

The Human Dimension to Kazakhstan's Plutonium Mountain

Siegfried S. Hecker | April 2023

As we drove deeper into the Semipalatinsk Nuclear Test Site, we found kilometer-long trenches that were clearly the work of professional thieves using industrial earth-moving equipment, rather than hand-dug trenches made by nomad copper-cable-searching amateurs on camelback. Our Kazakh hosts said they could do nothing to stop these operations. In fact, they weren't sure they had a legal right to stop them from "prospecting" on the site.

It was the sight of these trenches that urged me to convince the three governments that they must cooperate to prevent the theft of nuclear materials and equipment left behind when the Soviets exited the test site in a hurry as their country collapsed.



That was an unforgettable moment for me during a project that was later called "the greatest nonproliferation story never told."¹ We've since made sure to tell it. Scientists and engineers from the United States, Russia, and Kazakhstan told the story in the two-volume book *Doomed to Cooperate*.² Eben Harrell and David Hoffman told the broader story of cooperation at Semipalatinsk in the investigative report *Plutonium Mountain*.³

These stories have human dimensions that also need to be told. This is the back story of how I got to Kazakhstan and developed the personal relationships and trust to pave the way for the trilateral cooperation at Semipalatinsk. This story is based on my detailed notes from the trips to Kazakhstan that I have not shared previously.



When the Soviet Union collapsed in December 1991, the most urgent threat to the rest of the world was no longer the immense nuclear arsenal in the hands of the Russian government but rather the possibility of its nuclear assets—weapons, materials, facilities, and experts—getting out of the hands of the government. As director of the Los Alamos National Laboratory, I helped to initiate the US–Russia lab-to-lab nuclear cooperative program in 1992 to mitigate these nuclear threats.

The trilateral US–Russia–Kazakhstan cooperation began in 1999 to secure fissile materials that were left behind by the Soviets at the Semipalatinsk Nuclear Test Site, which was now in the newly independent country of Kazakhstan. The project was kept in confidence until the presidents of the three countries announced it at the Seoul Nuclear Security Summit in 2012.

In *Doomed to Cooperate*, individuals from the three countries recount their cooperative efforts at Semipalatinsk. Unlike the US–Kazakhstan projects initiated earlier on nuclear test tunnel closures, identifying experiments that left weapons-usable fissile materials (plutonium and highly enriched uranium) at the huge test site—whether in the field, in tunnels, or in containment vessels—required trilateral cooperation. The Russian scientists who conducted these experiments were the only ones who knew what was done and where. It required American nuclear scientists who conducted similar tests in the United States to assess how great a proliferation danger the fissile materials in their current state may constitute. And it required Kazakh scientists and engineers to take





Chimbulak Ski Basin – Alexander Slesarev, Siegfried Hecker, Kairat K. Kadyrzhanov, Aidl Zhianshakhovich Tuleushev, and Jim Toevs. Photo courtesy of Siegfried Hecker

measures to remediate the dangers. The project also required the political support of all three countries and the financial support of the American government because it was the only one at the time with the financial means. That support came from the US Cooperative Threat Reduction (or Nunn-Lugar) program.



Getting to Kazakhstan

I arrived with Los Alamos National Laboratory colleagues Jim Toevs and John Phillips in Almaty, at that time the capital of Kazakhstan, at 10:30 PM on Friday, April 17, 1998. It was almost 24 hours after our departure from Los Alamos. Toevs is a superb physicist and was a frequent traveling companion during my trips to Russia. Phillips was an excellent analytical chemist who had a long-standing interest in the Semipalatinsk test site. We were met by Dr. Kairat Kadyrzhanov and Dr. Adil Tuleushev, director and deputy of the Kazakhstan Institute of Nuclear Physics (INP). It was Kadyrzhanov who had invited me following their visit to Los Alamos in January. Although that visit was arranged to support cooperation in materials science research between the laboratory and their institute, it gave me an opportunity to inquire about the situation at Semipalatinsk, particularly if they had proliferation concerns. Kadyrzhanov told me they knew very little because the Russian nuclear experts (along with the Russian military) left suddenly when the Soviet Union collapsed and since then had not returned nor provided much information. All he knew was the test site had serious radioactive contamination. He also lamented that it was overrun by scavengers who mined copper cables and anything else that could be removed and possibly sold on the international market.

Almaty was a beautiful city, then with 1.2 million people, in a huge horseshoe area surrounded by the Zailiyskiy Alatau mountain range—a branch of the Tien Shan Mountains that reach all the way to the Himalayas. I was told there is a hiking trail to Ilitky Kul Lake in Kyrgyzstan. The mountain range in Almaty rises to 5,000 meters from a level of 700 meters or so—one of the steepest escarpments on our planet. It is only 5 km horizontal distance from the edge of Almaty to the peaks. The mountains are young, and hence peaks are very steep. The city is quite spread out with lots of agricultural fields toward the north. Since it is in a basin, it is quite polluted, as it was the night we arrived. Apparently, the main culprit was a big power plant and the area's many autos (most appeared to be broken down Soviet Ladas).

Strong winds and an early morning dust storm had knocked out the lights in the hotel. Nevertheless, I was able to keep my standard practice of taking an early morning run. I went out at 7 AM and ran past the Fantasy World Amusement Park, along a canal, and past the soccer stadium in this beautiful city in a country I never expected to visit.

Our Kazakh hosts picked us up later in the morning to tour the city, including some of the sites I passed on my run: the soccer stadium and the amusement park. The streets were wide throughout most of the city. The central area was especially spacious around the Independence column and the “White House.” One of the most interesting sites was the all-wooden cathedral constructed without nails—the only structure to survive the 1911 earthquake.

The main shopping area was a bit more crowded. There were many shops along one corridor by the Tsum Department Store, which was more like a mini mall. The closed street walking area near Tsum had arts-and-crafts markets. Traditional Kazakh goods were few—camel wool and leather bota bags. We saw wood carvings, wood yurts, and some traditional Persian rugs. People were quite well dressed; the young wore a variety of Western clothing. We saw no traditional Muslim dress (no veils) and only occasional traditional Kazakh dress.

We were driven to a lookout hill above the city. It had a cable car to the top, and along the way we passed the homes and dachas of the “new Kazakhs” and “new Russians.” Our hosts joked about this newly rich business class who made fortunes in the post-Soviet 1990s, often through questionable means. Tuleushev told us his grandfather had moved into the foothills in 1919 and lived there for 50 years. I was surprised when Tuleushev spoke German (my native tongue because I grew up in Austria). He explained that he grew up in the nearby village into which Stalin had deported the Volga Germans in 1941 because he was concerned about their loyalty to Russia during Hitler's invasion. The Volga Germans had settled in Russia in the 1760s during the reign of Catherine the Great, a former German princess who became empress of Russia.

I found a similar intrigue when I visited the market earlier in the day and saw many Koreans selling Korean food, especially kimchi. Koreans had settled in the Russian Far East to escape famine, poverty, and Japanese colonial oppression on the Korean Peninsula



between the 1860s and the 1930s. In 1937, they were forcefully deported to Central Asia under Stalin's ethnic cleansing.

In the afternoon, we drove into the mountains with a police escort, which we were told was required to get into the area without a hassle or a bribe. We passed through a very large tank barrier, erected because with a quick thaw and that steep escarpment, the flood would throw house-sized boulders into the city. We visited the Medeo ice rink—the world's highest-elevation speed-skating rink at 5,500 feet. It was a typical Soviet over-the-top construction project that began in 1948 and was the home to over 120 international speed-skating records before falling into disrepair with the dissolution of the Soviet Union.

We continued up to Chimbulak alpine ski area. It had five chair lifts, 1,000 meters of vertical terrain of open skiing, and a modest lodge at the base. Having grown up on skis in Austria, I was keen to try spring skiing in Kazakhstan. Unfortunately, the snow cover was insufficient. I did get a ride on the chair lift to midway. We had dinner in the Spring Place restaurant at the bottom of the canyon, where we had a chance to learn more about our hosts, their families, and their jobs.

During the visit, I learned a lot about a country that had never been on my radar, except for the test site. We talked some about politics. I asked about their view of Mikhail Gorbachev. They had no strong opinion about him. Somehow, he was not seen as the great liberator, because they believe he tried to preserve the Soviet Union to the bitter end. Russian president Boris Yeltsin was not viewed in very serious terms. They told me independence dropped down from God. It was by happenstance—nobody seemed to be responsible, we were told. They did not fight for it themselves; it just happened. However, they seemed glad it happened. Stalin was disliked; Khrushchev, they were not sure about; and Lenin still seemed to be a hero. However, most of the Soviet statues had been taken down. In Almaty, a statue of two Kazakh World War II women heroes replaced the main statue of Lenin. Many of the street names and towns had been changed from Soviet figures to Kazakh poets and former Kazakh generals.

My Kazakh hosts had no good answer when I asked what unites Kazakhstan—what is the organizing principle of the nation? Kadyrzhanov explained that the Turkmens (that's what they consider themselves) were always squeezed between the Chinese and the Russians. Three hundred years ago they decided to join up with the Russians to seek protection against the Chinese. They were Turkmenia before the Russian Revolution. Afterward, they were split into small republics under Soviet control. Kadyrzhanov said some Chinese maps still show parts of Kazakhstan belonging to China.⁴ He said Kazakhstan still feels squeezed by both big neighbors, Russia and China.

Kadyrzhanov also explained that Almaty was one of the stops on the Silk Road. This was the last stop before heading into the desert or the mountains. Caravans would usually consist of 2,000 people on foot and 200 camels. They carried an enormous amount of goods. Many people joined in along the way. I thought to myself,

what a great history lesson. It may not be exactly the way it had all played out, but it was fascinating to hear it from a local.

When I asked if Kazakhstan had developed a middle class, Tuleushev offered that Almaty had. The “intelligentsia” of the country resided there, he said. The rest of the country was very poor—especially the rural areas. The schools, he said, were not as good as in Soviet days. The literacy rate then was 98 percent, but now it was falling. He said that now one should send children to private schools, but these cost money. His two daughters had just graduated from a private school. He also had two sons who went on to universities. I asked about the role of religion. Kadyrzhanov said religion was not very strong in Kazakhstan. The Muslims (most Kazakhs), he said, were predominantly Sunnis, who are not very orthodox. The Russians were Orthodox Christians. He added that 70 years of communist suppression had done an effective job of diminishing religion for all segments of society.



The Visit to the Former Soviet Nuclear Test Site

The trip from Almaty to the Semipalatinsk test site was typical of the difficulties of traveling in Russia and the former Soviet Union during the 1990s. Our early morning flight on Air Kazakhstan was canceled because the airline failed to pay its fuel bill. We departed 12 hours later on Air Semey (which apparently paid its fuel bills), and arrived in the city of Semey shortly after a major snowstorm. From there it was a 120-km van ride to our destination. That stretch of highway had many reminders of the Soviet collapse as we discovered on the return trip during daylight hours.

Just west of Semey was a “tank farm,” of more than a thousand Soviet tanks that were brought from Eastern Europe five years prior. They were no longer operational, and the Kazakh government did not have the money to cut them up. Although they were promised such funds by the Soviet government, it, of course, no longer existed. A bit up the highway was an old air base—one of the three principal strategic bomber air bases during Soviet days. It was now deserted, the runways destroyed, the town that supported it, Chagan, a ghost town. Just beyond that, another ghost town—a failed collective farm. The landscape from there to Kurchatov was flat and featureless except for an occasional glimpse of the Irtysh River and the straight line of a huge pine forest boundary that stretches to the Pacific (we were told).

We arrived in Kurchatov city, named after the father of the Russian nuclear program, close to midnight. The “hotel” was a typical Soviet-era guesthouse. The marble steps were cracked, the outside stucco was crumbling. The suites were huge: a living room, lots of hallways, a bedroom with a single bed, a bathtub, and a separate toilet. My room was incredibly cold, perhaps 58 degrees Fahrenheit or so, but it had plenty of hot water. I filled the bathtub (despite its rusty hue) to warm up before going to sleep. The next





The towering statue of Igor V. Kurchatov at Kurchatov City. Sigfried Hecker, Samat Smagulov, John R. Phillips, Kairat K. Kadyrzhanov, and Jim Toevs. All photo courtesy of Siegfried Hecker

morning at breakfast, when my Kazakh hosts asked how the accommodations were, I told them fine, but I froze in the cold rooms. They asked if I didn't find the electric heater stored in the closet. I told them I looked everywhere but found nothing. My colleague Jim Toevs piped up and said, "Oh, I had two in my room." That explained it.

I'll never forget the eerie feeling during my morning runs. It felt like a movie set for a ghost town. What was left of the once bustling Kurchatov city (or Semipalatinsk-21, as it was then called) were mostly deserted buildings, both offices and apartments. Most of the windows in the buildings were broken. The streets were deserted, not a soul anywhere. All I saw was a herd of horses running loose through the outskirts of town and an enormous number of ravens (white and black, with huge nests in the trees). The streets were wide with mostly broken concrete, and the sidewalks upheaved. A huge statue of Igor Kurchatov towered over the center square area. The former test site headquarters now housed the city government and the mayor. Our Kazakh hosts told us that during Soviet times, Kurchatov housed roughly 30,000 Soviet military personnel and 20,000 civilian workers and their families. Most of the military returned to Russia after the demise of the Soviet Union. Roughly 5,000 people remained in Kurchatov, although we saw few.

The statue of Kurchatov was about the only reminder of the Soviet days. We were shown the building that once housed Stalin's henchman, Lavrenti Beria, who headed the military part of the early Soviet program. It sat by an idyllic spot on the banks of the Irtysh River. The tennis court was dilapidated; the house now served as an Orthodox church.

We spent two days at the Polygon, as they called the sprawling nuclear test site, which was the size of Connecticut. The drive out was as eerie as the morning runs in town. It began completely featureless and flat, with an irrigation ditch running along the paved road. As we passed a deserted shack with a barricade in the open position, we were told it was once the security gate for the test site.

Along the road to Opytnoe Pole, the site of the first and several subsequent Soviet nuclear tests, we saw an abandoned motorcycle with a side car. On the way back in late afternoon, Jim Toevs and I decided it was too good a photo op to pass up, so we climbed in just as two men arrived in an old car with a gasoline can. Apparently, much like our first plane

in Almaty, the motorcycle had run out of fuel. The two men were delighted to find us there and eventually got the bike running and took off.

Our Los Alamos contingent had a lot of information about places and activities at the Polygon, but it was still full of surprises. Its vast expanse was one. It took hours to reach some of the sites. We also found that US intelligence analysis of some of the facilities was far off the mark. A long underground facility in the Baikal area was thought to be one of the Soviets' most secret military nuclear sites. Instead, our hosts proudly showed us an ingenious, experimental, high-temperature, hydrogen-cooled reactor.

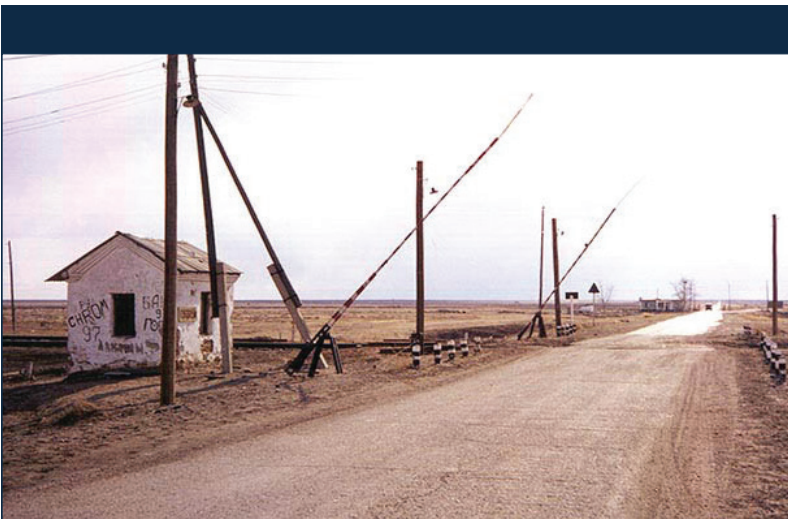
It was a stationary prototype of a nuclear rocket engine used to measure the impulse imparted to the hot gasses based on their passage through the reactor core. Once the hydrogen flowed through the complex piping network into the core, a chain reaction began, and then stabilized, the top cover of the underground reactor and the surface building dome were removed, and the hydrogen heated up in the reactor core to several hundred degrees Celsius, if not higher. This allowed the hydrogen to escape into the atmosphere once it had been ignited. This all came out as a gigantic flame escaping in a big whoosh, with lots of gamma rays

and some neutrons also escaping from the exposed top of the reactor that was around 10 meters below grade. Typically, the reactor operated two or three times a year.

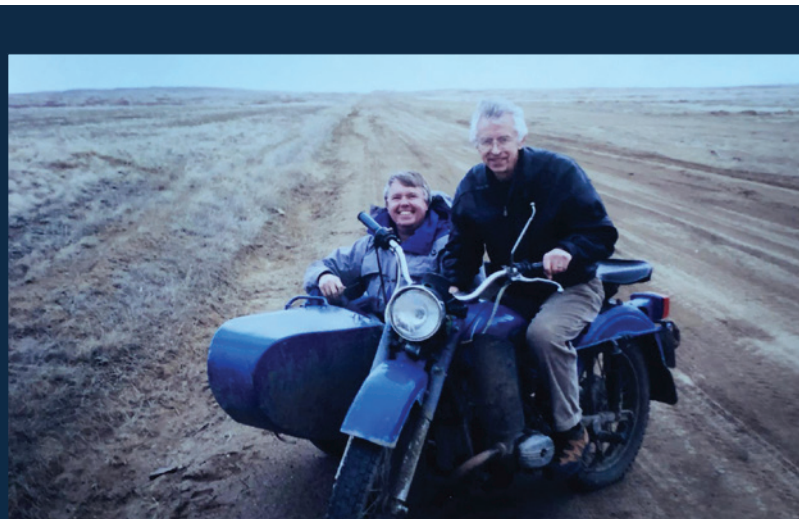
One curious feature of the site was a very long underground tunnel extending close to half a kilometer. In a future visit, Alexander N. Kolaenkov, the Russian chief engineer still in charge of the site, explained it was designed so that in case of an accident while the reactor was in operation, the tunnel could be used as an emergency exit for the operating crew to escape some distance away unharmed. This tunnel had the US intelligence community perplexed for decades.

We also found an interesting mix of scientists and engineers, all well trained in the Soviet nuclear enterprise. The leadership in the Kazakhstan National Nuclear Center (NNC) at the time comprised primarily ethnic Russians who decided to stay in Kazakhstan after the breakup of the Soviet Union. Many of the lead technical specialists were also ethnic Russians. Several told us that whereas Russia was still their home, there was no future in returning to the economic and political chaos there. They were much better appreciated and somewhat better off financially by working for the NNC. Besides, they still had a passion for research in nuclear





The deserted guard gate to the Semipalatinsk Test Site. Photo courtesy of Siegfried Hecker



The deserted guard gate to the Semipalatinsk Test Site. Photo courtesy of Siegfried Hecker

energy, and although life was challenging in Kazakhstan, it was much superior to Russia. We found later that quite a few of the ethnic Russians returned to the Russian Federation once the political turmoil settled down and the economy improved.

At the INP on our return to Almaty, we found scientists and engineers still dedicated to nuclear research under difficult economic conditions. They had also initiated a program on environmental remediation aimed at the Polygon and at the sites of the nearly 30 peaceful nuclear explosions the Soviets conducted at many other locations in Kazakhstan, including in the western salt deposits. I developed a good relationship and built trust with the leaders and technical specialists of the NNC by working with them on many of their nuclear projects over the years. That trust allowed us to share important information in the trilateral forum as well as work only with the Russians when it came to sensitive nuclear weapons issues.



Bringing the Russians on Board and Building a Strong Relationship with the Kazakhs

The visit to Semipalatinsk, particularly the surprises such as the long underground tunnel, convinced us that the proliferation risks were serious and that we would need the Russian scientists to help us assess and mitigate the problems. Otherwise, we would be looking for a needle in a haystack. Fortunately, we had begun to develop a close relationship with Russian nuclear weapon scientists during the Joint Verification Experiment (JVE) in 1988, which resulted from the Reagan-Gorbachev summit at Reykjavik, Iceland, in October 1986. The JVE consisted of Russians and Americans conducting underground nuclear tests at each other's test sites

and comparing on-site measurements of the nuclear blast size with remote measurements. These tests facilitated the ratification of the Threshold Nuclear Test Ban Treaty in 1990.

The relationships we developed during the JVE led to the exchange visits of nuclear weapon laboratory directors to each other's laboratories in early 1992, shortly after the dissolution of the Soviet Union. As a result of these visits, my Russian lab director counterparts and I initiated the lab-to-lab scientific cooperation described in *Doomed to Cooperate*. In turn, this opened the door to collaboration on the problems at Semipalatinsk.

I first approached Dr. Rady Ilkaev, director of the Russian Federal Nuclear Center VNIIEF (the equivalent of the Los Alamos National Laboratory), during a visit in November 1997 about potential nuclear security concerns resulting from what the Soviets may have left behind at Semipalatinsk. He explained that in their view, nothing constitutes a nuclear weapons concern. Besides, he said, they (meaning the Russian nuclear enterprise) were not going back. Any work at Semipalatinsk would paint them as irresponsible with respect to environmental problems left behind. He drew an analogy to the British situation at Maralinga in Australia, where the British government had to pay significant sums of money to remediate the environmental problems caused by British nuclear tests and experiments in Australia. He said Russia could not afford to pay.

When I returned to VNIIEF in July 1998 and showed Director Ilkaev the photos of the trenches dug by the copper cable thieves at Semipalatinsk, he persuaded the Ministry of Atomic Energy to allow VNIIEF scientists to work with us and the Kazakhs on the project. He told me they would still prefer not to go to Semipalatinsk to do this project, but he knew we were going to do it with Kazakhstan regardless, so they may as well be there to protect their own interests. He also said that in the end, it was the right thing to do—that they had a moral obligation to do so.



Ilkaev introduced us to the Russian scientists who had conducted experiments at Semipalatinsk: Yuri Styazhkin, Viktor Stepanyuk, and Anatoly Druzhinin. They would work with us over the next nearly 15 years to help mitigate the problems. We cemented the trilateral cooperation during a NATO-sponsored workshop in Almaty in June 1999. I helped INP Director Kadyrzhanov obtain NATO support for the workshop “Nuclear Physical Methods in Radioecological Investigations of Nuclear Test Sites,” the proceedings of which we jointly published.⁵ We invited and paid for the Russian scientists to participate in the workshop; Kadyrzhanov invited VNIIEF Director Ilkaev to attend. At the margins of the workshop, we signed the first trilateral agreement to work together on the issues of concern at the test site. The workshop also provided us the opportunity to strengthen the personal relationships among the leaders and scientists of the three countries. For example, Kadyrzhanov took Ilkaev and me to a nearby retreat that belonged to then Kazakh President Nursultan Nazarbayev, where we were allowed to ride his horses (at least long enough for a photo op).

We agreed on the key elements of the project during this visit. Yet any project of this magnitude and sensitivity requires government approval, financial support, and experienced project-execution personnel. We were fortunate that we had great leadership and support in all three countries. The US assistant secretary of energy for nonproliferation and national security, Rose Gottemoeller, who was also a Russia specialist, traveled to Moscow. She signed a governmental agreement with the Russian deputy minister of atomic energy, Dr. Lev. D. Ryabev, and Kazakhstan’s minister of science and new technologies, Dr. Vladimir S. Shkolnik.

The last essential elements were funding and an appropriate agency. I was able to convince Dr. Jay Davis, the new director of the Defense Threat Reduction Agency (DTRA), to bring the project into their purview and arrange funding. The agency had extensive experience in working with Kazakhstan in threat

reduction programs, including nuclear test tunnel closures. The DTRA and its parent agency, the US Department of Defense, also had experienced project-management teams to do so. Moreover, Andrew Weber, adviser for threat reduction policy in the office of the secretary of defense, helped us navigate the complex political hurdles in Washington for the Semipalatinsk project.



Viktor Stepanyuk spent the better part of 15 years as a Russian scientist on the Semipalatinsk project, including many 36-hour train rides from VNIIEF to Semipalatinsk (because he chose not to fly).

He begins his story in *Doomed to Cooperate* by writing, “The liquidation of consequences of nuclear tests on the territory of the former Semipalatinsk Test Site (STS) was carried out for over 15 years by a large team of professionals from Russia, Kazakhstan, and the United States. As a result, over 100 kg of nuclear fissile materials was cleaned up as radioactive waste.”⁶

Stepanyuk’s final words in his story are worth repeating because they stress the human dimensions of this story: “The success of the trilateral collaboration was mainly determined by the ability to find compromise solutions that were present in practically every operation. It appears that the main outcome of the trilateral collaboration is the experience of mutual understanding. We would like to hope that the experience of our ‘trilateral’ team will be of use to next generations whose well-being we have been working to ensure over these 15 years.”

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Notes

- 1 William H. Tobey, “What Lies Beneath?” *Foreign Policy*, April 30, 2012, 1.
- 2 Siegfried S. Hecker, ed., *Doomed to Cooperate: How American and Russian Scientists Joined Forces to Avert Some of the Greatest Post-Cold War Nuclear Dangers*, 2 vols. (Los Alamos: Bathtub Row Press, 2016).
- 3 Eben Harrell and David Hoffman, *Plutonium Mountain: Inside the 17-Year Mission to Secure a Dangerous Legacy of Soviet Nuclear Testing*, report by the Project on Managing the Atom, Harvard Kennedy School, Belfer Center for Science and International Affairs, August 2013, <https://nsarchive2.gwu.edu/NunnLugar/2015/64.%202013.08.00%20Plutonium%20Mountain-Web.pdf>.
- 4 China still holds ethnically Turkic people, the Uyghurs, much against their will in the Xinjiang Uyghur Autonomous Region.
- 5 S. S. Hecker, C. F. V. Mason, K. K. Kadyrzhanov, and S. B. Kislitsin, eds., *Nuclear Physical Methods in Radioecological Investigations of Nuclear Test Sites*, vol. 31 in NATO Science Series 1: Disarmament Technologies (Heidelberg: Springer Netherlands, 2000).
- 6 Stepanyuk chose the phrase “radioactive waste” primarily for internal Russian reasons. As the articles in *Doomed to Cooperate* make clear, what was remediated was potentially weapon-useable materials, not waste.



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