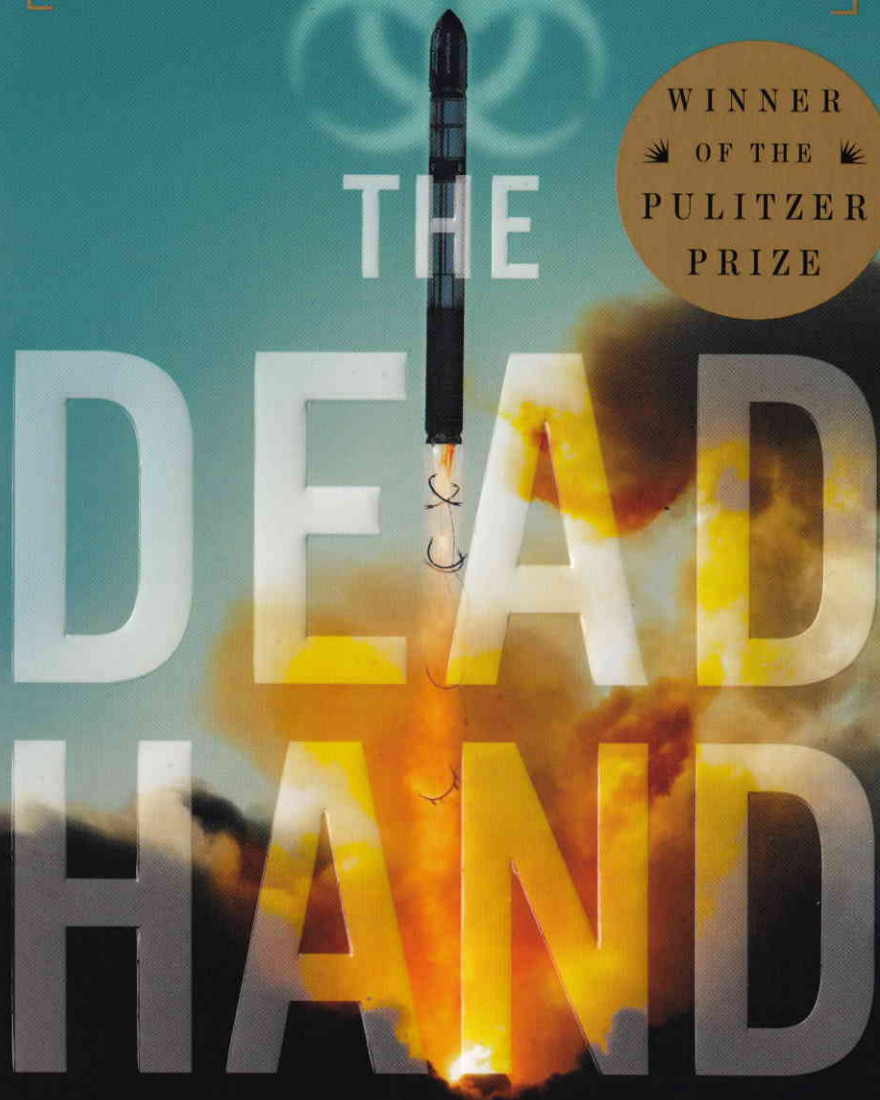


"Authoritative and chilling....A readable, many-tentacled account of the decades-long military standoff." —*The New York Times*

THE UNTOLD STORY OF THE COLD WAR
ARMS RACE AND ITS DANGEROUS LEGACY

WINNER
OF THE
PULITZER
PRIZE



DAVID E. HOFFMAN

PROJECT SAPPHIRE

The United States opened eleven new embassies in the far reaches of the former Soviet Union in the year after its implosion, and a younger generation of diplomats volunteered for hardship assignments in remote outposts. Andy Weber was among them. On a long airplane flight, reading the *Wall Street Journal*, he saw a page-one article with the headline “Kazakhstan Is Made for Diplomats Who Find Paris a Bore.” The article described how Ambassador William Courtney was working out of a dingy hotel in the capital, Almaty, with phones so bad he often could not place a call to Washington. “America is busy,” the operators would say. It sounded like an adventure, and Weber jumped at the chance. With tours in the Middle East and Europe under his belt, he asked the State Department if his next assignment could be Kazakhstan. They signed him up on the spot. After Russian-language training, he arrived in July 1993 to take up the embassy’s political-military portfolio. He found Kazakhstan’s landscape a breathtaking tableau of steppe, lakes, forests and mountains, but Almaty was dismal. He threaded his way through fetid corridors without lightbulbs in the apartment blocks, and went to markets where pensioners stood forlornly offering to sell a vacuum tube.¹

Weber took a recently built house in the foothills of the Tien Shan Mountains that resembled a Swiss chalet, with a large fireplace, paneled walls and a sauna. When he needed to meet Kazakh officials, he invited

them home for lunch or dinner. Weber had a cook and a few guards, and he relied on an auto mechanic and all-round fixer, Slava, at a time when everything was difficult to obtain. Slava was also an avid hunter, and Weber learned to stalk pheasant, moose and elk in the secluded wilds. One day not long after he arrived, Slava came to him and said, "Somebody wants to meet you." Weber realized that whoever it was wanted a discreet meeting.

He was picked up on a street corner, taken to an apartment building and shown to the door of a company that sold hunting rifles, scopes and night-vision equipment. Inside, he found a lively former Soviet navy submarine commander, Vitaly Mette, who wore a leather jacket. Mette's thick hair was combed back from an angular face, and he carried himself with a self-confident air. Standing nearby was a large man with a polished head like a bullet, introduced as Colonel Korbator, and a very attractive blonde woman. Weber sat on a chair in the small room. The colonel left, then so did the blonde.

When they were alone, Mette turned serious. He said he wanted to discuss the possibility of selling uranium to the U.S. government.

Mette was vague about the nature of the uranium, except that it was stored at the Ulba Metallurgical Plant, an enormous industrial complex that fabricated reactor fuel in the grimy city of Ust-Kamenogorsk, in Kazakhstan's northeast. Mette was the factory director. As he listened, Weber was curious, but his training told him not to rush. He wanted to talk to Courtney, the ambassador, an experienced foreign service officer who knew something about the Soviet military-industrial complex. That night, Weber and Courtney drove together to see Mette at a guesthouse in Almaty. Courtney asked questions about the material Mette was offering, but Mette just said "uranium."

Then Mette turned to Weber. Please come hunting with us, he asked.

Kazakhstan, the second largest of the former Soviet republics, suffered as a Cold War proving ground and arms depot. In the remote steppe, the Soviet Union built test sites and factories for nuclear, chemical and biological weapons. The most spectacular was Semipalatinsk in the northeast, where 456 nuclear blasts were carried out from 1949 until

1989. Eighty-six of them were exploded in the air, 30 at the surface, and 340 underground in tunnels and boreholes.² Contamination poisoned the population.³ Fallout from a 1956 explosion drifted over Ust-Kamenogorsk. Also in the north, at Stepnogorsk, anthrax was weaponized at the mammoth factory Alibek once led. A third facility in the north, built at Pavlodar on the banks of the Irtysh River, was a dual-purpose plant to make chemicals for civilian use and, if needed upon war mobilization, for weapons.⁴ Farther to the west, missiles were launched from the Soviet space complex at Scientific Research Test Range No. 5, at Tyuratam, later named Baikonur. And in the southwest was the Aral Sea, where the Soviet biological weapons testing site was built on Vozrozhdeniye Island. When the Soviet Union collapsed, Kazakhstan inherited the world's fourth-largest nuclear arsenal, including 104 SS-18 intercontinental ballistic missiles with ten warheads each.⁵

Richly endowed with natural resources, Kazakhstan's greatest treasure was 70 trillion cubic feet of natural gas and 16.4 billion barrels of oil reserves. But despite this wealth, as author Martha Brill Olcott has observed, the new Kazakhstan was a fragile state, crippled by history and geography and born entirely out of the collapse of an empire, without a cohesive national identity.⁶ About 37 percent of the population was Russian, concentrated in the north, and 40 percent Kazakh, among a total of nearly one hundred ethnic groups and nationalities. In Soviet times, the Russians were the elite, but after the collapse many felt shipwrecked there. The newly minted country was ruled by Nursultan Nazarbayev, a onetime steelworker whom Gorbachev had named Communist Party leader of the republic. An ethnic Kazakh, Nazarbayev gradually transformed himself after the Soviet collapse into a Central Asian potentate, mixing authoritarianism, oil wealth and crony capitalism. Now Nazarbayev wanted to be rid of the scourge of weapons that had so disfigured the landscape. He had no use for the uranium at Ust-Kamenogorsk.⁷

A few weeks after their first meeting, Weber flew to join Mette for a hunting expedition. They drove in a jeep for hours to a base camp in the Altai Mountains of eastern Kazakhstan, near the borders of Russia and China, an ideal territory for hunting. Weber enjoyed the *banya* steam baths, chewed on smoked pork fat and shivered in the early-morning cold with the Russians, speaking their language, hunting with them and earning their trust. He also shot a moose. He did not ask them about the

uranium then. At the end of the trip, returning to the city, Mette volunteered to show Weber the plant in Ust-Kamenogorsk. They drove him around the gargantuan factory, fenced off, dark and brooding. Mette's workers were making fuel for Russian nuclear power plants. If they weren't exactly thriving, Weber saw they were not starving either. The entire town seemed to be a "little Russia"—Weber saw no Kazakhs there. Just before leaving, Weber inquired gently about the uranium. "If it is not a secret," he asked, "do you have any highly-enriched uranium?" Highly-enriched uranium could be used for nuclear weapons. Mette was still evasive.

The former Soviet Union was brimming with highly-enriched uranium and plutonium. Viktor Mikhailov, the Russian atomic energy minister, revealed in the summer of 1993 that Russia had accumulated much more highly-enriched uranium, up to twelve hundred metric tons, than was previously thought.⁸ Outside of Russia, in the other former republics, less was known about stockpiles, but much was feared about the Iranians and the Iraqis hunting for material to build nuclear bombs. "We knew that Iran was all over Central Asia and the Caucasus with their purchasing agents," recalled Jeff Starr, who was principal director for threat reduction policy at the Pentagon.

At the same time, all the former Soviet lands were awash in scams and deceptions—people offering to sell MiGs, missile guidance systems or fissionable material, real and imagined. There was such a frenzy to strike gold that it was hard to detect what offer was genuine. "A lot of people thought it was a scam," Weber recalled of the initial reaction to his reports of finding enriched uranium.

He went back to Mette. "Look," he remembered saying, "for us to take this seriously, you have to tell me what the enrichment level is, and how much of it there is."

In December 1993, Weber was extremely busy. Vice President Al Gore visited Kazakhstan in the middle of the month. During the bustle, Slava, the mechanic, came to Weber and said, "Colonel Korbator wants to meet you." Weber quickly agreed. On a snowy day, he went back to the same small office where he had first seen Mette and Korbator a few months earlier.

Korbator said, "Andy, I want to talk to you. Let's take a walk."

They walked through the snowy, dim courtyard of the apartment

complex. Korbator spoke first. "Andy, I have a message for you from Vitaly," he said. "This is the answer to your question."

Korbator handed Weber a piece of paper. Weber unfolded it. On the paper was written:

U²³⁵

90 percent

600 kilos

Weber calculated that was 1,322 pounds of highly-enriched uranium, enough to make about twenty-four nuclear bombs. Weber closed the piece of paper and put it in his pocket. He said, "Thank you very much. Please tell him, thank you. This is very important."

Weber sent a cable to Washington, with very limited distribution. Then for a few days he was preoccupied by the Gore visit. Immediately after Gore departed on December 14, Weber was awakened after midnight by the embassy communications officer, who called saying a night action cable from Washington had arrived, requiring his immediate attention. Weber drove back to the embassy. The cable asked a thousand questions about the uranium. What was Mette's motivation? They wanted to make sure Weber was confident of his source. Weber answered the questions as best he could.

Nothing happened for about a month. Weber's response languished in the State Department until one day in January 1994, when it came up as an afterthought at a White House meeting. Ashton B. Carter, who had helped frame the Nunn-Lugar legislation in 1991 and was now an assistant secretary of defense, volunteered to take over the issue. Shortly after the meeting, he called Starr into his office. "Your job is to put together a team and go get this stuff out of Kazakhstan," Carter said. "Whatever you need—do it." Carter said to get the uranium out within a month. Starr quickly put together a top-secret "tiger team," an ad hoc group of action-oriented officials from different agencies.⁹

On February 14, 1994, Nazarbayev made his first visit to see President Bill Clinton. In a White House ceremony, Clinton praised Nazarbayev's "great courage, vision and leadership," and announced that American aid to Kazakhstan would be tripled to over \$311 million. In their public remarks, neither Clinton nor Nazarbayev, nor the official who briefed

reporters that day, used the word "uranium." But when Nazarbayev was at Blair House, the guest residence across the street from the White House, Weber and Courtney quietly paid him a visit. They asked Nazarbayev if the United States could send an expert to verify the composition of the uranium at Ust-Kamenogorsk. He agreed, but insisted it be kept under wraps.¹⁰

Starr's tiger team was uncertain of conditions at the plant in Kazakhstan. They needed someone who could quickly lay "eyes on target," as Starr put it, and know exactly what was stored there, and how vulnerable it was. They couldn't be sure if they could take samples, or photographs, so it had to be someone who could mentally absorb everything, who would know about canisters and metals. The job went to Elwood Gift of the National Security Programs Office at the Oak Ridge National Laboratory in Tennessee. A chemical-nuclear engineer, Gift had experience in most of the nuclear fuel cycle, including uranium enrichment.

Gift arrived in Kazakhstan March 1 amid swirling snowstorms, and for several days holed up at Weber's house. When the weather cleared, they boarded an An-12 turboprop for Ust-Kamenogorsk. The Kazakh government purchased tickets in false names to hide their identity. Fuel was scarce. Just ten minutes after takeoff, they unexpectedly landed again—the tanks were almost empty and the pilot attempted to coax more fuel from a military airfield. Gift and Weber spotted old Soviet fighter jets parked on the tarmac. After an hour or so, they took off again for the 535-mile flight north.

By this time, Weber had come to know Mette better. As plant director, Mette was perhaps the most powerful person in Ust-Kamenogorsk. Weber found him charismatic, gutsy and intelligent, the opposite of an old Soviet bureaucrat. When Weber and Gift showed up the first morning and proposed to take samples of the uranium, Mette consented, knowing that they had Nazarbayev's approval, and he told them the story of how it got there. The Soviet Union had designed and built a small attack submarine, known as Project 705, given the code name Alfa by NATO. The sub was distinguished by a sleek design, titanium hull and relatively small crew. The most futuristic part of Project 705 was the nuclear power plant, which used an unusual liquid lead-bismuth alloy to moderate heat from the reactor. The subs were completed in the late 1970s, but the reactors proved troublesome—the lead-bismuth alloy had

to be kept molten at 275 degrees Fahrenheit—and designers scrambled to build a new reactor. The uranium at Mette's factory was to be used to make the fuel for the new reactor, but Project 705 was scrapped altogether in the 1980s. Mette was left with the highly-enriched uranium.¹¹

When they approached the building where the uranium was stored, Weber saw the doors were protected by what he later described as a Civil War padlock. The doors swung open into a large room with concrete walls, a dirt floor and high windows. Knee-high brick platforms stretched from one end to the other. On top of the platforms, sheets of plywood were laid out, and resting on the wood, about ten feet apart, were steel buckets and canisters holding the highly-enriched uranium, separated to avoid a chain reaction. Each container had a small metal dog tag stating the contents and quantity. Weber and Gift, working with plant technicians, randomly selected a few containers and took them to a small laboratory area. They weighed them to verify the dog tag was correct. In one canister they found uranium rods wrapped in foil, like so many ice packs in a picnic cooler. From another container, they took a rod-shaped ingot, and Weber hefted it, surprised at how heavy the uranium felt. Gift wanted to break off a piece and bring it back as a sample. He asked a technician to take a wood-handled hammer and a chisel to it, but the ingot would not break.

Weber went off with another worker to watch him file off some shavings they could take as samples. At first, the technicians handled the uranium in a glove box, but one of them took it out and placed it on an open table in the center of the room. The technician slid a piece of paper under it and began to file the ingot. Sparks flew, like a child's holiday sparkler.

"My eyes are lighting up, because I've had this chunk of metal in my hand," Weber recalled. "I know it is bomb material. This uranium metal would require nothing—just being banged into the right shape and more of it to make a bomb. It didn't need any processing. This is 90 or 91 percent enriched uranium 235, in pure metal form. And I remember thinking that dozens of nuclear weapons could be fabricated from this, easily fabricated from this material, and how mundane it is. It was just a piece of metal. And just looking at these buckets, how could something this mundane have such awesome power and potential for destruction? So, as he started filing, and sparks are coming off, you can imagine what's going through my head. What is this bomb material going to do?"

Gift was on the other side of the room, dealing with another sample. When he saw the sparks, Weber said, "Elwood! It's sparking!" Gift didn't realize they had taken the uranium out of the glove box, but he didn't look up. "Don't worry," he said, "that's just normal oxidation."

Gift collected eight samples of highly-enriched uranium while at the plant. Portions of four samples were dissolved in acid and analyzed by mass spectrograph while Gift and Weber were still there, and they confirmed it was 90 percent enriched uranium. Three of the dissolved samples and the eight original samples were taken by Gift for further analysis.¹²

Gift carried a miniature dosimeter in his shirt pocket while they were inside. He and Weber wore face masks to protect against dust with beryllium, which is highly toxic and carcinogenic. Weber felt comfortable that they were protected—the dosimeter didn't issue any alarms. Mette reassured them that the uranium was fabricated from natural sources, not reprocessed, so in its present state, although highly enriched, it was not very radioactive. After they finished taking the samples, Weber cheerfully suggested that Gift show the little dosimeter in his pocket to Mette. Gift took it out and discovered that he had forgotten to turn it on. "I thought, *oh great!*" Weber recalled. In his briefcase, Gift placed the small glass vials that held the eleven samples into holes cut in foam cushioning and snapped it shut. When they walked away from the uranium warehouse, Gift, carrying the briefcase, suddenly slipped and fell hard on the ice. Weber and Mette helped him to his feet but looked at each other. "Both of us, our initial reaction was, *Oh my God, the samples!*" Weber said. Both Gift and the samples were fine. Back in Almaty, they told the ambassador they had verified the uranium was highly enriched. Courtney immediately sent a cable to Washington, noting the ancient padlock on the door. The cable, Weber recalled, "hit Washington like a ton of bricks." Starr, who was in Washington, said the cable "established there was a potentially serious proliferation issue."

Weber thought there was only one thing to do. "In my mind it was a no-brainer," he said. "Let's buy this stuff as quickly as we can and move it to the United States." He knew there was a risk Iran might buy it. Later, it was discovered the plant had a shipment of beryllium, which is used as a neutron reflector in an atomic bomb, packed in crates. Stenciled on the side was an address: Tehran, Iran. Apparently a paperwork glitch was the only thing that had kept the shipment from being sent.¹³

Gift could not carry the samples on a commercial flight—orders from Washington had arrived saying it was too risky. Weber locked the samples in his safe and waited for instructions. Soon, three boxes came addressed to him on the embassy's regular resupply flight. Weber put Gift's briefcase with the samples in his jeep and drove out to greet the arriving C-130. He opened the first two boxes and carefully packed the samples in them, and resealed them to be shipped back home. Then he opened the third box: it was the gloves, dosimeter and protective gear he was supposed to have worn while packing the first two boxes.

When the samples got back to the United States, an analysis confirmed the uranium was 90 percent enriched. The tiger team went into high gear, and Starr looked at all the possible options. One was to do nothing, but that was quickly rejected. Another was to secure the uranium in place; that too was rejected on grounds that no one knew what would happen at the plant, or to Kazakhstan, in a few years. A third option was to turn the uranium over to Russia. A tense debate unfolded on this point. The Pentagon representatives wanted nothing to do with the Russians. The State Department people thought it would be an opportunity to show some goodwill and make a point about nonproliferation. A few low-level queries were sent to Moscow. The first went unanswered. A second triggered a reply that Russia would, naturally, want millions of dollars from the United States. After more internal arguments, a decision was made to have Gore raise the issue at his next meeting with Russian Prime Minister Viktor Chernomyrdin, in June. Gore carried with him a set of talking points that did not ask, but informed, the Russians that the United States would take the uranium out of Kazakhstan. Everyone held their breath, but Chernomyrdin did not object. Nazarbayev at one point picked up the phone and called Yeltsin, who agreed not to interfere. The tiger team wrestled with other difficult issues over the summer, such as how much to pay Kazakhstan, and how to prepare an environmental impact statement for the arrival of uranium at Oak Ridge. They went over every detail to make sure the mission would succeed. Weber, waiting for action in Almaty, was frustrated by the delays. "It was absurd because the Iranians probably would have paid a billion dollars for just one bomb's worth of uranium, and we were talking about dozens of bombs' worth," he recalled.

By early 1994, there were signs of progress in the struggle to avert a nuclear nightmare. Russia managed to bring its tactical nuclear weapons back from Eastern Europe and the outlying former Soviet republics. The rail cars carrying warheads were upgraded. Ukraine, Belarus and Kazakhstan were moving toward giving up their strategic nuclear weapons. The United States announced plans to buy 500 tons of highly-enriched uranium from Russia and blend it down into reactor fuel. In the first year of his presidency, Clinton appointed several architects of the Nunn-Lugar legislation to high-level policy positions. He named Les Aspin his first defense secretary. William Perry, the Stanford professor, was appointed deputy defense secretary, and became secretary in February 1994. Carter was appointed assistant secretary of defense for international security policy, overseeing the Nunn-Lugar legislation.¹⁴ In Russia, after a violent confrontation with hard-liners in October 1993, Yeltsin won a new constitution giving him broad powers and a new legislature.

Nonetheless, what Andy Weber had seen in one factory in Kazakhstan existed across Russia. Kenneth J. Fairfax, an officer in the environment, science and technology section of the U.S. Embassy in Moscow, had arrived in July 1993, assigned to work on improving nuclear power plant safety. He soon discovered the Russian nuclear establishment was showing the same signs of deterioration as the rest of the country. Some of the worst conditions were at facilities that Russia considered civilian, but which held large quantities of weapons-usable uranium and plutonium. The materials were so poorly protected as to be up for grabs. Fairfax sent a series of startling cables from Moscow to the State Department describing what he saw.

Fairfax reported that almost everyone in the atomic sector, from maintenance workers to world-class scientists, was in distress. He started a personal effort to help nuclear scientists link up with American firms. "I would try to get scientists to show me what they could do, to really display their most outstanding talents," he said. Then he would seek out American companies that could pay for their skills. "I had no big program or budget," he said. "Just a rolodex and a head for business." When a few early efforts succeeded, scientists who had been receiving a paltry \$7 a month soon were bringing in \$3,000 or \$4,000. They told colleagues, leading to new contacts, and Fairfax was soon a welcome visitor at the once-secret nuclear cities across Russia. He was even granted an official

security pass to enter Minatom's headquarters in Moscow, the nerve center of the nuclear empire. More than once he recalled waltzing into Minatom while frustrated bureaucrats from Russia's Ministry of Foreign Affairs were stuck at the security desk at the entrance.

While looking for jobs for nuclear scientists, Fairfax began to notice security standards for some nuclear materials were at times "shockingly poor," he recalled. One of his early visits in Moscow was to the Kurchatov Institute, the prestigious nuclear research facility led by Velikhov. While on the grounds one day, looking at reactor research, he was shown Building 116, which held a research reactor powered by highly-enriched uranium. The building was surrounded by overgrown trees and bushes. "It was literally a wooden door, with a wax seal on it, with a piece of string. You break the wax seal and open it," he recalled. Inside, the Kurchatov workers brought out the highly-enriched uranium in the shape of large heavy washers. Fairfax picked up some of them. It was the first time he had ever held highly-enriched uranium in his hands.

Fairfax received "lots of scary information" from technicians and scientists in laboratories and from the security people—including sources in the 12th Main Directorate of the Defense Ministry, responsible for guarding the nuclear arsenal. Fairfax wrote cables describing what he witnessed: holes in fences, storerooms full of materials for which there was no proper inventory, heaps of shipping and receiving documents that had never been reconciled.

Fissile material was scattered across thousands of miles and tucked inside hundreds of institutes and warehouses, much of it in ingots, pellets and powder, held in canisters and buckets, poorly accounted for by long-hand entries in ledger books, or not accounted for at all. Fairfax wrote in his cables that the weakest security was often found for highly-enriched uranium and plutonium, usable for weapons but intended for civilian use or basic scientific research. Since it was not headed for warhead assembly, it got less protection. Large quantities of weapons-usable material was stored in rooms and warehouses easy for an amateur burglar to crack: unguarded windows, open footlockers, doors with a single padlock, casks with a wax seal and a near-total absence of sophisticated monitors and equipment.

In Soviet times, the nuclear security system depended on closed fences, closed borders, a closed society, as well as the surveillance and intimidat-

tion of everyone by the secret police. In the Soviet system, people were under stricter control than the fissile materials. When the material was weighed or moved, it was tracked in handwritten entries in ledger books. If material was lost, it was just left off the books; no one wanted to get in trouble for it. And factories would often deliberately keep some nuclear materials off the books, to make up for unforeseen shortfalls.¹⁵

One of Russia's leading nuclear scientists at the Kurchatov Institute told a group of visiting U.S. officials in March 1994 that many facilities had never completed a full inventory of their bomb-grade materials, so they might not know what was missing.¹⁶ The single greatest obstacle to building a bomb—whether for a terrorist or an outlaw state—was obtaining enough fissile material. Now it was evident from the Fairfax cables that in some places the former Soviet Union was turning into a Home Depot of enriched uranium and plutonium, with shoppers cruising up and down the aisles.

The same month as the Kurchatov briefing, three men were arrested in St. Petersburg trying to sell 6.7 pounds of weapons-usable highly-enriched uranium. The material was smuggled out of a facility in an oversized laboratory glove. Separately, two navy officers and two guards used a crowbar to rip off the padlock on a nuclear fuel storage facility on the Kola Peninsula, stole two fuel assemblies, fled to an abandoned building, and used a hacksaw to open one—and extract the core of uranium.¹⁷

Although many of Fairfax's sources were clearly working outside official channels and taking risks in talking to him, Fairfax felt none of them were spies or traitors; most were scientists, police and even a few former KGB agents who understood the nuclear dangers. Fairfax recalled that one officer in the 12th Main Directorate of the Defense Ministry explained his motives by saying he had worked on nuclear weapons his entire life to defend the Soviet Union, and by helping to point out the deficiencies in Russia, he was still keeping the country safe.¹⁸

When the Fairfax cables landed in Washington, Matthew Bunn read them with fascination. "It was just incredible stuff," Bunn recalled. He was a staff member at the White House Office of Science and Technology Policy. While the cables were distributed to the White House and elsewhere in Washington, not everyone recognized the warning signs. But

Bunn was totally floored. The cables, plus a string of nuclear smuggling cases in 1994, showed him that a crisis was coming, and he was standing at the bow.

His father, George Bunn, had been a pioneer in arms control and nuclear nonproliferation, helping to negotiate the nuclear Nonproliferation Treaty of 1968, and serving as the first general counsel of the Arms Control and Disarmament Agency. Matthew graduated from MIT and followed in his father's footsteps in Washington during the 1980s. He became editor of a magazine, *Arms Control Today*. Then, just as the Soviet Union was collapsing, he took on a new assignment at the National Academy of Sciences, to direct an in-depth study of the dangers of excess plutonium coming from dismantled Cold War nuclear weapons. Bunn concluded the risks were not only plutonium, but also the much larger supply of highly-enriched uranium. Bunn broadened his study, and the two-volume report recommended that, to the extent practical, every kilogram of the uranium and plutonium should be locked up as securely as the nuclear warheads.¹⁹

With the research project complete, in January 1994 Bunn was recruited to come to the White House by Frank von Hippel, the Princeton physicist. Von Hippel, a self-described citizen-scientist, had joined the new Clinton administration, working in the White House Office of Science and Technology Policy. Bunn saw there was little he could do to influence arms control, so he decided to devote almost all his time, with von Hippel, to fighting the leakage of uranium and plutonium in the former Soviet Union.

Bunn's early days in the White House were discouraging. The government was moving at a glacial pace. The plans at the time were to build one or two pilot projects in Russia over several years to show how to secure fissile material, and hope Russian specialists would learn from the experience. The pilot projects were for low-enriched uranium facilities that didn't even pose a proliferation risk. Bunn practically shouted his impatience. "We haven't *got* several years," he said, "the thefts are happening *now*!" The U.S. government was typically caught up in its own maddening budget and turf wars. Should the Defense Department or the Energy Department deal with nuclear materials policy? What about the national laboratories, such as Los Alamos, which were building their own bridges to the laboratories in Russia with some success?

To make matters worse, suspicions from the Cold War still ran deep

on both sides. The Russians steadfastly refused to give the Americans access to facilities handling highly-enriched uranium or plutonium. Russia and the United States were prisoners of their old habits. "As long as you approach this from the point of view of arms control—let's negotiate for 20 years and make sure everything is reciprocal and bilateral—then you are left with a situation when you can't get anything done," Fairfax recalled. He suggested, radically, that they simply work together immediately, since neither would benefit from a nuclear bomb in the wrong hands. "My attitude was: does a fence make us more secure?" he said. "If so, build the fence." In a similar mind-set in Washington, Bunn came up with a scheme he called "quick fix." The idea was to ask the Russians to identify five to ten of their most vulnerable or broken-down facilities, rush in and improve the security, then identify the next worst, attack those, and so on. But the Russian response was: no way. "They were just not at all interested," Bunn said. The chief obstacle was the Ministry of Atomic Energy, known as Minatom, the nuclear empire lorded over by Mikhailov.²⁰

On May 10, 1994, in the small town of Tengen-Wiechs, near Stuttgart, police searching the home of a businessman, Adolf Jaekle, unexpectedly discovered in the garage a cylinder containing 56.3 grams of powder. On testing, about 10 percent was extraordinarily pure plutonium. Jaekle was arrested and jailed, and the source of the plutonium never identified. Then, on August 10, Bavarian criminal police at Munich's Franz Joseph Straus Airport confiscated a black suitcase being unloaded from a Lufthansa flight arriving from Moscow. Inside was a cylinder containing 560 grams of mixed-oxide fuel that included 363.4 grams of plutonium-239, 87.6 percent pure. The suitcase also included a plastic bag with 201 grams of nonradioactive lithium-6, a metallic element used in making tritium, a nuclear weapons component. Bavarian authorities arrested the apparent owner of the suitcase, Justiniano Torres Benitez, and two Spaniards, one of whom came to meet Benitez at the airport. The arrest was the culmination of a sting operation set up by the Bavarian police and the German federal intelligence service, the BND, and had a huge impact on thinking about fissile material in Russia, seeming to confirm that it was

leaking, badly. "We were going crazy worrying about this stuff though much of 1994," Bunn recalled.²¹ Fairfax, writing from Moscow, sent a message to Washington that pointed to four Russian nuclear facilities as "my best guesses on where to look" to find the origins of the material.²²

A month after the Munich arrests, Fairfax drove von Hippel to the Kurchatov Institute. Again, they visited Building 116, where Kurchatov employees poured out onto a tray some of their seventy kilos of highly-enriched uranium, pressed into washer shapes. Von Hippel noticed it was stored in what looked like high school lockers. "I was dumbfounded," von Hippel said. There were no motion detectors, no guards. Anyone could have walked off with the uranium.

In October, von Hippel returned to Mayak, near Chelyabinsk, which he had visited five years earlier on Velikhov's *glasnost* tour. The facility was one of those on the Fairfax list of possible sources of the material seized in Munich. On this visit, von Hippel was taken to a building he had not seen before, No. 142, a single-story warehouse, originally built in the 1940s. A lone Interior Ministry guard held a key. Inside the building were stored 10,250 containers, each about the size of a hotel coffeepot. Each held 2.5 kilos of plutonium oxide. They were lined up in trenches. The cans were double-sealed to avoid leaks, but the warehouse was so hot with radioactivity that employees were allowed inside for only short periods each week. Moreover, the building was an easy target for theft. There were no security cameras; a ventilation shaft would have made an escape route. The building "would not offer much resistance to penetration," von Hippel wrote after the visit. "The walls have multiple windows and doors and the roof is lightweight. The plutonium containers within are easily accessible by simply cutting the sealing wire, removing a 20-kg cover, and reaching down and pulling out the canisters. The seals are easily defeated lead seals. The guards do not have radios . . ." After the containers are put in the trenches, he added, "no inventories are made to check that the canisters are still there." Von Hippel figured there was enough plutonium in the warehouse to make several thousand bombs.

By autumn 1994 it was clear the entire former Soviet Union was awash in fissile material, and the United States had yet to do much about it. Von Hippel noted in a memorandum, "progress in gaining cooperation from the Russian side has been extremely slow" although "scores of facilities and hundreds of tons of weapons-usable material" were at risk.²³

After months of preparation, the covert mission to remove the uranium in Kazakhstan was almost ready in October. The winter snows were coming. "I kept pressing and pressing to get this thing going, knowing full well that winter comes early in this part of the world," Weber said. "It would get messy if we didn't get it finished before the first snowfall." A small group of Americans slipped unnoticed into Ust-Kamenogorsk during the summer to check whether the airport runway could handle C5 Galaxy airlifters, and to examine the containers inside the Ulba warehouse. The Oak Ridge Y-12 laboratory built a mobile processing facility. A team of twenty-nine men and two women were recruited for the mission, including Elwood Gift, who made the first visit. On October 7, President Clinton signed a classified presidential directive approving the airlift, and the final briefing was held at Oak Ridge. The next day, three C5 aircraft, among the largest planes in the world, lifted off from Dover Air Force Base, Delaware, carrying the team and their processing facility. They flew to Turkey, and then, after some delays, to Ust-Kamenogorsk. Weber was waiting for them in the control tower of the small airport. "This was one of those bizarre post-Cold War experiences you have to live through to believe, but I'm in the control tower, nobody in the control tower speaks English," Weber recalled. "So they said, 'Andy, can you talk to the planes and guide them in?'" The C5s needed a six-thousand-foot runway, and landed like a "bucking bronco," in the words of one pilot, on the bumpy eight-thousand-foot strip at Ust-Kamenogorsk. The planes were unloaded, and flew off to bases elsewhere until it was time to return.

On the ground, at the Ulba factory, the team began its arduous work. Twenty-five members were from Oak Ridge; the others were a communications technician, a doctor and four military men, including three Russian-speaking interpreters. Each day, they left their hotel before dawn and returned after dark, spending twelve hours packaging all the uranium into special containers suitable for flying back to the United States. The total material to be packed up was 4,850 pounds, of which approximately 1,322 pounds was the highly-enriched uranium. There were seven different types of uranium-bearing materials in the warehouse, much of it laced with beryllium.²⁴ Altogether, the team discovered

1,032 containers in the warehouse, and each had to be methodically unpacked, examined and repacked for transport into quart-sized cans that were then inserted into 448 shipping containers—55-gallon drums with foam inserts—for the flight. Laborious checking was necessary, each can compared with the Ulba handwritten logs. In the end, the Americans discovered several canisters lying in the warehouse without dog tags. Some of the uranium had to be heated in special ovens to remove water to facilitate the repacking. The entire process required precision, endurance and secrecy. If word leaked, the whole effort might have to be aborted. The tiger team in Washington had worked out a cover story—if the Americans were discovered, they were to say they were helping Kazakhstan prepare declarations for the International Atomic Energy Agency. Working conditions were stressful; many of the team members had never been outside the United States. Some were so homesick they broke the rules and called home from local telephones. From a distance, Kazakh special forces troops kept a watchful eye to protect the Americans inside the plant.

By November 11, the job was finished and the 448 barrels loaded onto trucks. The team was determined to get home for Thanksgiving, but then winter weather set in. The original air force order was for five C5s to evacuate the uranium and the team. But only three planes were ready when the right moment came. Mechanical problems and bad weather caused delays. Finally, on November 18, one plane left Turkey for Kazakhstan. While it was in the air, at 3 A.M., the uranium was driven from the Ulba plant to the airport, with Weber in the lead security car, a Soviet-era Volga. "It was black ice conditions," Weber said. "And these trucks were sliding all over the place, and I'm thinking, I don't want to make the call to Washington saying one of the trucks with highly-enriched uranium went off the bridge into the river, and we're trying to locate it. But somehow, miraculously, we made it all safely to the airport."

The plane took three hours to load. But before it could take off, the runway had to be cleared of snow. A pilot recalled the airfield was being pummeled by sleet, ice and rain. There were no snowplows to be seen. Then the local airport workers brought out a truck with a jet engine mounted on the back. They fired up the engine and blasted the runway free for takeoff. The Galaxy heaved itself into the sky. The next day, two more C5s flew out the remaining uranium, the gear and the team. The

enormous transports, operating in total secrecy, flew twenty hours straight through to Dover with several aerial refuelings, the longest C5 flights in history. Once on the ground, the uranium was loaded into large, unmarked trucks specially outfitted to protect nuclear materials and driven by different routes to Oak Ridge.

Weber remained on the tarmac until the last plane took off.

When it was announced to the public at a Washington press conference on Wednesday morning, November 23, Project Sapphire caused a sensation. Defense Secretary William Perry called it "defense by other means, in a big way." He added, "We have put this bomb-grade nuclear material forever out of the reach of potential black marketers, terrorists or a new nuclear regime."²⁵ With imagination and daring, Sapphire underscored what could be done. The United States had reached into another country, which was willing to cooperate, removed dangerous material and paid for it.²⁶ But that method could not be replicated inside Russia, where there was far more uranium and plutonium, and much more suspicion. It was hard to imagine landing C5s in Moscow and emptying out Building 116 at the Kurchatov Institute.

The U.S. government has long run a secretive intelligence committee, spanning different agencies, which studies nuclear developments overseas. In late 1994, the Joint Atomic Energy Intelligence Committee prepared a report about the extent of the Russian nuclear materials crisis. The top-secret report concluded: not a single facility storing highly-enriched uranium or plutonium in the former Soviet Union had adequate safeguards up to Western standards. Not one.

In the White House science office, Bunn felt he had "zero power" and worked "10 tiers down from the top." His quick-fix idea was dead on arrival. In late 1994, on advice from his staff, Clinton asked for a blueprint for action on nuclear smuggling and loose fissile material, to be written by the President's Committee of Advisors on Science and Technology. The study was chaired by Professor John Holdren, then of the University of California at Berkeley, and Bunn was named study director. When finished in March 1995, the study, classified secret, called for a multifront war. The study identified approximately one hundred sites

handling sizable quantities of weapons-usable nuclear materials in the former Soviet Union.²⁷ Then, to drive home their point, Bunn and Holdren lobbied for, and won, permission to give a briefing to President Clinton and Vice President Gore in the Oval Office.

They stayed up until 2 A.M. the night before preparing. On May 1, 1995, just weeks after the Oklahoma City bombing, they told Clinton and Gore the fissile material crisis was one of the gravest national security problems the country faced. Holdren described to Clinton the serious gaps: how Russian facilities had no idea, or precise records, of the amount of uranium and plutonium lying about; the weak links in buildings, fences and guard forces; and the threat that terrorists could walk off with a bag or bucket of uranium or plutonium. In a clever move, Holdren had brought an empty casing from one of the fuel pellets used at the nuclear power and engineering institute at Obninsk, south of Moscow. He tossed it on a table and told Clinton there were perhaps eighty thousand of those filled with uranium or plutonium, and not one with an inventory number on it. The institute had no monitors to stop someone from carrying one out in their pocket. Bunn thumped on the table a two-inch stack of press clippings he'd assembled, including a *Time* magazine cover with the headline "Nuclear Terror for Sale." At the end of the presentation, they showed Clinton a diagram of what would happen to the White House if the Oklahoma City bomb had been set off on Pennsylvania Avenue—superficial damage. Then they showed what would happen if it was a one-kiloton nuclear "fizzle"—a bomb that didn't work very well. In that case, the White House was at the edge of the crater.

Clinton said he realized that security was bad, but he had no idea that the Russians didn't even know if something had been stolen.²⁸

In the weeks after Clinton's briefing, a delegation from the United States Department of Energy arrived in Ukraine, including a young logistics assistant, Erik Engling. He had landed a job in the department just the year before, doing administrative chores for the office of National Security and Nonproliferation, which required a security clearance. Engling possessed the right credentials from an earlier job working in a government library. He helped with visas, cables, and chores for government

officials struggling to cope with the fissile materials crisis in the former Soviet Union. One day, he recalled, a senior policy-maker came and sat down in his office. Engling was twenty-nine years old then, a large young man, blunt-spoken and eager to learn more about the nuclear problems they were discovering. "The problem is so huge," the senior policy-maker said, "your grandchildren won't be able to work this out."²⁹

In June, Engling made his first visit to the former Soviet Union, accompanying the delegation to Ukraine. The team went to the Kharkiv Institute of Physics and Technology, once a premier research institute. Engling wound his way through a labyrinthine corridor, up and down stairs and then through a door. "And we went through the door, and into that room, and there's 75 kilos of highly-enriched uranium lying on the floor. *On the floor!* You've got it on racks, too. There's an oversized dumbwaiter that goes up and down to one of the rooms above where they were doing experiments. The uranium is in all sorts of configurations. Some in tubes, some in boxes. And we all had this sinking feeling, like, *why?* Why do you guys even have this shit?" The uranium was entirely unprotected. "We walked up a couple of stairs, we're out in a parking lot. This is where the nuclear materials are stored, and not a thing between the parking lots and these doors. The stuff was sitting just 55 feet from the back door. You could just walk in, and walk out."³⁰