuclear weapons at commercial nuclear power plants is dangerously and foolishly wrong in two important ways. It is wrong, first, because it will increase the likelihood that nuclear weapons will spread to countries or groups that now do not possess them. It is wrong, second, because the modifications necessary to produce tritium for weapons will make these three reactors, already marginal in terms of safe operation, even more likely to undergo accidents that could expose thousands of people to deadly radioactive doses.

The Impact on Nuclear Weapons Proliferation

There is a widespread belief that the peaceful side of nuclear energy has little to do with its military side, but that is false. The nuclear fuels used in power reactors are the same materials as the nuclear explosives for bombs. The specialized technology for enriching the former is the same as for the latter. The physics of the energy release is the same.[1] It is only through strict administrative controls that the use of nuclear energy for commercial electricity can be prevented from causing proliferation of nuclear weaponry.

In chapter 2 we will see that the U.S. government has, over time, come to recognize these requirements and has worked closely with other nations to establish a far-ranging system of constraints that has grown into a vast international nonproliferation regime. The system is complex and pervasive, encompassing

- barriers on international commerce in nuclear explosive materials
- export controls on critical nuclear weapons technology
- tight secrecy on weapons design information and on the technology for producing nuclear weapons materials
- intrusive in-country monitoring by the International Atomic Energy Agency (IAEA)
- a variety of other government policies and processes

Through many of these functions runs a key principle: strict isolation of civilian nuclear plants from military missions. The principle of "no dual use" for commercial reactors has its roots in the Manhattan Project of the 1940s and Eisenhower's Atoms for Peace initiative in the 1950s. It has been reflected faithfully in the policies of eight presidential

administrations. Secretary Richardson's decision of December 1998 was the first significant breach of it.

But even aside from historical tradition, there is today an important practical reason for adhering to the principle of separation. It involves the attitudes and behavior of other countries, particularly signatories and potential signatories of the Nuclear Nonproliferation Treaty (NPT), which will be discussed in chapter 4. This international agreement is the binding mechanism for worldwide restraint on nuclear weapons proliferation. It is also one of the greatest American diplomatic achievements of the twentieth century. It is effectively a contract between the five nations that officially possess nuclear weapons and other countries that agree to eschew acquiring them. In exchange for that agreement, the nuclear "haves" agree not only to assist the "have nots" in their nuclear electricity industries, but also—and this is a key point—to work toward reducing and eliminating nuclear arms worldwide.

One hundred eighty non–weapons states have signed the NPT, but some nations severely criticize it as a cynical means of perpetuating the asymmetry between the weapons states and the non–weapons states. They complain that technical assistance on nuclear electricity is nothing but a way of perpetrating a kind of high-tech imperialism and that the weapons states' commitment to eliminating their nuclear arsenals is a sham. India refuses to sign the NPT for those reasons. It has now acquired a substantial arsenal of small nuclear weapons. India's bitter rival Pakistan has followed the same path.

Clearly, the continued success of the NPT in the twenty-first century depends critically on the sincerity and credibility of the United States's actions with respect to reducing nuclear arsenals and avoiding nuclear proliferation. The new tritium policy sends a wrong signal to potential nuclear-armed countries. Many in those countries have said so.

As chapter 5 will show, the Department of Energy (DOE) has rationalized the new tritium policy with white papers and public presentations that brush aside the policy issue with sophistry, deception, and artful legalese. But the policy issue is profoundly important, and the breach is substantive and irresponsible.

The Impact on Public Safety

The safety of the particular reactors chosen for the new tritium job was apparently not a factor in Secretary Richardson's 1998 decision to allow tritium production at commercial nuclear power plants. The thinking was, no doubt, that if the Nuclear Regulatory Commission (NRC) granted operating licenses to these three reactors, they must be safe. But as chapter 3 will show, nuclear safety experts know that when it comes to protecting the public from accidental radioactive releases, there are vast differences between the best of our reactors and our worst.

From a safety perspective the U.S. government could probably not have made a worse choice of a type of commercial reactor for this new military mission. All three of these TVA reactors are "ice condensers," so designated because they are equipped with gigantic arrays of wire baskets filled with chipped ice to absorb the steam and heat that would be released in a nuclear reactor accident. The containment buildings housing these great ice chests are small and weak compared to the awesomely large and strong containments that are considered the safest, a class that includes that of the Three Mile Island plant that underwent a core meltdown in 1979.

Out of the 104 commercial nuclear reactors currently operating in the United States, only 9 are ice condenser plants. All were manufactured by Westinghouse Electric Company. Numerous studies have shown that this type of plant is exceptionally vulnerable to a wide range of core melt accidents that their more robust brethren handle well. This bad situation is likely to be made worse by the modifications planned for the reactors at Watts Bar and Sequoyah, as chapter 6 will show. The reasons for fearing deterioration in safety as a result of the planned modifications lie as much in the potential impact on the TVA management's commitment to safety as in the way the engineering changes might affect the progression of events during a reactor accident.

The obvious question arises, If these changes result in unsafe plants, won't the NRC prohibit them? Indeed, the NRC must review the changes and either approve or reject the proposed amendment to the TVA's operating licenses that would allow the plants to produce tritium. That review is expected to be completed sometime in 2002. Many of the safety issues involved are subtle and technically complex. For reasons laid out in chapter 6, there is cause for concern that the NRC will not take the high

ground on this license amendment review, that the technical staff will take a superficial perspective, and that the decision will be made at the highest levels of the NRC to let the TVA and DOE have their way.*

Besides elaborating on the charges listed above, this book will also try to explain why these three agencies of the federal government are collaborating to implement the new policy, despite the danger it represents to the people of Tennessee and the rest of the world. By delving into some of the hidden agendas that influence the behavior of these organizations, we can sometimes see the logic of their actions. The message about how the public's well-being is set aside in these complex bureaucratic games is disturbing, perhaps even more so than the tritium policy itself.

Dance of the Hidden Agendas

Picking on government agencies is unfair sport. Rare is the federal, state, or local agency unembarrassed by stories of wrongheaded policy, foolish decisions, and incompetent execution. Fortunately a free press ensures that most government agencies operate in the full view of stakeholders: voters and their representatives, interest groups, and so on. The bigger the issue, the more attention is paid. So the usual process is that an agency makes a mistake, some kind of uproar occurs, the agency backpedals (or not), pressure is applied from above, and things get fixed (sort of). And then on to the next cycle.

But it is a more serious matter when there is a persistent bias in an agency's behavior that reflects a set of more or less unstated assumptions about priorities within the organization. These understood priorities are quite separate from and sometimes in conflict with the organization's official charter. Such hidden agendas are less susceptible to correction by external scrutiny because their influence on organizational behavior is more likely to be carefully packaged and because reform in these areas is more likely to be resisted by those in control. Specialists in the theory of organizations have developed sophisticated methods for studying such processes, but average citizens understand the basic concepts. We know

* At press time, the NRC still has the TVA's license amendment requests under review.

about tax assessors' being tough on new parts of town, easy on older neighborhoods. We know about redistricting commissions' drawing strange voting boundaries to favor the powers that be. We know about water and highway projects that make little sense until you know who owns the land nearby.

When it happens at the level of the great federal agencies charged with serving the public interest in things nuclear, it is not always so obvious what is going on. The agencies' ability to obscure their motivations is aided by the technical nature of nuclear issues and by the discomfort some nonspecialists feel when confronted with scientific jargon and intentionally confusing explanations. This book will look at the hidden agendas of the key players in three federal agencies that have been brought together to implement the new tritium policy: the DOE, which needs the tritium for its nuclear weapons; the TVA, whose electricity-producing reactors will make the tritium; and the NRC, which must review the proposed changes in the reactors and pass judgment on their safe operation. There is a risk of oversimplification in such an analysis, but it is not possible to gain a true understanding of why the new tritium policy is being pursued and what it portends without exploring how these federal agencies are pressured from within to compromise the interests of the public they are supposed to serve.

The DOE lies at the center of the new policy. It is a vast, loosely coordinated collection of bureaucratic fiefdoms and classified nuclear weapons production facilities. Promotion of commercial nuclear power and production of nuclear weapons both lie within its charter, resulting in occasional temptations to bridge the traditional gulf separating military and civilian uses of nuclear technology. It is a notoriously intractable agency, hamstrung by conflicting internal requirements and paralyzed by deeply embedded no-win situations for its leaders. As chapter 5 discusses, selecting a technology for new tritium supplies has been a DOE mission for over twenty years, a mission that should not have been a great challenge, given the department's extraordinary budget and technical resources. But the decision process has floundered under the political pressures of selecting one technology over another or one site over another. Finally, in 1998, under intense budgetary pressure from Congress, Richardson, at that time the newly appointed Secretary of Energy, made the surprise choice of commercial reactors for the supply

of tritium. The decision has all the markings of following the path of least resistance. To the secretary, it had the delightful property of shuffling most of the hard work off to the TVA and NRC. The staying power of the DOE's hidden agenda with respect to tritium production is reflected in the fact that the new tritium policy persists even after a change of administration.

The TVA is another strange federal beast. Created during the depression to bring electricity and prosperity to the impoverished mid-South, the TVA has grown to be the largest electric utility in the nation, today operating more or less independently of federal funds.[2] Its headlong plunge into nuclear electricity in the 1970s is generally regarded as the agency's biggest failure, leaving it with a $26 billion debt and just five operating reactors out of the seventeen originally ordered. As detailed in chapter 6, the TVA's nuclear division has a record of safety violations, reactor accidents, and intervention by the NRC that is by far worse than that of any other utility in the nation.

Much of the reason for the TVA's poor financial and safety record can be traced to the management structure of this strange throwback agency. A three-person board of directors appointed by the president and approved by the Senate rules the authority. The board is remarkably autonomous, reporting to no member of the cabinet and exempt from much of the oversight to which other power companies are subject.

Many in Congress find the TVA's arrogance and independence infuriating, and recently there have been vigorous attempts to dismantle the agency and sell off its electricity-producing assets to private utilities. Throughout the TVA's history, it has been able to fend off such threats, partly through the protection provided by congressional delegations from the seven states in which it operates. Nonetheless, the board fears dismantlement more than any other threat. And herein lies the secret behind the TVA's cooperation with the DOE on the new tritium policy. If the TVA takes on this new defense mission, it becomes effectively a part of the nuclear weapons establishment. The practical barriers to dismantling this great nuclear dinosaur would then suddenly become insurmountable. Check and checkmate.

Finally there is the NRC. Unlike the TVA, it is a relatively modern agency, having been created in 1974 when the old Atomic Energy Commission was split into the NRC and what is now the DOE. Unlike the

DOE, its official mission is straightforward: it is supposed to ensure that the public is safe from all nonmilitary nuclear activities. But internally the NRC is damaged goods. In 1979 the accident at the Three Mile Island (TMI) plant forced the NRC and the industry it regulates to do something about core melt accidents, events deemed incredible before TMI. As chronicled in chapter 3, the NRC responded to the challenge, but the political reaction from the financially burdened nuclear industry has made the agency extremely sensitive about core melt accidents. One can sense a kind of "see no evil, hear no evil, speak no evil" quality in its recent behavior regarding the possibility of such accidents.

Unfortunately, core melt accidents are at the heart of the very significant safety problems of the TVA's three ice condenser reactors. To properly address those problems will require a considerable degree of courage and integrity on the part of individuals at several levels within the NRC. Current regulations allow the regulators to ignore safety problems of this type, even if they dominate the risk to the public. As chapter 6 will discuss, the NRC is likely to follow this easier path in reviewing the TVA's request to modify its reactors to make tritium for nuclear weapons.

Behind the actions of any federal agency there are no doubt dozens of hidden agendas, some subtle, others simple, some broadly understood, others selfish and covert. Some are even harmless. In the case of bad policy, however, it is essential to study what seems to lie beneath the surface. In the chapters that follow, the impact of hidden agendas on the actions of agencies and of individuals will be revealed through events from recent history. In some cases these hidden agendas explain why officials took certain otherwise inexplicable actions. In other cases the agendas are revealed when individuals in the organization choose to ignore the hidden requirements and pay a high personal price.