

The background of the cover is a complex architectural line drawing in white on a dark blue background. It features various geometric shapes, including circles, rectangles, and lines, suggesting a technical or engineering drawing. The drawing is dense and intricate, with many overlapping lines and shapes.

Routledge Histories of Central and Eastern Europe

TRACING THE ATOM

NUCLEAR LEGACIES IN RUSSIA AND CENTRAL ASIA

Edited by Susanne Bauer and Tanja Penter



Tracing the Atom

This book is about nuclear legacies in Russia and Central Asia, focusing on selected sites of the Soviet atomic program, many of which have remained understudied. Nuclear operations, for energy or military purposes, demanded a vast infrastructure of production and supply chains that have transformed entire regions. In following the material traces of the atomic programs, contributors pay particular attention to memory practices and memorialization concerning nuclear legacies.

Tracing the Atom foregrounds historical and contemporary engagements with nuclear politics: how have institutions and governments responded to the legacies of the atomic era? How do communities and artists articulate concerns over radioactive matters? What was the role of radiation expertise in a broader Soviet and international context of the Cold War? Examining nuclear legacies together with past atomic futures and post-Soviet memorialization and nuclear heritage shines light on how modes of knowing intersect with livelihoods, compensation policies, and historiography.

Bringing together a range of disciplines – history, science and technology studies, social anthropology, literary studies, and art history – this volume offers insights that broaden our understanding of twentieth-century atomic programs and their long aftermaths.

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Nuclear Legacies in Russia and Central Asia

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Tracing the Atom

Nuclear Legacies in Russia
and Central Asia

**Edited by Susanne Bauer
and Tanja Pentter**

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Preface and Acknowledgments

This book brings together scholarship in history of Eastern Europe with interdisciplinary inquiries drawing on social anthropology, science and technology studies (STS), and studies of literary and artistic productions. Conceptualizing this multidisciplinary volume, we foregrounded different modes and scales of tracing: from the analysis of nuclear imaginaries and memorializations to studies of radiation expertise; from tracking nuclear supply chains to reconstructing the atom's epistemic, institutional, and legal heritage; from artists' engagements with radioactive matter through radiophotograms to the tracing of residual radionuclides in environmental health sciences.

This volume took its point of departure at the workshop “Nuclear Landscapes in Eastern Europe and Asia. Knowledge – Practices – Social Change,” held at Heidelberg University, Germany in December 2014. The editors wish to thank Laura Sembritzki for her support in organizing and coordinating the symposium, which brought together several contributors to this volume. Many thanks to all participants, presenters and discussants at the Heidelberg workshop – Melanie Arndt, Klaus Gestwa, Olga Kuchinskaya, Elena Maltseva, Eglė Rindzevičiūtė, Magdalena Stawkowski, Hiroko Takahashi – for their insightful and inspiring contributions and comments. As the work continued, the volume benefited from further academic exchange within the networks of the project “Nuclear Technopolitics in the Soviet Union,” funded by German Research Foundation (<https://nuctechpol.org>).

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1 Introduction

Tracing the Atom. Nuclear Legacies in Russia and Central Asia

Susanne Bauer and Tanja Pentler

“It was not just one nuclear power station that exploded, but that whole complex of irresponsibility, lack of discipline and bureaucracy,” wrote the Belarusian writer Ales’ Adamovich in a letter to Mikhail Gorbachev in 1986.¹ During the Perestroika period, the conflictual nature of the nuclear legacy became openly apparent and contributed to the disintegration and end of the Soviet empire. While, in the international public, Ulrich Beck referred to the Chernobyl accident of 1986 as an “anthropological shock”² within the Soviet Union, the explosion of the nuclear reactor provided the impetus for criticism of the ruling system: the cover-up and downplaying of the nuclear accident and the delay in taking countermeasures by the Soviet authorities mobilized large sections of the population, particularly in Ukraine. Chernobyl awakened an ecological awareness that became an important element of the political opposition. Already in the final years of the Soviet Union, the question of reparations for the victims of the Chernobyl disaster moved onto the political agenda in Ukraine as well as in Belarus. Chernobyl subsequently became a kind of “social catalyst,” forcing politics and society alike to rethink their positions and, at least in the first decade after the disaster, fostering the emergence of civil society involvement.³

In Ukraine and Belarus, the Chernobyl movement became an important part of the national movement. Representatives of the Ukrainian and Belarusian national movement even regarded the Soviet Chernobyl policy as “genocide” against their people.⁴ The uncovering of the Chernobyl disaster also encouraged revelations about previous nuclear accidents inside the Soviet Union: in the Chelyabinsk region of Russia, a public debate on the 1957 nuclear waste accident and its consequences became possible for the first time, and the environmental activists became part of a broader regionalist movement. In Semipalatinsk, Kazakhstan, a critical examination of the nuclear legacy of decades of atomic bomb tests began, which was also taken up by representatives of the movement for independence.

The change of concept from perestroika to “catastroika,” which goes back to the famous Russian dissident Alexander Zinov’ev, expressed the attitude toward life of many contemporaries who were overwhelmed by the increasing revelations about environmental disasters and the general problems of the

transformational period.⁵ After the end of the Soviet Union, however, the environmental movements lost their social significance again in the second half of the 1990s, and attention to the problematic nuclear legacy of the Soviet era faded into the background in the face of other colossal transformational tasks. But the era of “catastroika” is far from over and there are many signs that the issue of how to deal with the nuclear legacies of the Soviet period will become one of the central issues of the twenty-first century.

This volume historicizes the legacies of nuclear weapons programs by focusing on the long-term consequences of nuclear programs, many of them tied to atomic weapons development. Their very epistemologies and material legacies have remained with us, even where disarmament and decommissioning have been more successful or were reintroduced. In terms of production infrastructures and nuclear supply chains, military and civil uses of nuclear power have been closely intertwined. Nuclear operations, for energy or military purposes, demanded a vast infrastructure of production and supply chains that have transformed entire regions. In foregrounding and following the material traces of the atomic programs, contributions in this volume pay particular attention to the memorialization of nuclear legacies and memory practices in a broader sense. We focus on the interrelations of legacies and transitions, sociotechnical imaginaries, memory practices, and heritage making in order to shed light on how modes of knowing intersect with livelihoods, politics of transitional justice and compensation, and historiography. Broadening the existing studies of nuclear history,⁶ this volume centers on radiation knowledge, institutional responses to nuclear legacies, and on how various communities, scientists, and artists articulated their concerns over nuclear issues. In what follows, we conceptualize an approach to studying the temporalities of the Cold War nuclear and discuss what the concepts of tracing, heritage, and legacies entail to this end. In following nuclear matters at different scales, chapters of this book examine the role of radiation expertise within specialized research institutes in Soviet and international settings as well as variegated modes of living with the political, legal, and epistemic endurances of the atom.

Nuclear Fission and the Supply Chains of the Soviet Atomic Programs

Nuclear operations, for energy or military purposes, have always demanded a vast technopolitical infrastructure of mining, processing, and handling of nuclear materials. The development of nuclear fission technologies goes back to the 1930s with the race for a nuclear weapon between the allied forces and Nazi Germany of the late 1930s and 1940s during World War II. Nazi Germany’s nuclear program was pursued at the institutes of the Kaiser Wilhelm Gesellschaft in Berlin. In the United States, research into nuclear fission had begun to form in 1939, when the core agencies that led to the Manhattan Project were formed. Military researchers involved in the Manhattan Project

conducted the first nuclear detonation in the Alamogordo desert in New Mexico on July 16, 1945, later known as the “Trinity test.”⁷ Trinity was followed by the two disastrous nuclear bomb attacks on the Japanese cities of Hiroshima and Nagasaki in August 1945, at the end of the war, already after Nazi Germany was defeated. After World War II, nuclear weapons programs and civil nuclear technologies were pursued on both sides of the iron curtain, with large-scale testing projects occurring in the global south. In the decades that followed, the United States and Union of Soviet Socialist Republics (USSR) established and ran large-scale nuclear programs with both civic and military components. While these programs included nuclear weapons development and testing, civil use of nuclear energy was pushed despite public controversies. This also increased the demand for uranium ore globally, with the United States, Canada, Congo, and East Germany as the main mining sites. But in addition, there has been smaller-scale mining in Central Asia since the 1940s, including Kazakhstan (which, since the massive development of uranium mining, has been the world leader in uranium exports since 2009), Kyrgyzstan, and Tajikistan (Roche).⁸ In Japan, however, there has been a strict separation of the promoted nuclear energy usage and anti-nuclear weapons stances by its government, which only after the 2011 Fukushima nuclear disaster had become connected in the public discourse and this connection became one of the key arguments of the protesters against nuclear energy in the wake of the Fukushima triple disaster.

During the Cold War, the extended production and supply chains have irreversibly transformed large areas, not least for their enduring material legacies, given the long half-lives of the radionuclides of technologies that cannot be contained in time. These massive infrastructures have operated within a deferred temporality – the handling of nuclear waste was optimistically deferred to technoscientific futures that were expected to solve the issue. Along the entire nuclear supply chains, radiation expertise was needed and developed. At the beginning of the nuclear fuel cycle is uranium mining, which provides the materials that are needed for nuclear fission: Roche gives an ethnographic account of an understudied site of nuclear mining in Leninabad/Khujand (Tajikistan), which was one of the first smaller scale uranium mining sites in the USSR from the early 1940s.⁹ Particularly, the largest site of nuclear processing, the plutonium production facility at Mayak (the Hanford, United States and Sellafield, United Kingdom counterpart) figures prominently in the nuclear infrastructure. The nuclear programs extended to entire professions during the Soviet time, ranging from expert scientists and bureaucrats dealing with everyday radiation risks and radiation protection issues (Nikonova, Sembritzki) to policies of compensation (Penter). Several contributions focus on the development of nuclear expertise, involving various professional groups in physics but also in medicine and the life sciences more broadly. Just like in the western biomedical sciences, the nuclear programs transformed and shaped the formation of fields from radiation biology, health physics to medical radiologists and ecologists in the USSR. These

took shape between civilian and military pursuits of nuclear technologies – well between precarious working conditions and little occupational hazards response and a technoscientific nuclear utopia of a nuclear-powered and thus energy-abundant urban landscape (Guth). At the nuclear processing facilities such as in the Southern Urals, professionals in radiation protection, medical staff, and scientists were dealing with everyday burdens and damage and had to come up with ad-hoc responses in case of minor and major radiation accidents in the plutonium plants (Nikonova, Sembritzki). The testing of a total of 715 nuclear devices continued until 1989, mainly at the two nuclear test sites near Semipalatinsk and in Novaya Zemlya.¹⁰ Especially the above-ground nuclear explosions between 1949 and 1965 deposited local and global fallout leading to persistent anthropogenic traces in the environment (Bauer).

With this volume we zoom in on the Soviet atomic programs during the Cold War and beyond, focusing on nuclear sites that are much less known, compared to the more broadly researched Chernobyl accident of 1986 or the Fukushima–Daiichi disaster of 2011.¹¹ This book brings to the fore nuclear infrastructures, from uranium mining and the envisioned nuclear fuels cycle, as well as its visions to fuel socialist modernity and a military complex justified as a requirement for peacebuilding. In line with nuclear modernity's visions of energy abundance, the Soviet civil nuclear energy program launched a nuclear-powered model city of Shevchenko/Aktau in today's Republic of Kazakhstan (Guth). For four decades, the Soviet atomic weapons program conducted nuclear testing near Semipalatinsk/Semey in the eastern region of today's Kazakhstan (Bauer).

Indeed, the supply chain of nuclear projects in the USSR starts with uranium mining. In addition to Central Asian sites such as Leninabad/Khujand in Tajikistan and Mailuu Suu in Kyrgyzstan, the USSR obtained uranium from the Wismut sites in East Germany, and from Czechoslovakia and Bulgaria as early as 1949–1951, before the first nuclear reactor for energy opened in Obninsk (110 km south-west of Moscow) in 1954.¹² A key part of the nuclear supply chain was channeled through the Southern Urals nuclear weapons complex, including the Mayak plutonium production plants (Nikonova, Sembritzki). Following the production chain, this volume addresses the uranium processing and plutonium production sites and pertinent radiation expertise at the Southern Urals nuclear facilities. The enriched uranium and plutonium from these facilities were then, after warhead design and assembly in Arzamas-16 (Sarov),¹³ brought to the nuclear test sites in Kazakhstan and Novaya Zemlya, where they were “tested” and detonated. Nuclear test explosions, especially atmospheric nuclear tests as conducted between 1949 and 1963, led to heavy local radioactive fallout, but also contributed to significant global radioactive fallout as well. Outside the two major test sites, so-called civil nuclear explosions were carried out; these included at least 15 sites in Russia, Ukraine, Kazakhstan, and Uzbekistan. Sometimes these “peaceful nuclear explosions” were used in mining, oil and natural gas industries, to create underground storage and crush ore, and even used to extinguish

gas torches, as conducted at the Urta-Bulak gas field in Uzbekistan in 1966.¹⁴ Nuclear politics – on both sides of the iron curtain – can only be understood when attending to the infrastructures of the large-scale atomic technology programs during the Cold War. This volume extends histories of the atomic age to include its negotiation and shaping through visual culture, literature, and the arts (Kaibach, Castringius).

Contributions in this book follow these nuclear trajectories and further address the consequences and policies of compensating for radiation exposure situations in the USSR and in post-Soviet states, their regimes of compensation, their Soviet style, and situate these in transitional and environmental justice literature (Penter). Beyond the nuclear medical expertise, nuclear production and its lingering legacies gave rise to literary accounts in the USSR, which reflected on the conditions of nuclear modernity in their own ways (Kaibach). This also includes the long shadow of Hiroshima and Nagasaki that has been part of the popular and artistic production in the atomic age and beyond. Seminal photographers have taken up the very materiality of radiation photography, making visible radiation in the aftermath of the Hiroshima and Nagasaki atomic bombs (Castringius).

Studying the Post-Nuclear: Traces, Heritage, Legacies

As part of the atomic era, radioactive isotopes have been extensively used as tracers in the life sciences and became a core technique in biomedical research.¹⁵ While the traceability of radioactive materials has shaped the Cold War life sciences, this book takes its cue in the humanities and social sciences to re-examine the Cold War nuclear. In following some of the material traces of things nuclear, the contributions of this volume attend to memory practices as they encounter and address nuclear legacies. Practices around memorialization are an important recent field of study, especially in post-Soviet states, which saw tremendous shifts and a complete remaking of their own historical narratives. This included a realignment of the past, culminating in the post-Soviet nation states as well as new futures articulated as a shared goal. Time and temporalities are already present in the very materiality of the nuclear – half lives, long and short, the long-term of nuclear remainders, waste issues and long-term exposure effects, or the biological half-lives of radionuclides in the human body – as well as the memorialization of war, of the nuclear bombs, paraphernalia, popular culture, and literary engagements with the nuclear weapons complex (Kaibach).

During the 1980s and 1990s – the years of glasnost and perestroika and the end of the Soviet Union – new approaches and perspectives in social science research emerged. Important strands of work have been conducted by Galina Komarova from the Institute of Ethnology and Anthropology of the Russian Academy of Sciences who very early on studied the everyday life at the banks of the river Techa, an area of extreme exposure, with soils, water, and bodies impacted by plutonium production in Southern Urals. As one of the pioneers

who carried out extensive field research and interviews in the 1990s, she paid special attention to the socio-cultural consequences of radioactive contamination, in particular, the livelihoods of various ethnic and religious groups, including the nutritional traditions of the population, as well as everyday life and socio-cultural practices in the zone of increased radiation. Her surveys from 1993 and 1998 revealed that despite the fact that the residents of the Techa river villages had already been informed about the danger of contamination with radionuclides, the Techa river and especially its floodplain were actively used by the local peoples. Moreover, the fish of the river, an everyday food supply, were a significant source of radionuclide intake into the human body. During the economic transition crisis of the 1990s, people turned to traditional practices of natural resource use, including fishing. Komarova's 1998 survey showed that a majority of the inhabitants of the contaminated area organized their diet, relying mainly on their own farms, as the purchasing power of most of the local people was so low that they were barely able to acquire the minimum of what they needed.

As Komarova has described, social and cultural dimensions can affect the conditions of radiation exposure: in specific conditions that are equally dangerous to all residents, the commitment to different cultural and religious norms can be an ecologically significant factor that, to some extent, improved or aggravated the psychological and physical wellbeing of the residents of the area, prevented or provoked radiation-related illnesses, i.e., served as a dose-forming or dose-decreasing factor. With their work since the end of the Soviet Union, social anthropologists like Komarova have laid important foundations for public debates on societal issues as well as on environmental justice and compensation policies. In this way, ethnographic research became both social science and civil rights activism; ethnographic research aimed to foster literacy as to radiation and health by working with the local population and to improve general living conditions in the Techa river villages. Last but not least, Komarova's studies take into account gender perspectives and showed how women dealt with the challenges of nuclear legacies.¹⁶ The work by Galina Komarova and other scientists in the 1990s has sharpened our awareness of how people's everyday practices are an important yet neglected part in the social and historical studies of Cold War nuclearity.

The concept of "legacy" of the nuclear age has been used frequently for example for the transformed landscapes after nuclear testing in the Pacific and Central Asia as well as in the environmental justice literature.¹⁷ The atomic age has recently featured prominently in studies of the sociology and history of the atomic age as well as in Cold War studies as legacy has been a core concept also used widely in the public sphere, such as in UN documents and NGO reports. Legacies are often invisible but can linger and imply "slow violence."¹⁸ Invisibility has been central to studies of science and technology studies (STS) and social studies of radiation.¹⁹ Social scientists and historians have recently proposed "atomic heritage studies" as a broad and open engagement of interdisciplinary scholarship in social and cultural studies,

building to some extent on museology and more broadly on studies of popular culture.²⁰ Nuclear heritage studies encompass the broader atomic cultures, including imaginaries, artifacts, architectures, and institutions. As research from the emerging field of nuclear cultural heritage studies has pointed out, the relevance of atomic heritage becomes visible in its material, relational, and representational features.²¹ This opens up for the study of entangled histories and relational networks – from situated technologies, planning, modes of governing, and expertise to everyday practices. Such a more plural approach to things nuclear allows different actors, social groups, and publics to engage with matters kept secret during the Cold War era and, in parts of Central Asia and Russia, subject to secrecy again after a short opening during the 1990s and early 2000s.

The chapters in this volume show how the heritage of the atom in the former Soviet space has become manifest in urban planning (Guth) and public monuments (Bauer), museums, and literature (Kaibach), artistic productions (Castringius), archival documents, legal legacies (Penter), specific stocks of medical knowledge (Sembritzki), and everyday practices (Roche). Moreover, memory work also takes place through the very scientific data labor aimed at documenting the impact of nuclear testing, including the work to navigate the layering of open and secret materials for risk assessment and mitigation of radiation effects (Nikonova, Bauer). Especially given the decades of secrecy and an “information boom,” followed again by new restrictions for many of these sites, we believe it is worthwhile to probe both the concept of heritage and legacies. The latter can function as generative heuristics to examine the heterogeneous assemblages of the post-Soviet nuclear complex.

For this volume, the concept of legacy allows us to render visible and articulate concerns linked to lingering shadows of the past, hauntings that might have been secret, covered up, or forgotten over time, but which can still materialize quite violently in the present and/or the future. Heritage, in contrast, denotes an active seizing, interpreting, or configuring of the past. As Gisela Welz notes (in her study of heritage and food in Cyprus), “heritage does not exist prior to preservation,” but rather is “the result of purposeful action.”²² Often this is guided by standards that are external to the context and developed along with heritage making. This approach builds on studies of value and valuation as well as on studies of heritage production.²³ It offers an interesting mode of connecting the chapters in this volume – from where they were situated in the nuclear production, supply, and usage chain in the first strand to the question of how they feature if we place them on a continuum of legacy and heritage – when we define legacy as the uncanny, uncertain consequences of the nuclear industries and heritage as the purposeful production of memory and memorialization of an era of the past or the active shaping of products for the future. Here, for instance, the atomic landscape gardens of urban planning in Aktau/Shevchenko (Guth) would feature into an account of the heritage of modernist utopia, while the shadow

photography (Castringius) and the traces of the nuclear after Semipalatinsk (Bauer) would address the uncanny, unknown, but incorporated traces of radioactivity in the human body. Kaibach reflects on the literary expressions of physicists dealing with experiences of working in the midst of technologies and dark knowledge of nuclear war and scientists' responsibility.²⁴ Sembritzki and Nikonova show how the radiation expertise attempts to balance some of these dimensions by producing knowledge and attempts of monitoring and controlling the radiation exposure to workers, patients, and populations. Pentec then addresses the efforts to confront and mitigate the long-term exposure through policies of documentation and compensations of the harm these populations experienced. The larger part of the essays in this volume deals with legacies – that, even if reconfigured as heritage in artistic and literary productions, showcase the catastrophic and the yet unknown shadows that accompany the nuclear matters under secrecy. While much of the nuclear programs were under strict secrecy on both sides of the Iron Curtain, there have been windows of accessibility to sources and documents, including for historians and social scientists. Scholars working on these matters have often seen these windows opening and closing again. This implies that nuclear memorabilia of all kinds often cannot be easily converted into a more pluralistic public heritage. Much remains under state control that is becoming tighter and more restrictive again after 2010, which researchers need to reflect on in their accounts and seek new methodological pathways. Consequently, this volume foregrounds archival projects, ethnographic engagements, and reflections on interdisciplinary research, thereby endeavoring into nuclear politics. This contributes to an understanding of how conditions of invisibility and secrecy have shaped the ways in which local communities are living with legacies of the atomic age.

Together, taking their cue in nuclear technopolitics, the essays assembled in this volume engage with the complex temporalities encountered in things nuclear. They address temporalities in terms of legacies, regulatory matters but also the very materialities, such as half-lives and radionuclide decay. The approach of thinking legacies, transition, imaginaries, memory, and heritage together will contribute to our understanding of how these multiple temporalities intersect in the knowledge that shape what is at stake for livelihoods, politics, and historiography. In these multiple intersections, the specific characteristics of Soviet nuclear modernity and post-Soviet temporalities become visible.

Contested Historiographies and the Politics of the Nuclear

Post-Soviet historiographies and cultures of remembrance have developed differently in the successor states of the Soviet Union and today there is no common narrative on the history of the Soviet era. In Russia and beyond, Putin is increasingly acting as the country's "chief historian" in this process.

The fight against “falsification of history” and for the “preservation of historical memory” has even been included in article 67 of the new Russian constitution.²⁵

Today’s historians have to assert themselves against two different trends: on the one hand, against attempts by governments to control the field of historiography and history politics more strongly by passing appropriate laws and creating institutions, such as the Institutes of National Remembrance in Poland and Ukraine, and the suppression of the development of pluralistic historical narratives. On the other hand, growing democratization and differentiation in dealing with history can be observed in Eastern Europe “from below,” which is characterized by the fact that new actors beyond the field of specialist science occupy the field of history and history politics: while the younger generation in particular is involved in the heated online memory wars on Twitter and in social networks,²⁶ private regional initiatives for the exhumation of mass graves from World War II are often the concern of the older generation. At the same time, these developments are accompanied by an archival revolution (e.g., in Ukraine) that now also includes the opening of the former secret service archives and provides a completely new source base for future research.

When the 100th anniversary of the Russian Revolution was celebrated in 2017, the conflicts of memory came to the fore, and it became clear that in the various successor states of the Soviet Union, there has long been a lack of agreement about what the revolution was and how it should be remembered today. In Russia, the revolution was more an object of forgetting and official silence, and the Russian government tried to wrap the memory of the revolution in anti-revolutionary messages. The most important slogan of the commemorative year was issued by President Putin: “The revolution must not be repeated,” combined with warnings against opposition and protests. In the president’s view of history, the revolution was a dangerous chaos that had led to defeat in the World War I, the collapse of the empire, and civil war.²⁷ Putin had already criticized the Bolsheviks several times before in his politics of history, speaking of the “national treason” of the Bolshevik leaders who were responsible for Russia’s defeat in World War I.²⁸ In the wake of the Ukraine crisis in 2014, he had also criticized the Bolsheviks’ demarcation of the borders (between Soviet Russia and Soviet Ukraine) during the founding phase of the Soviet Union.²⁹

For many Ukrainians, the revolutionary year of 1917 is associated above all with the traumatic experience of a failed state foundation. According to the presidential decree, the “National Ukrainian Revolution” was to be celebrated in 2017, with the national movement of the Ukrainian people and the struggle for the founding of the state at its center.³⁰ Georgia, too, did not celebrate the anniversary of the revolution, but rather the 100th anniversary of the founding of the Georgian nation state in 2018.³¹ In authoritarian Belarus, on the other hand, the old myth of the “Great October Socialist Revolution” persists to this day, with minor adjustments to the requirements of current politics.³²

In Central Asia, the memory of the great armed uprising of the Muslim population in 1916, which was sparked by the planned conscription of Muslims for military service and quickly expanded into an anti-colonial uprising, dominates the memory of the revolution. Several hundred thousand people, mostly Central Asians, had died during and after the uprising.³³ In Tajikistan, the 100th anniversary of the revolution in 2017 received no attention at all and simply passed by without a sound, whereas the end of World War I was mentioned in the government press and a government delegation traveled to Paris especially for the celebrations.³⁴ Tajikistan's post-Soviet historiography has reinterpreted the historical narratives of the Soviet era, in which postcolonial interpretations of the Russian imperial and Soviet history of Central Asia have recently gained in importance.³⁵ New spaces of memory have emerged, which shed light on the Russian imperial conquest of the Central Asian steppes. Especially the Ferghana valley and its agricultural history and cotton plants are a case in point to ask for the limits of the proclaimed decolonization during the early Soviet period.³⁶

In the post-Soviet era, governments drew on pre-Soviet colonial histories in order to shape nationally anchored historical narratives. When the newly independent states of Central Asia rebuilt their national historiographies, they rejected some but kept large parts of Soviet historiography – for instance in the memory of World War II, which continues to be a uniting moment. Moreover, Soviet Central Asia had built on local elites as well as institutions and the leaders of the new independent republics (except for Kyrgyzstan) continued to mainly come from these local party elites established during the Soviet era.³⁷ The modes of nation-building and geopolitics of the new independent states differed substantially across Central Asia. To varying extents, the 1990s gave rise to a revived traditionalism that also drew on various Islamic traditions in Central Asia.³⁸ Kazakhstan was the only Central Asian country to build on a pre-Soviet national movement – the Alash Orda that was in government before the 1917 revolution.³⁹ These different strategies of renewal also included the management of nuclear legacies – both in national regulatory policies as well as in their international relations.⁴⁰ Institutional continuities in terms of administrations in post-Soviet governments persisted, but also as for nuclear weapons testing in Kazakhstan, international and UN bodies were called to assist with dealing with legacies and creating a nuclear weapons-free zone in Central Asia.⁴¹ Here, the end of nuclear weapons testing in Kazakhstan's north-east was aligned with the new nation-building. At the same time, however, the government began to embark on massive uranium mining projects in southern Kazakhstan.

Since the 1990s, some of the successor states of the Soviet Union have made great efforts in the field of “transitional justice” to document not only the crimes of Stalinism but also those of the National Socialist occupation and to give recognition and support to the numerous victims.⁴² The end of the Soviet Union was accompanied by the extensive uncovering and documentation of the crimes of the past hand in hand with an erosion of old Soviet

patriotic memory and the development of a new culture of remembrance. The victims of nuclear accidents and radioactive contamination played a central role in the nation- and state-building processes in some of the successor states of the Soviet Union (Penter). The process of coming to terms with the experiences of Soviet rule after the end of the Soviet Empire therefore has a strong ecological component, which requires that approaches to transitional justice and environmental justice be thought of as interconnected. More recently, this process has also taken on a European dimension, manifested in a growing number of appeals to the European Court of Human Rights (ECHR) by post-Soviet environmental victims.

In the future, the nuclear legacies could become even more of an object of post-Soviet memory conflicts, because the achievements of Soviet nuclear modernity are by no means undisputed in the successor states of the Soviet Union. The answers to what the nuclear legacy meant for the successor states of the Soviet Union vary today, with the nuclear shield in the Cold War era and the accelerated progress of industrialization and modernization being weighed against nuclear accidents, gigantic environmental and health damage, and social conflicts.

While the acknowledgment of victims of radioactive contamination played a central role in the nation-building in Ukraine, Belarus, and Kazakhstan since the 1990s, this was not to the same extent the case in the Russian Federation or in Tajikistan. In Russia, the nuclear victims were not perceived as victims of an inhuman Soviet system, but rather as individuals who happened to be in the “influence zone of unfavorable factors.” This might be due to still prevailing views that these inhabitants were bearing the consequences of the Soviet nuclear shield, thus protecting Soviet citizens as a whole. This idea of a peace-building effect in nuclear weapons is also held by local scientists working at the Semipalatinsk nuclear test site during Soviet time. However, in the Semey region and, to some extent in Kazakhstan as a whole, a public debate followed the information boom on nuclear test activities of the late 1980s and early 1990s, which went together with state research and compensation programs.⁴³ In Tajikistan, no critical debate has yet begun about the nuclear legacy of the Soviet era and its victims (Roche).

A future conflict could revolve around the Soviet legacy of nuclear waste. It has been apparent for some years now that the legacy of uranium mining is one of the most important long-term problems facing Kyrgyzstan and Tajikistan and that these states are completely overburdened with the disposal of radioactive waste.⁴⁴ Around the densely populated Ferghana Valley, in the border region between Kyrgyzstan, Tajikistan, and Uzbekistan, there are several highly dangerous uranium waste repositories with millions of tons of toxic radioactive waste, which need urgent remediation. If released, this material would massively affect all three neighboring countries and fuel old conflicts among the Central Asian states. According to many experts, the question is not whether this will happen, but rather when, as earthquakes, floods, and

landslides regularly occur in this region.⁴⁵ International conflicts over nuclear legacies could also become even more significant in the future.

In Russia, where since the 1980s and 1990s, thanks to *perestroika* and *glasnost*, small “corners of freedom” for environmental activists have developed, which allowed them to make a first inventory of improperly stored nuclear waste in the Soviet Union, the Russian Government has reintroduced the old Soviet practices of concealment and secrecy for the nuclear sector. As Tatiana Kasperski has stated, the general attitude of the government toward the problem of nuclear waste has changed significantly. Russian politicians and even some scientists no longer see the contaminated sites as the terrible legacy of a Soviet regime, which irresponsibly dumped waste, thereby damaging the environment and people, but as the glorious heritage of the military and industrial strength of a superpower. While environmental activists have once again come under the general suspicion of the Russian government and have been accused of being and labeled as “foreign agents,” the local residents affected must continue to live in the nuclear-contaminated environments.⁴⁶ In today’s Russia, the memory of Soviet nuclear modernity seems to again be unbroken, shaping the social reality and everyday practices of many people.

Incidents in international affairs, such as the United States’ withdrawal from the Intermediate-Range Nuclear Forces Treaty in 2019, demonstrate the continuing relevance and novelty of the nuclear legacies from the Cold War until today, both in the post-Soviet space and globally. What had begun in 1982, the Strategic Arms Reduction Talks (START) and its agreements of nuclear disarmament, came to halt, when on August 2, 2019, the US administration’s withdrawal from the Intermediate-Range Nuclear Forces treaty became effective.⁴⁷ This put an end to more than 50 years of nuclear arms control efforts and, when it comes to the relations between Russia and NATO, politicians and political analysts already refer to the increasing tensions as a “new Cold War.”⁴⁸ Disarmament of nuclear weapons began in the 1970s after two decades of Cold War between the United States and USSR, when Strategic Arms Limitation Talks began between the then two superpowers. Limiting, reducing, banning, keeping, and modernizing nuclear arsenals has remained an important issue in international relations since efforts against nuclear testing commenced in the wake of global fallout from the many atmospheric nuclear tests during the 1950s and 1960s. The first limited ban on atmospheric nuclear testing was issued in 1963. Until the present, however, the ratification of a comprehensive test ban on underground nuclear tests is still ongoing.⁴⁹ Nuclear disarmament has been subject to movements, controversies, rationalities of changing character, and configurations. The ratification of a Comprehensive Nuclear Test Ban Treaty lacks several countries – including the United States, Israel, India, and Pakistan, who have not ratified the treaty.⁵⁰ Despite large global movements and efforts for a UN Treaty prohibiting nuclear weapons, such as the International Campaign to Abolish Nuclear Weapons (ICAN),⁵¹ recipient

of the Nobel Peace Prize in 2017, nuclear weapons have become a neglected topic on the agenda in a world shaped by reemerging nationalisms and increasing uncertainty.

By bringing together researchers across disciplines for in-depth investigations into the complex entanglements of the nuclear past and present, this volume offers a beginning in recalibrating our thinking around nuclear legacies, which all too often finds itself entrenched in Cold War paradigms.

Notes

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Part I

Past Futures

Soviet Nuclear Sciences and Politics



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2 The Nuclear Landscape as a Garden

An Envirotechnical History of Shevchenko/Aktau, 1959–2019

Stefan Guth

Nuclear Landscapes as Wastelands or Gardens?

If we think of nuclear landscapes today, we commonly imagine them as barren wastelands – sites irreparably destroyed by atomic bomb tests, plutonium production mishaps or reactor catastrophes, such as Semipalatinsk, Kyshtym, or Chernobyl in the former Soviet Union, or the Nevada test site, Richland, and Fukushima in other parts of the world.¹ In the postwar heyday of high-modern optimism, however, nuclear energy inspired promethean imaginaries of large-scale nature improvement. Peaceful nuclear explosions (PNEs) were seen as a means to alter the physical features of landscapes,² and novel reactor technologies such as fuel-reproducing fast breeder reactors (FBRs) were expected to soon deliver virtually unlimited quantities of inexpensive power for energy-intensive purposes such as the large-scale desalination of seawater – an application both the United States and the USSR deemed highly promising for the development of arid regions within and beyond their borders.³ Over the course of the third quarter of the twentieth century, most of these visions resulted in disillusionment, but their investigation remains instructive none the less, precisely because it allows us to trace trajectories from optimistic imaginaries of large-scale nature transformation to more critical appraisals of human intervention in nature.⁴

What follows is an account of arguably the most comprehensive project of atomic-powered nature transformation to have been realized in the Soviet Union. The “nuclear oasis” of Shevchenko (today Aktau) was built in the 1960s and 1970s as a hub for the development of uranium and hydrocarbon deposits on the desert peninsula of Mangyshlak in Western Kazakhstan and by the end of the Soviet era was home to almost 200 000 people. Since 1973, it relied on the world’s first industrial-scale FBR, operating in tandem with the largest nuclear-powered water desalination plant ever built for energy and freshwater provision. Combining modernist architecture with lavish greenery, fountains, and swimming pools, it was showcased domestically and abroad to great acclaim. In the long run, however, the radiant future was found to come at significant ecological cost, even though the city escaped major nuclear accidents.

Adopting recent coproduction theorems, this chapter analyzes Shevchenko as an envirotechnical system⁵ – a hybrid space where technology and ecology were purposefully reblended in historically specific ways, the study of which provides insights into the particular “sightedness and blindness”⁶ guiding Soviet nuclear technopolitics at the apex of atomic-powered communism.⁷ Tracing later developments reveals a learning process in which the authors of the nuclear *technopolis* came to acknowledge not only the graveness of technology’s unintended detrimental effects on the environment, but also the latter’s unforeseen potential to interfere with technology in beyond-design-basis events such as earthquakes and rising sea levels of the Caspian Sea, thereby posing the danger of large-scale envirotechnical accidents. Finally, the chapter looks at how, in the new millennium, an ambitious, multibillion city expansion project predicated on the construction of a contemporary nuclear power plant (NPP) revealed the multiple problems of mapping a new atomic-powered future onto the unresolved legacy of a nuclear past.

Improving – and Exploiting – Nature

The decision-making process which led to the creation of Shevchenko was both more involved and more mundane than the later, streamlined narrative of single-minded nature improvement would have had it. Initially, military considerations took precedence over the requirements of atomic-powered communism. It was the discovery of large uranium deposits in Mangyshlak, resulting from an all-union prospecting effort carried out in 1954–1956 under the impression of a critical dearth of fissile material for the atomic bomb project, which brought the remote region into the focus of Soviet industrial and infrastructural development for the first time.⁸ In 1959, a joint resolution by the CPSU Central Committee and the Council of Ministers commissioned the nuclear ministry (*Minsredmash*) to build a uranium mining and processing combine based on the Mangyshlak deposits, which later came to be known as the Caspian Metallurgical Mining Combine (*Prikaspiiskii gorno-metallurgicheskii kombinat* – PGMK).⁹ Likewise, the future showpiece of Shevchenko’s nuclear complex, the BN-350 FBR, was initially designed and commissioned as a breeder of weapon-grade plutonium in 1960, and the subsequent decision to site it on the peninsula owed much to the intention to isolate the unproven technology in a remote region where it would do limited harm in the case of malfunction.¹⁰

Nonetheless, as the nuclear arms race geared up to reveal the absurdity of nuclear war through the Cuban missile crisis in 1962, peaceful applications of atomic energy assumed an ever increasing importance in both of the two superpowers’ efforts to prove that they, rather than their competitor, “represented the last, best hope for the rescue of a rational, transcending modernity from the horrors of war.”¹¹ Less than a decade after the nuclear bombings of Hiroshima and Nagasaki, Dwight D. Eisenhower’s 1953 *Atoms for Peace* initiative offered the Soviet Union a perfect opportunity to juxtapose the

peaceful socialist atom to its belligerent capitalist counterpart.¹² Using the stages of the four Geneva Conferences on the Peaceful Uses of Atomic Energy (1955–1971) and the International Atomic Energy Agency (IAEA, established in 1957), the USSR claimed not only moral, but also technological leadership in the field, stunning the international public, among other things, with the world's first NPP in 1954 and a number of cutting-edge contributions to the development of breeder and fusion reactors. In the late 1950s and early 1960s, the peaceful atom quickly became a centerpiece of the Soviet rhetoric and iconography of progress,¹³ giving birth to an imaginary that Paul Josephson has aptly termed “atomic-powered communism.”

However, the new technology had yet to demonstrate its transformative clout. As Sheila Jasanoff argues, visions of technoscientific futures “must latch onto tangible things” that “generate economic or social value” in order to gain assent beyond the bounded communities of scientists.¹⁴ Given the perceived *hostility* of much of the USSR's geographical space and the promise of unlimited energy offered up by the atom, projects of large-scale nature improvement constituted a particularly appealing field of application for nuclear energy in the minds of Soviet technologists. The Soviet state had engaged in “correcting the faults of nature” through large-scale infrastructural development since its inception, from Lenin's electrification program (GOELRO) to Stalin's *Plan for the Transformation of Nature*, but only the advent of the atomic age promised to remove whatever limitations had hitherto hampered the large-scale creation of *new natures*.¹⁵ “In our times of technological progress, especially in the field of nuclear energy and its use for peaceful purposes, mankind will be able to proceed with [...] activities of radical transformations of nature,” a Soviet author proclaimed in 1961,¹⁶ and another added that “the elemental evolution of the biosphere is giving way to a conscious, purposeful regulation of it.”¹⁷ The CPSU joined the conversation, claiming in its 1961 program that where other societal systems lacked the clout to intervene in nature and left it to its self-will, Communism “greatly increases [man's] power over nature,”¹⁸ – a process that was facilitated by the country's pioneering role in the utilization of atomic energy for peaceful purposes.¹⁹ Radiating with confidence, Soviet nuclear scientists and engineers saw themselves “at the onset of a man-made world,” as one of them put it.²⁰

Transforming deserts into gardens had been a paragon of Soviet nature improvement since Stalinist times.²¹ That Mangyshlak, of all the arid places in the country, became the testing ground for harnessing the atom's power to achieve the task was due to a historical contingency. Shortly after the discovery of uranium, large oil and gas deposits were found on the peninsula, which at the time were believed to rival the West Siberian fields. The fact that the region was already being developed at great cost by Minsredmash created favorable preconditions for their exploitation, as Gosplan argued in a letter to Khrushchev in 1961.²² Pursuing this strategy, however, required the presence of a permanent labor force numbering in the scores and potentially hundreds of thousands – and hence, the construction of a sizable city

in a region that Soviet planners had hitherto deemed all but uninhabitable due to its scarcity of freshwater.²³ On the parched peninsula, the utopian vision of turning deserts into gardens thus acquired a rational quality, as the *humanization of hostile nature* appeared a necessary prerequisite for its purposeful exploitation.²⁴ Furthermore, the multi-industrial development of the region also required lifting the veil of secrecy that had hitherto concealed Sredmash's activities in the region, thereby opening up the opportunity of exploiting the nuclear oasis as a showpiece of Soviet technological prowess.

Sara Pritchard has described the transformation of the Rhône into a complex envirotechnical system used for electricity generation, irrigation, and transportation as a literal process of "nation-building," which "cemented" progress into the fibers of the country.²⁵ The same undoubtedly applies to the Soviet "construction of communism" and its exemplary enactment in Mangyshlak. Over the course of a decade, the vision of atomic-powered communism became "concrete" in the double sense of the word, as dozens of the country's foremost research institutes, industrial enterprises, and building trusts participated in designing and building the reactor-cum-desalination batteries, a modernist model city and industrial cluster, plus the necessary energy transmission, water distribution, and transportation infrastructure.²⁶ In 1972, the reactor reached criticality, and in 1973, the Mangyshlak Atomic Energy Combine (MAEK) started providing electricity (150 MW electrical) and desalinated water (up to 120 000 m³/day) to the city and its industries. Triumphantly, exponents of Soviet nuclear technopolitics claimed an unmitigated success: Shevchenko's nuclear complex, they affirmed, pioneered the "unlimited" provision of mankind's two most crucial resources, energy and freshwater. Producing more nuclear fuel, in the shape of plutonium, than it consumed, the BN-350 was said to demonstrate FBRs' capacity to "solve the energy crises for millennia to come,"²⁷ and the successful application of its power to the purpose of large-scale desalination allegedly provided a technical solution to a "national challenge" – the supply of drinking water to the arid regions of the country.²⁸

Invariably, Shevchenko was cast as a triumph over nature. *Pravda* celebrated the city as proof of Soviet man's unbending will "to create better conditions for life on earth than what mother nature provided us with,"²⁹ and in 1975, the *Union internationale des architectes* awarded the city with its Sir-Patrick-Abercrombie Prize for the "humanization" of a "hostile natural environment."³⁰ At the same time, Shevchenko's authors took care to stress that nature was not so much defeated as improved upon through the project. As Pritchard points out, not only does the creation of envirotechnical systems involve *technologizing nature* – at the same time, their legitimation often implies *naturalizing technology*.³¹ This was particularly true for the Shevchenko project, of which nature improvement formed an integral part. Significant efforts were therefore invested in rendering visible the beneficial effects of technology on nature, beginning with the transformation of the nuclear oasis into a showcase garden city. Harmoniously inscribing the city layout

into the local topography and orienting it toward the sea,³² Shevchenko's city planners took the best that local nature had to offer and then started amending its deficits: in a generously funded project, botanists of the Kazakh Academy of Sciences invested years of research to identify plants that could withstand the harsh climate and the saline soils of the peninsula.³³ The first saplings, as well as fertile soil, arrived by plane;³⁴ thought only a few years later, the city already boasted 60 000 trees, 2 million bushes, and 15 ha of lawn and flower beds, according to the meticulous counts of the creators of "new natures" – enough, in their eyes, to decorate it with the epithet of a "garden city."³⁵ The trope of harmonious nature-technology symbiosis permeated the rhetoric employed to describe the achievement: with the start-up of the BN-350 reactor, "Mangyshlak's atomic heart had started beating," and from the desalination plant, "a man-made river" poured into the desert and made it bloom.³⁶ Not only had the self-proclaimed conquerors of Mangyshlak "cured" nature of its "diseases," as Kapitsa had put it³⁷ – they had also "perform[ed] plastic surgery on nature's face" and thereby achieved, as they saw it, an esthetical goal.³⁸

The garden city, however, did not yet satisfy the *atomshchikis'* ambitions. As a next step, they hoped to transform part of the desert into arable land for the cultivation of various crops. At the time, nuclear-powered agro-industrial complexes occupied the minds of technologists all over the world.³⁹ US engineers of the Atomic Energy Commission and the Bureau of Reclamation's Office of Saline Waters were particularly bold in their plans, envisioning agricultural clusters relying on NPPs delivering 2 GW of electricity while also producing a billion gallons of fresh water per day – allegedly enough for irrigating crops to feed no less than 6 million people. Production of fertilizers on-site was also considered.⁴⁰ After the Six-Day War in the Near East in 1967, the US Senate even considered subsidizing three such complexes in Egypt, Israel, and the Gaza strip⁴¹ – "literally, to make the desert bloom – and thereby create a major new possibility for a settlement of the Israeli-Arab conflict," as Alvin Weinberg, the director of Oak Ridge National Laboratory, put it.⁴² Nothing came of these visions, neither abroad nor domestically in the United States.⁴³

The project that Soviet agronomists proposed for Mangyshlak was somewhat less grandiose in its initial stage, but, in return, also considered more realistic. As early as 1965, experts of Leningrad-based *Lengiprovodkhoz* figured that the "improved" nature of Mangyshlak should not only be able to quench the thirst of its inhabitants – soon to number in the hundreds of thousands – but also to feed them. Conjuring up the image of a Soviet "irrigated Eden,"⁴⁴ they anticipated that the region could reach food self-sufficiency, at least for potatoes and vegetables, within a time span of 20 years, if irrigated areas were expanded to a minimum of 150 000 ha.⁴⁵ Although the State Planning Committee (Gosplan) gave a very skeptical review of these plans, the agronomists steadfastly defended the viability of their project, and the local Sredmash authorities embraced it wholeheartedly.⁴⁶ In 1973, Iurii A. Koreisho, the

director of the PGMK, declared agriculture a top priority: “I tell you, straight from the podium, that this effort is necessary, and that it does not represent some kind of ‘hobby’, as some comrades apparently think,” he proclaimed single-mindedly in front of the Combine’s assembled workers’ collective.⁴⁷ The allure of the project was further enhanced by the fact that the PGMK already produced large quantities of fertilizers from the by-products of uranium mining, thereby providing yet another puzzle piece for the agro-industrial complex. Nevertheless, the project stalled once it became clear that the desalination capacity of the nuclear complex was insufficient to sustain large-scale agriculture in addition to supplying the city and its industries, and enhancing the nuclear complex was considered too costly. Some thought was given to the construction of canals or pipelines to divert water from the Emba and Amu Darya rivers, but these projects did not carry the same showcase value.⁴⁸

As little was heard of the project thereafter, MAEK’s representatives were left with a few greenhouses to demonstrate the agricultural potential of nuclear-powered water desalination,⁴⁹ though this did not stop the technologists from dreaming about upscaling the nuclear oasis. Up to this point, they had wrested “no more than a tiny plot of land” from the desert, they admitted. “But the time will come when we turn all of it into a flowering garden. And the conquest of hostile space [*pokorenie surovogo prostranstva*] will proceed from here on, from the city that has already become a legend.”⁵⁰ Amalgamating technological and environmental features, they envisioned that a few decades into the future, there would be “groves and cities, [...] lakes, fountains, factories [and] four-lane highways” all over the peninsula.⁵¹ The “Mangyshlak precedent” was not to remain limited to the peninsula, but was expected to find broad application in other regions of the country and, potentially, worldwide.⁵² Prominent exponents of the Soviet nuclear sector, such as Anatolii Aleksandrov, proposed the construction of a number of large-scale nuclear water desalination plants along the USSR’s arid southern flank from Crimea to Vladivostok.⁵³ Third World countries were also targeted as potential beneficiaries and customers of the technology.⁵⁴

Conversely, Mangyshlak was expected to benefit from large-scale enviro-rotechnical development projects on the all-union level. In the mid-1970s, the Siberian river diversion project breathed new life into the vision of transforming the Mangyshlak desert into arable land. One of its variants envisioned a canal that would traverse and irrigate the Mangyshlak peninsula before flowing into the Caspian Sea. Again, the atom was to play an eminent part in this large-scale reconstruction of nature: nuclear explosions were to excavate the bed of the new river, and in places where the water needed to flow uphill, large reactor farms were planned to provide electricity for gigantic pumping stations.⁵⁵ Atomic minister Slavskii himself envisioned a series of cascading water basins across the Kazakh steppes, created by PNE, and a number of nuclear test explosions carried out on Mangyshlak in 1969–1970 have retrospectively been associated with the project.⁵⁶

It is well known that the river diversion project never came to fruition. As Tetsuro Chida has recently pointed out, the technopolitics of the late-Soviet era were characterized by a fierce battle of Prometheans against realists, with the former proposing grandiose projects and the latter insisting on feasibility studies and appraisals of consequences.⁵⁷ In questioning the economic and ecological rationality of the project, the latter eventually prevailed, and as a result, Shevchenko remained the pinnacle of Soviet nuclear-powered nature transformation. Oleg Kazachkovskii, one of the fathers of the Soviet breeder program, explained the meaning of the atomic oasis to everybody willing to listen: “Here is what matters: In the desert rose a city for 100 thousand inhabitants, with many trees, wide green boulevards, and all this is made possible by desalinated water. Here you have an example, how man’s activity does not hurt nature, but on the contrary, benefits it.”⁵⁸

Environmental Degradation and Health Hazards

Kazachkovskii’s statement exemplifies the specific “sightedness and blindness” of Soviet technopolitics,⁵⁹ both in terms of what he chose to highlight – the nuclear oasis – and with regard to what he preferred to overlook – namely the fact that the creation of new nature came with a hefty ecological price tag. The environmental impacts of Shevchenko were manifold: for one, the extraction of Mangyshlak’s natural riches released large amounts of toxic and radioactive pollutants into the environment. Second, it consumed and permanently spoiled enormous quantities of other valuable resources – especially freshwater. Third, the extraction of resources from the depth of the peninsula and the deposition of wastes on its surface (most notably, liquid tailings resulting from uranium processing) affected not only the ecology, but also the geology of the peninsula in ways so profound that they were eventually believed to facilitate seismic activities.⁶⁰

The PGMK was one of the main offenders. Uranium processing by hydrometallurgical methods requires large quantities of fresh water in conjunction with hydrochloric and sulfuric acids. Once used, these waste waters or “tailings” are both toxic and radioactive, and thus in need of safe storage. Nevertheless, for the first few years, they were unceremoniously dumped into a nearby depression, where they accumulated to form a pond, which was quickly surrounded by the sprawling city’s cynically named “lakeside” residential district. Today, the pond is known as the “dead lake”; in 2012, it was found to contain an exceptionally high concentration of depleted uranium (U-238).⁶¹ Eventually, inspectors from the Ministry in Moscow discovered and stopped the dumping, which was illegal even by the lax standards of the time, and in 1965, the uranium-processing plant and its tailings reservoir were transferred to the industrial area outside the city limits – as had been planned from the very beginning.⁶² It was a marginal improvement at best, for the new reservoir was neither sealed in any way, nor were the tailings treated prior to discharge,⁶³ and with both the city and

the reservoir growing at a quick pace, the cloaca soon again came dangerously close to the city. After some 30 years of operation, a lake of 72 km² filled the Koshkar-Ata depression a mere 5 km North of the city, brimming with more than 350 million tons of tailings – including low and midlevel radioactive wastes, acids, and toxic heavy metals.⁶⁴ Today, it constitutes one of the largest tailings reservoirs worldwide, and its activity level is currently estimated at 11 000 Ci or 888 TBq, according to various sources.⁶⁵ Due to evaporation, ever larger parts of the lake fall dry and expose radioactive and toxic sediments to wind erosion, leading to a constantly deteriorating radiation situation.⁶⁶ Compounding the problem of radioactive dust is the danger of ground and seawater contamination. Tailings have seeped from the unsealed reservoir into the ground for decades to presently form a contamination halo of 2–4 km around it; they are expected to eventually trickle into the nearby Caspian.⁶⁷

In addition to liquid wastes, the PGMK also released large quantities of pollutants into the atmosphere, including radioactive dust.⁶⁸ Oil and gas drilling further exacerbated the problem of radioactive contamination.⁶⁹ The problem was caused by radioactive brine that accompanied the oil when it was pumped to the surface and left residues on pipes over time. Most of the drilling equipment used in the region therefore accumulated activities ranging from a moderate 40 to an impressive 1 500 μ R/h (micro roentgen per hour), and accordingly, should have been treated as radioactive waste.⁷⁰

While many ecological problems were left unattended for most of the Soviet period (for what limited protection measures there were, see below), some efforts were made to limit the impact of production-related health hazards on the employees of the city's nuclear industries. Both at the hydrometallurgical factory of the PGMK and at the reactor building of the MAEK, shift times were reduced when radiation levels exceeded the permissible limits.⁷¹ At the uranium mines, the driveways were regularly sprinkled with water to settle radioactive dust, and truck drivers were required to wear respirators.⁷² At the uranium-processing combine, healthcare measures included, somewhat oddly, the administration of a glass of red wine to workers before shifts, which was believed to impede the absorption of radionuclides into the human body.⁷³

Unlike the early days of the Soviet nuclear project – or, for that matter, its American counterpart – in the 1970s, employees of nuclear enterprises in the USSR were no longer left ignorant about the health hazards associated with their jobs.⁷⁴ Rather, working conditions for a number of functions were officially categorized as “harmful” (*vrednye usloviia truda*), which entitled the respective workers to privileges such as higher pay, shorter workdays, and early retirement.⁷⁵ As a result, “accumulating unhealthy work years” (*zarabotka vrednogo stazha*) became a valid career option for part of the workforce. Among those who chose benefits over health, male workers seem to have aspired to quickly make a good fortune and then return to their regions

of origin. Women, on the other hand, often wished to reduce the double burden of professional life and domestic chores. For instance, operation of the uranium pulp filtration facilities, which came with an increased radiation exposure, was mainly administered by women who aspired to a retirement age of 45.⁷⁶ A social contract in which benefits and privileges compensated for radiation-induced health hazards was thus in place throughout the Soviet nuclear industry since the 1970s, anticipating the post-Chernobyl sense of entitlement which Adriana Petryna has described in terms of “biological citizenship.”⁷⁷

If production-related health hazards seemed calculable under normal conditions of operation, they were clearly not in times of accidents. Spills of radioactive pulp were not uncommon at the PGMK’s hydrometallurgical plant. At the BN-350, during the initial stage of reactor operation, engineers were exposed to excessive radioactivity as a result of leaking fuel rods and risky repairs of breakdowns. In a well-documented case, workers crept into a pipe of the highly irradiated primary cooling circuit of the reactor to remove an oil spill.⁷⁸ In another incident, fuel elements got stuck in the core and needed to be extracted manually with the help of a sledgehammer because the automatic system refused to function. The workers involved afterward fell ill with radiation sickness.⁷⁹ While such incidents affected only a limited number of workers, the sacrifice of human health could quickly become a mass phenomenon in the case of major nuclear accidents. Many of the inhabitants of Shevchenko experienced this on their own bodies during the Chernobyl catastrophe: more than 4 000 of them participated as so-called liquidators in the cleanup of the accident in Ukraine and many of them suffered serious damage to their health.⁸⁰ One of the participants recalled that when he and other prospective liquidators were enticed with the prospect of making a car’s worth of pay in a couple of weeks at Chernobyl, they understood that this prize “needed to be earned with the most precious thing a person owns – their health.”⁸¹

Running the Risk of Large-Scale Technogenic and Envirotechnical Accidents

For many inhabitants of Shevchenko, the Chernobyl disaster threw into sharp relief for the first time the inherent risk of large-scale technogenic catastrophes that loomed over their city’s nuclear industries. The technologists of Sredmash, contrarily, had always been calculating, taking, and limiting risks when planning, siting, and operating their technological artifacts. This was particularly true of the BN-350. Soviet designers had built experimental breeders before, but this reactor was more powerful than its predecessor by almost two orders of magnitude, and the risks associated with this upscaling were deemed substantial.⁸² Later, when asked by a visiting foreign delegation whether they were comfortable with operating a powerful experimental FBR this close to a major city, the

staff of the MAEK replied that there was always a trade-off to be made between safety concerns and technological breakthroughs – after all, “the first automobile had also been risky.”⁸³ This is not to say that the designers and operators of the BN-350 took security lightly – rather, they adopted what they considered conservative operating parameters and conducted extensive equipment tests before the reactor became operational. But their task was complicated by the fact that at the time, for lack of experience, neither domestic nor international safety standards existed for large-scale sodium-cooled FBRs.⁸⁴

Despite precautions, the BN-350 experienced numerous incidents and several near-catastrophes over the course of its operation, for various reasons. Shortly after start-up, critical components failed due to shoddy workmanship and low-quality materials. In particular, leaks in the steam generators provoked repeated sodium-water fires that threatened to disrupt the reactor’s cooling system. Other problems were caused by the fact that knowledge of the physical and chemical processes at work in FBRs was still limited at the time. Fuel rod claddings embrittled prematurely under the conditions of intense irradiation, and radioactive decay within the rods released gases that caused the rods to swell – a phenomenon that had not been fully understood when the reactor was designed, and which, in the initial phase of operation, caused fuel rods to leak and become jammed in the reactor core.⁸⁵ Several years into operation, depleted fuel elements became stuck in a transportation mechanism without sufficient cooling, and a major accident was only narrowly avoided.⁸⁶ Finally, critical safety features lacked redundancy, including reactor control and power supply systems. In 1984, the reactor’s power provision failed, and with the only backup system out of order, it was a fortunate stroke of serendipity that the electricity supply could be restored in time.⁸⁷ At the PGMK, uranium processing posed its own set of safety problems, including spills of radioactive pulp and sporadic releases of toxic gases.⁸⁸ Still, these dangers paled in comparison to the risks associated with the combine’s large-scale production of chemical agents and fertilizers, which involved handling large quantities of highly explosive substances.⁸⁹ The same held true for local petrochemistry, and in particular the city’s plastics plant.⁹⁰

Shevchenko’s large-scale technologies therefore entailed a significant number of risks before the possible *natural* causes of technological accidents were even considered.⁹¹ It is no wonder then that the potential for *envirotechnical* disasters – disasters resulting from an interaction of natural and technological factors – was initially ignored.⁹² Eventually, however, Soviet technologists in Mangyshlak found themselves confronted with the insight that nature did not necessarily behave within the bandwidth of parameters and scenarios that their artifacts had been designed to accommodate. Nature, they realized, was prone to interfering with them in beyond-design-basis events.

Fluctuations of the Caspian Sea’s water level were a first case in point. From 1929 through 1977, it had been falling constantly, leading Soviet constructive

geographers to conclude that improving nature consisted in supplying the sea with additional influx – hence the plan to divert water from the Siberian rivers into the Caspian Sea. However, beginning in 1978, the level of the Caspian Sea began to rise quickly.⁹³ By the mid-1990s, the Caspian Sea was up 2.5 m from its historic low and was still absorbing a surplus influx of about 56 km³ annually. Given the extremely shallow shores of the Northern part of its basin, this resulted in the flooding of large areas with valuable infrastructures and facilities.⁹⁴ In 1991, a government commission found that any further rise in sea levels would render Mangyshlak's regional economy, including its harbor, railway communications, many oil wells and, above all, the Atomic Energy Combine, largely nonfunctional, and ordered the immediate construction of protective dams.⁹⁵

Even more worrisome was the discovery that Mangyshlak was a seismically active region. On December 16, 1987, a gigantic landslide in the open-pit uranium mine of the PGMK alarmed the authorities in Mangyshlak. In the absence of any other plausible cause, research into the seismic activity of the peninsula was commissioned. The resulting satellite photographs showed evidence of several ancient earthquakes with epicenters no farther than 70–100 km from the city of Shevchenko. The study of old mosque chronicles revealed that one earthquake had taken place in 1310 with an estimated force of 8–9 on the Richter scale.⁹⁶ Further research observed, “at present, an intensive development of tectonic processes in the basin of the Caspian Sea and its adjacent territories, which poses a real danger for large industrial objects, the nuclear power plant, and housing in the city of Shevchenko and the neighboring settlements.”⁹⁷ The force of a possible earthquake hitting the city was estimated at 6–7 on the Richter scale. This was alarming news in view of the fact that the construction of the city, its industries, and, most notably, its reactor had been conducted on the basis of the official seismic zoning map of the USSR in use at the time, which assigned Mangyshlak to the seismically inactive regions of the country. As a result, none of the city's buildings had any earthquake protection at all.⁹⁸ The perception of risk was further heightened by geohistorical observations leading to the conclusion that earthquakes around the Caspian basin had usually been preceded by rising sea levels.⁹⁹ And there was yet another disconcerting observation – namely, that the human transformation of nature was at least partially to blame for the imminent danger. Experts assumed that “the natural geodynamic processes in the region are influenced by technogenic activities” – above all the extraction of oil, gas, and groundwater from the peninsula's depths that had already caused a visible depression with a diameter of 30–40 km, as well as the steadily increasing pressure exerted on the surface by the growing tailings reservoir Koshkar-Ata, whose surface area had increased to 70 km².¹⁰⁰ It could also not be ruled out that nuclear test explosions, conducted on the peninsula at the end of the 1960s and beginning of the 1970s, had activated seismic processes.¹⁰¹ Vladimir N. Mosints, a mining engineer and one of the Soviet Union's preeminent specialists for

technogenic seismicity, drew philosophical conclusions from these observations that aptly reflect the *zeitgeist* of those years:

To the extent that man comprehends his natural environment, he not only adapts to it, but also strives to control it ever more actively. The reclamation of desert regions, ... the regulation and diversion of rivers ... testifies to the highest achievements of civilization in leveraging the laws of nature. The development of the Mangyshlak peninsula bears witness to this. But on this difficult journey, man is not accompanied by success alone. ... Such dangers [as earthquakes] are slumbering in the depths of Mangyshlak, too. [...] The large-scale technogenic and natural disasters which have taken place in our technological civilization over the last few years demand a re-thinking of the present approach in this realm, which needs to include a transition from mitigating the consequences of catastrophes to preventing them from happening, to anticipating their possible consequences and to elaborating scenarios for dealing with them.¹⁰²

Against this background and attuned to the apocalyptic mood of the period, Shevchenko's once overly confident technologists developed gloomy worst-case scenarios for a combined natural and man-made disaster: a strong earthquake would destroy tanks and pipes at Shevchenko's chemical industries and trigger immense explosions, especially at the fertilizer and plastics plants where high quantities of explosives were stored, as well as at the thermal power station in the immediate vicinity of the NPP. Damage from the earthquake, combined with the shockwave of the explosions, would wreak havoc upon the BN-350, with catastrophic consequences for the city. Retrofitting the reactor against these hazards was deemed impossible.¹⁰³

Coping with Environmental Degradation before and after 1991

Technogenic environmental degradation and unexpected changes in the natural environment thus taught Soviet technologists that nature and technology were thoroughly interdependent – inseparably intertwined in a shared envirotechnical system. While the urgency of the resulting problems was new, the insight itself had been in the making for decades. The need to complement nature transformation with *conservation* was recognized in Soviet theory, if not in practice, since the Khrushchev era.¹⁰⁴ Environmental protection figured in the CPSU program as early as 1961,¹⁰⁵ and in subsequent years, so-called *Societies for Environmental Protection* were established in most Union Republics to funnel growing ecological concerns among the population into the bedrock of official mass organizations.¹⁰⁶ The Mangyshlak region received its own *Regional Society for Nature Protection* when it was granted *oblast'* status in 1973,¹⁰⁷ and less than a decade later,

the society counted almost 50 000 members – but merely 67 instructors. The latter number indicated the modest clout of the organization, whose activities remained essentially limited to *subbotnik*-like campaigns such as collecting cigarette stubs from flower beds, and whose most daring interventions criticized the sporadic breakdowns of the local sewage plant.¹⁰⁸ Meanwhile, the region's petrochemical and especially nuclear industries remained decidedly off-limits for grassroots criticism. However, the worsening ecological situation throughout the country eventually forced the CPSU leadership to acknowledge that symbolic politics would not suffice to cope with the problem.¹⁰⁹ In 1972, the Central Committee of the CPSU and the USSR Council of Ministers issued a joint decree "On Intensifying the Protection of the Environment," which prompted the creation of a network of nature protection and monitoring agencies at various levels of the state administration and industrial management hierarchies.¹¹⁰

Contrary to what is sometimes claimed, Sredmash was not exempt from the provisions of this legislation,¹¹¹ even though the ministry's leisurely pace of implementation betrayed no particular sense of urgency. It was only at the beginning of 1977 that a system of Laboratories for Environmental Protection (LOOS) was established throughout the nuclear industrial complex. These laboratories were entrusted with implementing environmental protection measures that henceforth formed a part of the enterprises' annual target plans.¹¹² Elaborating these plans and controlling their implementation was the task of top-level Central Laboratories for Environmental Protection (TsLOOS), one of which was instituted at every production-related General Directorates (GU) of Sredmash. Thus, the Fourth GU (GUKhO), responsible for fuel reprocessing and plutonium production, based its TsLOOS at The Maiak reprocessing plant, also known as Chelyabinsk-40.¹¹³ Shevchenko's PGMK was chosen to host the TsLOOS of the First GU (GUGO), responsible for uranium mining. Subsequently, the laboratory collected emissions data from all uranium mining and processing facilities in the USSR, elaborated air, water, and soil protection plans for the mining industry and devised recycling and reclamation strategies.¹¹⁴ The results were ambivalent, even at the PGMK itself, notwithstanding the fact that it should have performed a lighthouse function for the other enterprises of the uranium-mining sector. For instance, the PGMK began filtering its toxic exhaust gases before releasing them into the atmosphere in 1980,¹¹⁵ but in 1984, it was rebuked for under-fulfilling its annual water protection plan by a whopping 70% – a measure of neglect that would have been utterly unacceptable with regard to other performance indicators.¹¹⁶ For its ecological (and other) misdeeds, the PGMK answered to a military rather than a civilian prosecutor. The fines were moderate.¹¹⁷ If nothing else, the institutionalization of nature protection at least heightened the sensibility for ecological problems, even though amending them was often postponed indefinitely. For instance, the engineer and physicist Vladimir Velikotskii, who had specialized in ecological projects in Minsredmash since 1962 (measuring plutonium in waste waters, amongst

other things) started to devise a project for the remediation of the Koshkar-Ata tailings reservoir in 1982.¹¹⁸ Also, Shevchenko's TsLOOS reportedly proved its value at Chernobyl, where its specialists developed a number of measures for disaster mitigation.¹¹⁹

At MAEK, the Fourth Main Directorate (responsible for reactors) ordered radiation measurements around the BN-350 to be taken years before the reactor went online.¹²⁰ Outfitting the facility with a radio-based control system capable of measuring gamma radiation within a 25-km perimeter and transmitting the results back to the control room amounted to an acknowledgment that major accidents could not be ruled out, but the system was also invoked to prove that "virtually no change of radiation levels" was measured within the control zone upon start-up of the reactor, nor, allegedly, at any later point in time.¹²¹ The Combine's LOOS, created in January 1977 by the simple act of renaming what had hitherto been the dosimetry service,¹²² consequently spent most of its efforts on presenting the BN-350 as a source of clean energy which allegedly scored not a single incident of increased emissions of radionuclides or toxic chemicals into the atmosphere.¹²³ This narrative was challenged only in 1989, when MAEK's workers' collective deemed it necessary to establish "maximum values for the release of radionuclides into the atmosphere and harmful wastes into the Caspian Sea," thereby calling into question the trustworthiness of prior official measurements.¹²⁴

The years immediately before and after the collapse of the Soviet Union were characterized, in Mangyshlak as in many other places of the USSR, by an overwhelming sense of ecological emergency. For a few years, the containment and mitigation of ecological degradation was considered a top priority in local politics. To assess the environmental impact of the region's brute-force industrialization, a short-lived local think tank by the name of the *Mangistau Scientific-Technological Centre for Regional Studies* offered to elaborate a comprehensive ecological damage report, which was to provide comparisons with the status quo ante by overlaying up-to-date aerial imagery with satellite photographs from the 1950s to 1960s. This, the authors claimed, would render visible changes in vegetation, erosion, oil pollution, and so on, and thereby provide a better understanding of the "vulnerability" or "resilience" of nature vis-à-vis the anthropogenic impact. This knowledge could then be used for the "elaboration of a strategy to minimize the conflict between the constant strive of man for ever greater wealth (satisfaction of needs) and nature protection."¹²⁵ Nothing came of the project as local authorities decided that literally no rocket science was needed to discern the traces of human pressing on the environment.

Instead, a commission of the Oblast' parliament devised a five-year plan for the region's ecological recovery. It called for the development of a radiation protection scheme for the Koshkar-Ata tailings lake, the construction of a safe storage for radioactive oil production equipment, the elaboration of various concepts to ensure safe operation and eventual decommissioning of the

BN-350, and a study of the long-term consequences of underground nuclear explosions.¹²⁶ Lacking the resources to deal with these challenges themselves, the local authorities addressed appeals for assistance to the Council of Ministers of the Kazakh Union Republic as well as the Central Ministries in Moscow to contribute financial means toward the “ecological regeneration” [*ozdorovlenie*] of the region.¹²⁷ However, only a few months later, the collapse of the Soviet Union left the region to its own devices, as Moscow declined further responsibility for territories outside the Russian Federation. Meanwhile, the government of newly independent Kazakhstan was faced with other, still more pressing priorities, and possessed neither the means nor the expertise required to tackle the imposing nuclear heritage, which the Soviet Union had left on its territory. What limited efforts were undertaken focused primarily on securing the Semipalatinsk nuclear weapons test site in Eastern Kazakhstan.

At the same time, rather unexpectedly, the consequences of nuclear test explosions became a concern for the inhabitants of Mangyshlak, too, as journalists uncovered in 1990 that the peninsula had temporarily served as a theater for underground nuclear detonations in 1969–1970.¹²⁸ With the help of eye witnesses, local authorities located two craters some 200 km from Shevchenko, one of which was found to emit more than 1.5 R/h on the surface and was therefore covered in concrete. But no soil or groundwater samples were taken, nor was there a medical investigation of people living nearby.¹²⁹ Local authorities asked the Soviet Defense and Atomic Ministries to provide further information and conduct in-depth investigations into the possible health and environmental consequences of the explosions, but in response, received only vague promises that the matter would be looked into.¹³⁰ In an attempt to increase pressure, the Oblast administration broke the story to Moscow newspapers, prompting articles in *Izvestija* and *Ogonek* – but again, to little avail.¹³¹ Eventually, the detonations were officially declared PNEs,¹³² allegedly “directed at the development of water reservoirs in arid locales.”¹³³ Other speculations point in a different direction – namely, that the Soviet military was looking for a new site to test megaton-scale warheads for a new generation of heavy intercontinental missiles, but found Mangyshlak’s geological conditions unfavorable and the proximity of Shevchenko’s nuclear facilities somewhat worrisome.¹³⁴

For a while, the test explosions eclipsed concerns about the BN-350’s continued operation, notwithstanding the risks arising from an exodus of the reactor’s predominantly Russian staff and Kazakhstan’s difficulties to pay for its continued maintenance.¹³⁵ Moreover, hidden from public sight, the reactor housed one of the more imposing leftovers of the Soviet atomic project: in its cooling ponds were stored tons of weapon-grade fission materials, mainly plutonium and highly enriched uranium (HEU). Luckily for Kazakhstan, the United States Department of Energy was worried enough about the proliferation risk posed by these materials (enough for nearly 800 atomic bombs) to assist Kazakhstan in securing and transport them to a safe storage site in

Eastern Kazakhstan, an operation completed in 2010 at a cost of a quarter billion USD.¹³⁶

The reactor itself was shut down in 1991. Nevertheless, even with the HEU and the plutonium removed, decommissioning and eventual dismantling remained (and still remains) a challenging undertaking. Initial feasibility studies, commissioned in the last years of the Soviet period, had warned of an exceedingly difficult process, given that the reactor had been planned and built without consideration for its eventual decommissioning.¹³⁷ In 1999, experts renewed their warnings, stating that decommissioning was no simple legal act but required “a major industrial undertaking that can take many years.”¹³⁸ More than 3 000 m³ of liquid waste with a total activity of 2.66×10^{14} Bq required treatment in a complicated multistep process involving evaporation, filtration, ion-exchange, and cementation, while solid radioactive wastes – roughly twice as much both in volume and activity – needed to be fragmented, supercompacted, and cemented in a remotely handled facility. Low and medium-level wastes are earmarked for on-site storage, while a management concept for highly active RW is vaguely described as being developed, and may include the storage of solid waste within the reactor vessel.¹³⁹ Only after an additional 50-year period of so-called long-term safe storage, a partial or complete dismantling of the reactor and burial of wastes may be considered – or so it is hoped. Decommissioning is complicated by the fact that it has never before been undertaken for high-power FBRs of a similar size, and hence, involves many firsts.¹⁴⁰ This is also one of the reasons why the process is co-funded by international sponsors such as the United States and the European Union, which, in addition to nonproliferation concerns, see the BN-350 as a testing ground for rehearsing the future decommissioning of similar reactors in other countries – especially in the United Kingdom, which faces similar challenges at its Sellafield site.¹⁴¹

As for Shevchenko’s uranium mine and the Koshkar-Ata tailings reservoir, a government program of the Republic of Kazakhstan eventually planned to “conserve” and “recultivate” all of the republic’s abandoned uranium mines within the decade of 2001–2010. However, by 2011, a state company named *Uranlikvidrudnik*¹⁴² had completed no more than a single pilot project, and had not even started to tackle what was considered its most difficult task: the deactivation of the tailings reservoirs in Aktau and Stepnogorsk.¹⁴³ In Aktau, post-Soviet authorities have been quick to point out that average exposure rates along the lake’s shore are moderate, but some hotspots reach up to 3 000 $\mu\text{R}/\text{h}$,¹⁴⁴ and the situation deteriorates constantly as ever larger parts of the lake fall dry and expose radioactive and toxic sediments to wind erosion.¹⁴⁵ Also, the problem is bound to aggravate if an ambitious city expansion project by the name of Aktau City will be built as planned in close proximity to the reservoir. For the time being, worst off are the inhabitants of a shantytown in the immediate vicinity of the lake, deep within the sanitary protection zone surrounding it. The slum was built illegally in 2004–2007 by ethnic Kazakh immigrants from neighboring central Asian republics and has been

tolerated so far by city authorities, allegedly for lack of better alternatives.¹⁴⁶ Just as worrisome as radioactive air pollution is the fact that with the levels of the nearby Caspian Sea still rising, groundwater is expected to eventually wash radioactive and toxic wastes into the sea. Nevertheless, at present, waste waters are again channeled into the reservoir to slow the drying up, given that radioactive dust is considered the more imminent problem.¹⁴⁷

The fact that a thorough conservation is expected to be extremely costly has prompted some unconventional suggestions for solving the problem.¹⁴⁸ In 2001, the then president of the national nuclear company *Kazatomprom*, Mukhtar Dzhakishev, suggested to transform one of Aktau's former uranium mines into a repository for both domestic and imported solid nuclear waste. The expected multibillion revenues from storing the latter could then be used for the cleanup of radioactively polluted areas and the reprocessing of nuclear wastes not only around Aktau, but also in all of Kazakhstan, he explained. Clearly, the idea was inspired by contemporary discussions about the commercial import of nuclear waste in the Russian Federation.¹⁴⁹ However, the Kazakhstani parliament refused to amend the country's environmental protection law accordingly.¹⁵⁰ As a result, Aktau escaped the fate of becoming the world's nuclear dumping ground, but the remediation of its uranium-mining legacy also remains pending. Recently, the director of MAEK has once again brought up the idea for discussion.¹⁵¹

Even without importing other countries' nuclear waste, Kazakhstan still struggled not only with safely disposing its own waste materials, but also with keeping track of it. Radioactive scrap metals, in particular, continue to pose a serious problem in Mangyshlak. In one of the more spectacular cases reported by Aktau city authorities, metal rods that had apparently been stolen from the unguarded site of the former uranium-processing plant were found in a suburban garden plot emitting 1 500–150 000 $\mu\text{R}/\text{h}$ – enough to receive a lethal dose within hours.¹⁵² Exacerbating the problem, large quantities of radioactive scrap metal from oil production are scattered all over the peninsula,¹⁵³ and in other regions where the Soviet nuclear complex has left its traces, the situation is no different. In the early 2000s, the problem was so endemic that China adopted the practice of checking freight trains, which were arriving from Kazakhstan and carrying scrap metal, for radioactivity at its border crossing points, denying entry if radiation exceeded permissible values.¹⁵⁴ Instead of importing radioactive wastes, Kazakhstan was unwillingly exporting them.

Back to the Future? Outlook and Conclusions

If dystopian nuclear landscapes will accompany humankind into the future, so will their utopian counterparts. This, at least, is the impression to be gained from studying the showcase projects of authoritarian modernization regimes in the post-Soviet space, which, in many cases, still revolve around nuclear-powered nature transformation. In their most unmitigated form,

these imaginaries are currently extolled by the public relations department of Russia's nuclear state corporation Rosatom: computer animations produced in 2012 show a floating NPP-cum-desalination-plant dropping anchor on a desert shoreline, sending electricity and freshwater to the shore, whereupon palm trees and skyscrapers start sprouting from the sandy ground (in the same animation, the reactor vessel also makes port in the Arctic to give life to a city radiating with warmth and light).¹⁵⁵ Far-fetched as these visions may seem, a prototype floating NPP by the name of *Akademik Lomonosov* has recently been completed at a St. Petersburg shipyard, and one of the usage scenarios for this type of vessel calls for it to work in tandem with a floating desalination plant to supply energy and freshwater to arid coastal regions on short notice, such as to support the development of oil and gas fields in the Near East.¹⁵⁶ In broader terms, Rosatom has identified atomic-powered water desalination as a highly promising business field. Forecasting a global freshwater deficit of up to 2 trillion cubic meters by 2025 and expecting desalination to quickly become a multibillion-dollar business,¹⁵⁷ the corporation began offering its latest generation of pressurized water reactors (the VVER-1200) integrated with desalination facilities in 2015.¹⁵⁸ The "Mangyshlak precedent" figures prominently in these plans: not only does Shevchenko's MAEK serve as proof of concept for the technology,¹⁵⁹ but its specialists also take an active part in the present-day development of these technologies, with MAEK having joined the Kurchatov Institute and the Research Institute of Human Ecology and Environmental Health as the third party in Rosatom's Expert Council on Desalination.¹⁶⁰ Nor has FBR technology's promise of supplying virtually unlimited energy lost its luster yet: as part of an ambitious innovation program dubbed "breakthrough" (*proryv*), Russia envisions the transition to a closed fuel cycle and the mass deployment of FBRs and has recently brought online the BN-800 at Beloiarsk NPP, making Russia one of the few countries to still pursue the development of this controversial reactor type.¹⁶¹ Rosatom is thus still forcefully leveraging the very technologies it pioneered in Shevchenko – FBRs and nuclear desalination.

At the same time, Kazakhstan's post-Soviet nuclear policy is built on stark axiological binaries juxtaposing *good* and *bad* ways of exploiting nuclear energy, revolving around postcolonial motives of imperial versus sovereign control over national resources and around the dichotomy of peaceful and military applications of nuclear energy. On the one hand, the country has been leveraging its status as a victim of the Soviet nuclear weapons' program to garner international support since the day it gained independence. On the other hand, it also imagines itself as a shareholder of civilian nuclear modernity. In the context of what looked like a global nuclear renaissance driven by universal decarbonization efforts, the Kazakhstani leadership embraced nuclear technopolitics as a technological way forward, assuming that the country's uranium reserves, rather than its hydrocarbon deposits, promised to fuel its transition from a global commodity provider to a technologically advanced nation. As a consequence of significant investments in mining and

processing infrastructure, Kazakhstan rose to the status of the world's number one uranium exporter in the 2000s and concluded a series of strategic partnerships with nuclear companies all around the globe in which it bartered nuclear commodities (uranium) for nuclear technologies. However, in the aftermath of the Fukushima disaster in 2011, nuclear energy phaseouts in a number of countries curtailed Kazakhstan's choice of foreign technology partners and plummeting uranium prices undercut its ability to fund its ambitious nuclear modernization drive. Furthermore, unexpectedly tenacious resistance against nuclear power among the Kazakhstani population stalled projects for the construction of new NPPs, let alone the creation of a domestic nuclear manufacturing industry.¹⁶²

Once more, Aktau condenses these ambiguities in a local microcosm, highlighting how the ambitious plans for Kazakhstan's atomic-powered future are mapped onto the unresolved legacies of its nuclear past – and what problems result from this. While open-pit uranium mining in Mangyshlak was abandoned in the mid-1990s,¹⁶³ Aktau's MAEK remained the country's preferred location for the construction of a new NPP in view of existing infrastructure and expertise on-site. As early as 1994, Kazakhstan's National Nuclear Center in Kurchatov commissioned a feasibility study for a new NPP based on a yet-to-be-developed next-generation FBR of Russian manufacture.¹⁶⁴ In the new millennium, the overambitious project has been superseded by a more realistic one, based on a proposed Russian compact pressurized water reactor (the VBER-300), whose development was promised to involve Kazakhstani specialists.¹⁶⁵ Aktau was chosen as the preferred site because it offered relevant infrastructure and experienced personnel remaining from the BN-350 reactor, and also because the government expected opposition to nuclear power to be low as the city population “was already used to NPPs.” In 2012, a government strategy paper for the future development of the Mangistau region envisioned the commissioning of two reactor blocks by 2018 and 2020, respectively.¹⁶⁶

Importantly, the new atomic pile was no longer designed as a standalone project, but this time, was embedded in a more comprehensive socio-technical imaginary that easily matched earlier comprehensive visions of “atomic-powered communism”¹⁶⁷: Aktau City, a hypermodern city expansion project for up to 1 million inhabitants with an investment volume of up to 30 billion USD, for which the former president Nursultan Nazarbayev turned the first sod in 2008. Earmarked as a hub for the development of the Kashagan oil field off the Caspian coast and a transshipment point for China's New Silk Road project, the venture was to include a free trade zone and business park, and was said to be cofinanced by investors from the Far and Middle East.¹⁶⁸

However, public protest against the NPP project, expressed in the media and during citizen assemblies, proved unexpectedly vigorous. As a result, the Mangistau provincial government officially declared its opposition to the construction of the NPP in early 2014.¹⁶⁹ The prospects of Aktau city, too, started to look increasingly bleak at that time. Official explanations blamed

the withdrawal of international investors on the global financial crisis, but it is no secret that the declining appeal of the project reflected, above all, the investors' belated insight that it was to be realized in the immediate vicinity of one of the world's largest tailings reservoirs.

If one thing became clear in the process of updating the nuclear oasis, it was that past experience has rendered sociotechnical imaginaries of nuclear futures less appealing to the broader population than the political leadership had anticipated. But it is not just imaginaries that have suffered damage. Even more importantly, prior interventions of nuclear technopolitics are today indelibly inscribed into the landscape of Mangyshlak (and many other parts of Kazakhstan and the larger post-Soviet space), profoundly limiting the scope for further technopolitical action in many places.¹⁷⁰ In the end, then, the present architects of Kazakhstan's nuclear technopolitics find their attempts to recommit to visions of an atomic-powered future frustrated by the insight that nuclear technologies and nuclear ecologies unfold on vastly incommensurable timescales, forcing future generations to deal with the latter rather than to engage with the former.

Notes

1. For a recent exploration of the term's connotations and implications, see Laura Pitkanen/Matthew Farish, "Nuclear Landscapes," in: *Progress in Human Geography* 42 (2018) 6, 862–880.
2. Paul R. Josephson, *Red Atom. Russia's Nuclear Power Program from Stalin to Today*, New York, NY 2000, 243–252.
3. For the United States, see Michel Christopher Low, "Desert Dreams of Drinking the Sea, Consumed by the Cold War: Transnational Flows of Desalination and Energy from the Pacific to the Persian Gulf," in: *Environment and History* 26 (2020) 2, 145–174.
4. This shift in perspective is in-line with a current trend in research "toward a more constructionist approach to the history of technology and away from the declensionist narratives in environmental history." Hugh S. Gorman/Betsy Mendelsohn, "Where Does Nature End and Culture Begin? Converging Themes in the History of Technology and Environmental History," in: Martin Reuss/Stephen H. Cutcliffe (eds.), *The Illusory Boundary. Environment and Technology in History*, Charlottesville, VA/London 2010, 265–290 (277).
5. For the concept, see Sara B. Pritchard, *Confluence: The Nature of Technology and the Remaking of the Rhône*, Cambridge, MA 2011.
6. Sheila Jasanoff, "Imagined and Invented Worlds," in: Sheila Jasanoff/Sang-Hyun Kim (eds.), *Dreamscapes of Modernity. Sociotechnical Imaginaries and the Fabrication of Power*, Chicago/London 2015, 321–341 (339).
7. Paul R. Josephson, "Atomic-Powered Communism. Nuclear Culture in the Post-war USSR," in: *Slavic Review* 55 (1996) 2, 297–324.
8. G.A. Mashkovtsev/A.K. Migupa/V.N. Shchetochkin, "Rol' VIMSa v sozdanii i razvitiu mineral'no-syr'evoi bazy urana," in: *Razvedka i okhrana nedr* 75 (2005) 10, 59–66.
9. V.N. Savel'ev/O.V. Bystritskii, "Atomnoi promyshlennosti Kazakhstana 65 let," in: *Khabarshy Vestnik: Nauchnyi Zhurnal* 25 (2010) 3, 7–17; Gosudarstvennyi Arkhiv Mangistauskoi Oblasti [GAMO], Aktau, f. 530.

10. Mikhail F. Troianov, *Moei sud'boi stal Fiziko-energeticheskii institut*, Obninsk 2007, 161–165; GAMO, f. 506.
11. Odd Arne Westad, “The Cold War and the International History of the 20th Century,” in: Odd Arne Westad (ed.), *The Cambridge History of the Cold War*, 3 vols., vol. 1, Cambridge 2010, 1–19 (17).
12. David Holloway, “The Soviet Union and the Creation of the International Atomic Energy Agency,” in: *Cold War History* 16 (2016) 2, 177–194. Holloway stresses that the Soviet Union had started development of a civilian atomic energy program prior to Atoms for Peace but shows how the latter intensified these endeavors.
13. See e.g. Sonja D. Schmid, “Celebrating Tomorrow Today. The Peaceful Atom on Display in the Soviet Union,” in: *Social Studies of Science* 36 (2006) 3, 331–365.
14. Jasanoff, “Worlds,” 326–327.
15. Dolly Jørgensen/Finn Arne Jørgensen/Sara B. Pritchard (eds.), *New Natures: Joining Environmental History with Science and Technology Studies*, Pittsburgh, PA 2013.
16. These were the words of Innokentii P. Gerasimov (1905–1985), an influential Soviet geographer and pedologist. Cited from Tetsuro Chida, “Science, Development and Modernization in the Brezhnev Time,” in: *Cahiers du monde Russe* 54 (2013) 1–2, 239–264 (244–245). The new possibilities would have to be deployed systematically within a framework that Gerasimov referred to as “constructive geography” in 1961. See *ibid.*, 246–247.
17. Genrikh N. Volkov, *Man and the Scientific and Technological Revolution*, Moscow 1975, 91.
18. *Programme of the Communist Party of the Soviet Union. Adopted by the 22nd Congress of the C.P.S.U.*, Moscow 1961, 59–60; 113–114.
19. *Programme of the Communist Party*, Moscow 1961, 17.
20. Nikolai A. Dollezhal', *U istokov rukotvornogo mira. Zapiski konstruktora*, Moscow 2010.
21. By way of illustration, a well-known poster by V. Govorkov (1951) advertising the construction of the Turkmen Main Canal (eventually aborted) shows Stalin bent over a map of Central Asia and crossing out the word “desert” in “Karakum desert”. Reproduced in Julia Obertreis, “Von der Naturbeherrschung zum Ökozid? Aktuelle Fragen einer Umweltzeitgeschichte Ost- und Ostmitteleuropas,” in: *Zeithistorische Forschungen* 9 (2012), 115–122 (117). Another propaganda poster juxtaposed illustrations of a Soviet irrigation project and of a city ravaged by bombing, with a caption explaining: “We transform deserts into flourishing landscapes. They [i.e. the capitalist powers] transform cities and villages into deserts.” See <<http://redavantgarde.com/collection/show-collection/1924-we-are-transforming-deserts-into-flowing-area-they-are-transforming-cities-and-villages-into-deserts-.html>> [January 3, 2022].
22. Petr Ia. Antropov, USSR minister of geology, to Nikita S. Khrushchev, August 1961 (Copy), Gosudarstvennyi arkhiv Rossiiskoi Federatsii [GARF], Moscow, f. R5446, op. 96, d. 671, l. 20–22. Subsequently, until the end of the Soviet Union, more than 350 Mio. tons of oil and 60 Bio. m³ of gas were extracted in Mangyshlak. GAMO, f. 322, op. 1-pr, d. 1124, l. 13.
23. It should be noted, however, that this seemingly inhospitable environment had supported an indigenous nomadic population of up to 400 000 people for centuries, before the violence and starvation of Stalin’s collectivization and sedentarization campaign all but depopulated the area. Zhaugashty Nabiev, *Stepnaia tragediia. Adaiskoe vosstanie 1929–1930*, Almaty 2010; see also Robert Kindler, *Stalin’s Nomads: Power and Famine in Kazakhstan*, Pittsburgh 2018.
24. Kojevnikov has pointed out that “[t]he Bolsheviks were particularly enamoured with the fields that combined revolutionary utopia with utilitarianism.” Alexei Kojevnikov, “The Phenomenon of Soviet Science,” in: *Osiris* 23 (2008), 115–135 (122).
25. Pritchard, *Confluence*, 8. Italics added.

26. Rudolf Baklushin, “BN-350 Reactor Facility. Collected Experience [Part 1–4],” in: Atominfo, May 19, 2008, <www.atominfo.ru/en/news/e0257.htm> [January 3, 2022].
27. GAMO, f. 3p, op. 1, d. 126, l. 28.
28. GAMO, f. 10p, op. 1, d. 591, l. 13.
29. Iu. Kaz'min, “Urok geografii,” in: *Pravda*, February 2, 1972, 2.
30. A.F. Garkusha/A.S. Kozhagulova/M.M. Utebaeva, *Letopis' goroda Aktau. 1963–2003*, Almaty 2003, 3.
31. Sara B. Pritchard, “Toward an Environmental History of Technology,” in: Andrew C. Isenberg (ed.), *The Oxford Handbook of Environmental History*, New York, NY 2014, 227–258 (241).
32. Session protocol of the committee for judging proposals for the USSR State Prize in the field of architecture, May 18, 1977, Rossiiskii Gosudarstvennyi arkhiv literatury i iskusstva [RGALI], Moscow, f. 2916, op. 3, d. 82, l. 18–21 (l. 19).
33. GAMO, f. 506, op. 1, d. 513; GAMO, f. 506, op. 1, d. 514; Vladimir M. Borovskii/Esbon Usimbekovich Dzhamalbekov, *Pustyni Mangyshlaka i problemy ikh osvoeniia*, Alma-Ata 1982.
34. GAMO, f. 128, op. 1, d. 753, l. 6.
35. Irina Presniakova, “Gorod u moria,” in: *Smena*, no. 1261, December 1979.
36. GAMO, f. 506, istoricheskaiia spravka.
37. Petr L. Kapitza, *Experiment, Theory, Practice. Articles and Addresses*, Dordrecht/Boston/London 1980, x.
38. Grigor'ian on July 28, 1969, quoted from Tamara Pavlenko, *Zolotyie rossypi pamiati. Prikaspiiskii gorno-metallurgicheskii kombinat*, Almaty 2014, 259.
39. International Atomic Energy Agency (ed.), *Nuclear Energy Centres and Agro-Industrial Complexes. IAEA Technical Report Series no. 140*, Vienna 1972.
40. See Will Davis, “Nuclear Agro-Industrial Parks,” in: *ANS Nuclear Cafe*, January 20, 2016, <<http://ansnuclearcafe.org/2016/01/20/nuclear-agro-industrial-parks/>> [January 3, 2022].
41. Alvin M. Weinberg, *The First Nuclear Era. The Life and Times of a Technological Fixer*, New York, NY 1994, 144–147. On the ORNL study and other research into nuclear-powered agro-industrial complexes, see International Atomic Energy Agency, *Nuclear Energy Centres*.
42. Weinberg, *First Nuclear Era*, 145.
43. Low, “Desert Dreams.”
44. Mark Fiege, *Irrigated Eden. The Making of an Agricultural Landscape in the American West*, Seattle 1999.
45. Rossiiskii gosudarstvennyi arkhiv ekonomiki [RGAE], f. 4372, op. 66, d. 1280, l. 140.
46. *Ibid.*, l. 42–47; 48–50.
47. Rossiiskii gosudarstvennyi arkhiv sotsial'no-politicheskoi istorii [RGASPI], f. 17, op. 141, d. 1713, l. 63–67.
48. RGAE, f. 4372, op. 66, d. 1280, l. 140.
49. Motion picture *Proshchanie s sablei*, Kazakhfil'm, 1989. In line with a general trend in Soviet agriculture, the city's dachniki were more successful and indeed managed to grow cucumber and tomatoes on their garden plots, using a lot of precious, but generously subsidised freshwater.
50. GAMO, f. 340, op. 1, d. 4, l. 65.
51. Edvard Maksimovskii, Radio feature “Let's Meet on the Ustiurt Plateau,” May 7, 1973, GAMO, f. 340, op. 1, d. 4, l. 27–34 (citation l. 34).
52. S. Mukashev, “Mangyshlakskaia variant,” in: *Nauka i Zhizn'*, no. 2, 1985, 34–35.
53. A.V. Bakanov, “All-Union Conference on Softening And Desalination of Sea Water,” in: *Soviet Atomic Energy* 27 (1969), 1141–1142; Nataliia Aleshina, “Kak sozdat' oasis”, in: *Ezhednevnye novosti*, July 2, 2004, <<http://dlib.eastview.com/>

- [browse/doc/6440137](#)> [January 3, 2022]; G.V. Kruglikov/N.K. Tokmantsev, “Dubrovnik September 1970 International Symposium on Desalination of Salt Waters,” in: *Soviet Atomic Energy* 30 (1971), 406–407.
54. GAMO, f. 506, op. 1, d. 715, l. 40–42; l. 116–125; l. 126–132; GAMO, f. 506, op. 1, d. 1117, l. 77.
 55. Sarah White, “Siberian Water to Flow to the Caspian?,” in: *New Scientist and Science Journal*, May 20, 1971, 472–473; Josephson, *Atom*, 243–252, especially 248–249.
 56. B.V. Litvinov, “O budushchem mirnykh iadernykh vzryvakh [sic] i vzryvnoi deiterievoi energetike,” <<http://www.vniitf.ru/rig/konfer/9zst/plenar/8-pl.pdf>> [January 7, 2019, no longer available]. For further details on the nuclear explosions, see below.
 57. Chida, “Science,” 243. For a study of the expert controversies over the benefits and risks of the river diversions scheme, see David F. Duke, “Seizing Favours from Nature. The Rise and Fall of Siberian River Diversion,” in: T. Tvedt/E. Jakobsson (eds.), *A History of Water*, 3 vols., vol. 1: Water Control and River Biographies 2006, 3–34. See also Julia Obertreis, *Imperial Desert Dreams. Cotton Growing and Irrigation in Central Asia, 1860–1991*, Göttingen 2017, 382–386.
 58. “Oleg Kazachkovskii: Povelitel’ bystrykh neitronov,” in: *Strana Rosatom*, May 11, 2011, <<https://www.atomic-energy.ru/interviews/2015/05/06/22067>> [January 3, 2022].
 59. Jasanoff, “Worlds,” 339.
 60. The latter was true for the consequences of open-pit mining, oil extraction, and the creation of a large tailings reservoir – see below.
 61. Concentrations amounted to up to 150 nanograms per milliliter, more by an order of magnitude than the 13 ng/ml that had been found in the Koshkar-Ata. Viktor Gumnikov, “Kosovskii sindrom ‘mertvogo’ ozera,” in: *Megapolis* 2012, <http://m.megapolis.kz/art/Kosovskiy_sindrom_myortvogo_ozera> [October 14th, 2012, no longer available].
 62. *Ibid.*
 63. When the PGMK was required to deliver its first ecological impact report in 1977, it stated laconically that “Various pulps (the liquid waste of the hydrometallurgical process) are discharged into the reservoir without prior treatment.” GAMO, f. 530, op. 1, d. 585, l. 5.
 64. Sovet Tatambaev, *Radioaktivnoe nasledie atomnoi imperii*, Almaty 2006, 202.
 65. Ieva Rucevska/Otto Simonett (eds.), *Vital Caspian Graphics* 2, 2nd. ed., Arendal 2011, 49–51; T. Zhunussova/M. Sneve/O. Romanenko/A. Solomatina/I. Mirsaidov, *Threat Assessment Report. Regulatory Aspects of the Remediation and Rehabilitation of Nuclear Legacy in Kazakhstan, Kyrgyzstan and Tajikistan*, Österås 2011; K.A. Kadyrzhanov/K.A. Kuterbekov/S.N. Lukashenko/M.I. Melent’ev/V.N. Stromov/V.N. Shaitarov, “Overall Examination of the Ecological Situation in the Toxic and Radioactive Wastes Storage “Koshkar-Ata” and Development of Rehabilitation Actions,” in: International Atomic Energy Agency (ed.), *Radiation Legacy of the 20th Century: Environmental Restoration. Proceedings of an International Conference (RADLEG 2000) held in Moscow, Russian Federation, 30 October–2 November 2000*, Vienna 2002, 273–277.
 66. Rucevska/Simonett, *Caspian Graphics*, 49–51.
 67. Juri Demko, “Chernaia past’ khvostokhranilishcha,” in: *Ogni Mangistau*, February 4, 2012, <http://ogni.kz/index.php?option=com_content&task=view&id=5714> [October 14, 2012, no longer available]. However, some see the measure as an excuse for further using the lake as a convenient dump for untreated industrial and household wastewaters. Aidyn Serikov, “Budem vyzhivat,” in: *Karavan.kz*, September 5, 2009, <<https://www.caravan.kz/articles/budem-vyzhivat-370442/>> [January 3, 2022].

68. Luckily for the Combine, these emissions generally remained within the lax limits of legislation. GAMO, f. 530, op. 1, d. 585, l. 2–3.
69. Tatambaev, *Nasledie*, 184.
70. Jurii Demko, “Mangyshlak segodnia. ‘Griaznye’ tainy poluostrova sokrovishch,” in: *Tsentrasia*, February 5, 2007, <<https://centrasia.org/newsA.php?st=1170655740>> [January 3, 2022].
71. Savel’ev/Bystritskii, “Atomnoi promyshlennosti Kazakhstana 65 let.”
72. Yurii Lushin, “Bol’shoi sekret v mirnykh tseliakh,” in: *Ogonek*, no. 2, January 2, 1992, 14–15.
73. Author’s interview with Marat Shushakov, Aktau, 2013; Pavlenko, *Rossypi*, 854–855.
74. On unacknowledged health hazards in the early phases of both the US and the Soviet nuclear industries, see Kate Brown, *Plutopia. Nuclear Families, Atomic Cities and the Great Soviet and American Plutonium Disasters*, Oxford 2013.
75. See e.g. GAMO, f. 530, op. 3, d. 1 [Prikazy ob ustanovlenii l’gotnogo stazha rabotnikam rudoupravleniia za rabotu vo vrednykh usloviakh truda po spiskam 1 i 2, 1970–1985].
76. What concerns these female employees may have had about their health were soothed by local lore which had it that radiation cured infertility. Pavlenko, *Rossypi*, 587.
77. The important difference being that prior to Chernobyl, benefits applied only to the employees of the nuclear enterprises rather than the population at large. Adriana Petryna, *Life Exposed: Biological Citizens after Chernobyl*, Princeton, NJ 2002.
78. Lev A. Kochetkov, “Istoriia razvitiia bystrykh reaktorov v RF,” in: *Atomnyi ekspert* 22–23 (2014) 1–2, 50–61; Mikhail P. Grabovskii, *Puskovoi Ob’ekt*, Moscow 1999, 88–89.
79. Viktor Rubtsov, “Serye ptitsy na belom beregu. Narodnyi roman,” December 10, 2007, <http://samlib.ru/r/rubcow_wiktor_nikolaewich/rubcovvn2007.shtml> [January 16, 2016].
80. M.M. Utebaeva/A.F. Garkusha/N.B. Daumsharova/Ju.I. Kerzhbaum, *Chernobyl’: Mangistaustsy prikhodiat na pomoshch*, Almaty 2012.
81. *Ibid.*, 158.
82. Initially, another FBR of intermediate size and power (the BOR–60) had been planned to precede the BN–350, but the project was delayed for too long to provide usable input for the design of the latter.
83. Report on the Reception of a Yemenite Delegation on October 26–27, 1988, GAMO, f. 506, op. 1, d. 1117, l. 96–116 (l. 100).
84. V.I. Boiko/V.V. Shidlovskii/V.N. Meshcheriakov/I.V. Shamanin/D.G. Koshelev/D.G. Demianiuk, *Perspektivnye iadernye toplivye tsikly i reaktory novogo pokoleniia. Uchebnoe posobie*, Tomsk 2009, 167.
85. On leaking, see GAMO, f. 506, op. 1, d. 600, l. 42, on jamming see *ibid.*, d. 213, l. 78; *ibid.*, d. 214, l. 1–2; see also Rubtsov, *Ptitsy*.
86. Savel’ev/Bystritskii, “Atomnoi promyshlennosti Kazakhstana 65 let.”
87. Tatambaev, *Nasledie*, 206–207.
88. Savel’ev/Bystritskii, “Atomnoi promyshlennosti Kazakhstana 65 let”.
89. Author’s interview with Klara I. Smagina in Moscow, December 6, 2012.
90. Roger S. Case, Aktau Plastics Plant Explosives Material Report, Dezember 1999, <https://digital.library.unt.edu/ark:/67531/metadc620895/> [January 3, 2022].
91. Following Charles Perrow, large-scale technologies are understood here as complex and tightly coupled sociotechnical systems. Charles Perrow, *Normal Accidents. Living with High Risk Technologies*, New York, NY 1984.
92. On envirotechnical disasters, see Sara B. Pritchard “An Envirotechnical Disaster: Nature, Technology, and Politics at Fukushima,” in: *Environmental History* 17 (2012) 2, 219–243.

93. B.M. Kuandykov (ed.), *Kaspij ƙajraŋy – Caspian Shelf – Kaspiiskii shel’f*, Almaty 1996, 233–235.
94. *Ibid.*, 236–240.
95. GAMO, f. 330, op. 2dop., d. 87, l. 56–61.
96. GAMO, f. 330, op. 2dop., d. 89, l. 1–2.
97. The research was conducted by the Geophysical Institute of the Soviet Academy of Sciences (Institut fiziki zemli AN SSSR) in 1989–1990, GAMO, f. 330, op. 2dop., d. 89, l. 1–2.
98. *Ibid.*
99. *Ibid.*, l. 3–10.
100. *Ibid.* l. 1–2.
101. On the nuclear test explosions, see below.
102. V.N. Mosints, Liubimiy gorod, mozhet spat’ spokojno???, undated [1991], GAMO, f. 330, op. 2dop, d. 89, l. 3–10 (citations l. 3–4 and l. 8).
103. V.V. Pakhomov, Iu. L. Kamanin, A.I. Kiriuschchin, (all OKBM), Proposal for criteria and methods concerning the decommissioning of the BN-350, August 3, 1990, GAMO, f. 506, op. 1, d. 1989, l. 44–60 (citation l. 47).
104. Chida, “Science,” 246.
105. The programme promised “effective measures to combat air, soil and water pollution.” *CPSU Programme*, 87.
106. The Kazakh Society for Nature Protection was founded in 1963 and was modelled after its Russian counterpart that had existed since 1924. On nature protection as a matter of public concern, see, e.g., Douglas R. Weiner, *A Little Corner of Freedom: Russian Nature Protection from Stalin to Gorbachev*, Berkeley 1999.
107. The *Oblast’ Society for Environmental Protection* was tightly integrated into the structures of “democratic centralism,” and answered to the Central Committee of the Kazakh Society for Nature Protection. GAMO, f. 431.
108. V.N. Tychinin, On the Work of the City Society for Environmental Protection, October 10, 1982, GAMO, f. 128, op. 1, d. 753, l. 4–5.
109. Obertreis, “Naturbeherrschung,” 119.
110. Joint decree issued by the CC CPSU and the Council of Ministers of the USSR on December 29, 1972, “On intensifying the protection of the environment and improving the exploitation of natural resources.” This decree constituted the basis for the Atomic Energy Combine’s subsequent efforts in the field of environmental protection. See GAMO, f. 506, op. 1, d. 410, l. 40–41, and *ibid.*, istoricheskaiia spravka.
111. For claims to the contrary, see, e.g., Paul R. Josephson, “Umweltschäden des Kalten Krieges in der UdSSR,” in: Bernd Greiner et al. (eds.), *Ökonomie im Kalten Krieg*, Hamburg 2010, 326–346 (337); J.R. McNeill/Corinna R. Unger, “Introduction: The Big Picture,” in: J.R. McNeill/Corinna R. Unger (eds.), *Environmental Histories of the Cold War*, New York, NY 2010, 1–18 (10).
112. See e.g. Evgenii T. Artemov/Aleksandr E. Bedel’, *Ukroshchenie urana*, Ekaterinburg 1999, 322–323, on the establishment of a LOOS at the Electrochemical Combine in Novoural’sk, the main center of uranium enrichment of the Soviet nuclear project. For Shevchenko’s MAEK and PGMK, see below.
113. See V.N. Novoselov/Iu. F. Nosach/B.N. Entiaikov, *Atomnoe serdtse Rossii*, Chelyabinsk 2014, 289; L.P. Sokhina, *Radioaktivnye otkhody – problemy i resheniia (stranitsy istorii)*, Ozersk 2001, 74–76.
114. TsLOOS activity report for 1978, GAMO, f. 530, op. 1, d. 585, l. 1.
115. Nikolai P. Petrukhin, *Syrevaiia baza atomnoi promyshlennosti. Sobytiia, liudi, dostizheniia*, Moscow 2015, 215.
116. N.A. Vol’khin, Chief engineer at the PGMK, to military procurator of unit 9325, K.Sh. Talipov, On the fulfillment of measures for environmental protection in 1984, May 13, 1985, GAMO, f. 530, op. 1, d. 811, l. 4–6.

117. *Ibid.*
118. However, the project never left the planning stage. “Professional – eto zvuchit gromko. Vladimir Velikotskii,” in: *Ogni Mangyshlaka*, September 10, 2013, <<http://ogni.kz/rubrika/persona/professional-eto-zvuchit-gromko-.html>> [November 11, 2013, no longer available].
119. L.S. Kaibysheva, *Posle Chernobyliia*, vol. 1, Moscow 1995, 195.
120. GAMO, f. 506, istoricheskaia spravka, vol. 2, [chapter 6](#).
121. GAMO, f. 506, op. 3, d. 213, l. 141.
122. GAMO, f. 506, op. 1, d. 349, l. 14; GAMO, f. 506, op. 1, d. 410, l. 40–41.
123. The NPP’s first annual environmental impact report was compiled in 1977 and comprised 109 pages. GAMO, f. 506, op. 1, d. 412. On the reactor’s allegedly spotless radiation record, see also GAMO, f. 506, istoricheskaia spravka, vol. 2, [chapter 6](#).
124. Protocol of the assembly of the MAEK workers’ collective on May 30, 1989, GAMO, f. 506, op. 1, d. 1220, l. 45–57 (l. 47).
125. Research Programme for an Appraisal of the Ecological Situation in Mangistau Oblast’, 1992, GAMO, f. 486, op. 1–1, d. 15, l. 1–5.
126. GAMO, f. 330, op. 1, d. 1571, l. 46.
127. *Ibid.*, l. 4.
128. M. Gubaidullin, chairman of the Committee for Ecology and Exploitation of Nature of Mangistau Oblast, in response to the query by comrade N.N. Valitskii, October 30, 1991, GAMO, f. 330, op. 1, d. 1571, l. 20; M.D. Nordyke, *The Soviet Program for Peaceful Uses of Nuclear Explosions*, Springfield, VA 2000, 17–19.
129. GAMO, f. 330, op. 1, d. 1571, l. 54–56.
130. *Ibid.*, l. 20.
131. Oleg Stepashin, “Neizvestnyi iadernyi poligon,” in: *Izvestiia*, February 22, 1991, 2.
132. On the Soviet PNE programme in general see Josephson, *Atom*, 243–252. The USSR conducted PNEs from 1965 to 1988. Litvinov, “O budushchem.”
133. Nordyke, *Soviet Program*, 17–18.
134. Instead, a few years later, the Soviet military settled on a new weapons test site at the southern end of Novaya Zemlya. *Ibid.*
135. See e.g. D. Gutenev, “Atomshchiki pokidaiut Mangyshlak: unikal’nyi reaktor mozhnet ostat’sia bezprizornym,” in: *Pravda*, September 11, 1993, 2.
136. Author’s interview with Sig Hecker, Stanford, 2013; see also “The Sum of All Fears. ORNL Plays a Role in Securing Nuclear Materials in Kazakhstan,” in: *Oak Ridge National Laboratory Review* 44 (2011) 1, 10–12; “Delo zakryto,” in: *Ekspert Kazakhstan*, November 22, 2010, <<http://expert.ru/kazakhstan/2010/46/delo-zakryito/>> [January 3, 2022].
137. A.I. Kiriushchin, OKBM, Suggestions for Criteria and Procedures for Decommissioning the BN-350, August 3, 1990, GAMO, f. 506, op. 1, d. 1289, l. 44–60 (especially l. 52; l. 55–56). It was therefore suggested to leave it in place indefinitely and cover it with an additional mantle, in view of its high activity. *Ibid.*
138. A.G. Iksanov/S.N. Pustobaev/Yu.P. Shirobokov/G.P. Pugachyev, “Development of Devices for Handling with BN-350 Radioactive Waste,” in: Samuel A. Apikyan/David J. Diamond (eds.), *Nuclear Power and Energy Security. Proceedings of the NATO Advanced Research Workshop on Nuclear Power and Energy Security in Yerevan, Armenia, 26–29 May 2009*, Dordrecht 2009, 247–254 (247).
139. Iksanov et al., “Development of Devices,” 250, 252; Alevtina Donskikh, “S dozimetrom po uranovoi tsepochnke,” in: *Delovoi Kazakhstan*, July 10, 2014, <<http://dknews.kz/s-dozimetrom-po-uranovoj-tsepochnke-mae-k/>> [December 9, 2014, no longer available].
140. Iksanov et al., “Development of Devices,” 247–248. Among other things, dealing with hundreds of cubic meters of highly radioactive sodium from the reactor core and its primary cooling circuit poses particular headaches to international

- specialists. To tackle the task, an extensive research plan was drawn up as early as 1989. L.A. Kochetkov (FEI) to V.L. Levitin (MAEK), On Preparations for Decommissioning the BN-350, November 30, 1989, GAMO, f. 506, op. 1, d. 1289, l. 5–6.
141. Iksanov et al. “Development of Devices,” 253. The US Department of Energy (DOE) and the European Union’s Programme of Technical Assistance to the CIS countries (TACIS) have acted as the main sponsors. GAMO, f. 506, op. 1, d. 1452.
 142. Literally translated as “Uranium–Mine–Liquidation.”
 143. Tatambaev, *Nasledie*, 199–200. The pilot project consisted of the conservation and restoration of a single mine at the Zhidelinskoe deposit, located far from Mangyshlak. Zhunussova et al., *Threat*, 31.
 144. Serikov, “Budem vyzhivat’.”
 145. Rucevska/Simonett, *Caspian Graphics*, 49–51.
 146. Serikov, “Budem vyzhivat’.”
 147. Demko, “Chernaia Past’.”
 148. A simple sand and gravel cover to stop wind erosion from the dried-up shores of the reservoir (40 km²) would cost hundreds of millions of USD and still do nothing to improve the groundwater situation, *Ibid.* Note, for reasons of comparison, that remediation of the environmental damage caused by the Wismut uranium mining enterprise in the former GDR was put at 15 billion German Mark in West German estimates in 1989. To date, approximately 7 billion Euro have been spent on the project. See <<http://www.wismut.de/en/>> [January 3, 2022].
 149. Natalia Melnikova/Alexander Bedel/Evgenii Artemov, “Russia. Short Country Report,” July 2018, <http://www.honest2020.eu/sites/default/files/deliverables_24/RU.pdf> [January 3, 2022], 50–54.
 150. The authors of the project expected revenues of 30–40 billion USD over a time span of 30 years. Tatambaev, *Nasledie*, 155–156; Margarita Sevcik, “Kazakhstan’s Proposal to Initiate Commercial Imports of Radioactive Waste,” in: *Nuclear Threat Initiative*, January 1, 2003, <<https://www.nti.org/analysis/articles/kazakhstans-proposal-waste/>> [December 21, 2018, no longer available]. Before that, the pits had been under consideration as the central storage site for Kazakhstan’s domestic nuclear waste, an estimated 237 million tonnes with a total activity of 15.5 million Ci. “Burial of Foreign Waste,” in: Nuclear Engineering International, June 3, 2002, <<http://www.neimagazine.com/news/newsburial-of-foreign-waste>> [January 3, 2022].
 151. Aleksandr Tonkopriadchenko, “V Aktau obezvrezhena upravliaemaia termoiadernaia bomba,” in: *Informbiuro.kz*, October 13, 2015, <<http://informburo.kz/stati/v-aktau-obezvrezhena-upravlyaemaya-termoyadernaya-bomba-no-eyo-othodybudut-opasny-eshcho-50-let-13483.html>> [January 3, 2022].
 152. Konstantin Maskaev, “Vokrug Iadra,” in: *Novoe Pokolenie*, October 10, 2011, <https://archive.np.kz/events/9425-vokrug_jadra.html> [January 3, 2022]. The unsatisfactory solution to the problem consisted in returning the metal to the unguarded territory of the hydrometallurgical plant, where it had probably come from in the first place. Tat’iana Kazantseva, “Prestuplenie bez nakazaniia,” in: *Kazakhstanskaya Pravda*, September 20, 2005, <<http://www.kazpravda.kz/archives/view/36704/>> [January 18, 2016, no longer available].
 153. Tatambaev, *Nasledie*, 184.
 154. *Ibid.*, 186.
 155. “Rosatom Expo,” mobile application for iOS, 2012 [no longer available].
 156. Vitalii Sal’nik, “Net istochnikov energii? Novaia AES plyvet k vam,” in: *Pravda*, July 1, 2010, <<https://www.pravda.ru/economics/1038770-energy/>> [January 3, 2022].
 157. Sergei Leskov, “Malaia energetika v poiskakh shturmana. Atomnye reaktory nakanune dal’nykh stranstvii,” in: *Izvestiia*, November 29, 2003, 3.

158. Strategic Communications Unit Rosatom Overseas, “Desalination Facility Named a New Product of the Russian Nuclear Industry,” March 3, 2015, <<https://rosatom-europe.com/press-centre/news/114-desalination-facility-named-a-new-product-of-the-russian-nuclear-industry/>> [January 3, 2022]. One such installation was said to provide 170 000 m³ of freshwater daily to support a city of up to one million inhabitants. Leskov, “Energetika.”
159. Leskov, “Energetika.”
160. Ekaterina Tripoten’/Aleksandr Iuzhanin, “Iadernoe opresnenie: Ne presnyi plan Rosatoma,” in: *Atomnyi ekspert* 35 (2015) 2, 10–18.
161. Thomas B. Cochran, Introduction, in: Thomas B. Cochran et al. (eds.), *Fast Breeder Reactor Programs: History and Status*, Princeton, NJ 2010, 12.
162. For an overview of the domestic and international implications of the Kazakhstani nuclear programme, see Togzhan Kassenova, “Kazakhstan and the Global Nuclear Order,” in: *Central Asian Affairs* 1 (2014) 2, 273–286; see also “Konversiiia po-kazakhski. Obzor iadernoi industrii Kazakhstana,” in: *Atomnyi ekspert* 22–23 (2014) 1–2, 80–89.
163. Kazakhstan’s uranium extraction industry is now centred in the Chu-Sarysu province and has replaced open-pit and shaft mining by more cost-effective and seemingly lower-impact in situ leaching methods.
164. G.A. Batyrbekov, general director of the NNC, to V.L. Levitin, director of MAEK, Commission for a Feasibility Study on the Construction of a Nuclear Power and Heating Plant with BMN-170 Reactor to Replace the BN-350 at the Mangyshlak Energy Combine (City of Aktau), no date [1994], GAMO, f. 506, op. 1, d. 1413, l. 3–7. On the BMN-170, see <https://inis.iaea.org/search/search.aspx?orig_q=RN:37052847> [January 3, 2022].
165. On the VBER-300, see <<http://www.atomic-energy.ru/technology/23451>> [January 3, 2022].
166. Author’s interview with Gennadii M. Isakov, head of Kazatomprom’s representative office in Moscow, December 3, 2012, Moscow.
167. Josephson, “Communism.”
168. Joanna Lillis/David Trilling, “Kazakhstan: A Showpiece of Energy Wealth Rises in the Western Desert,” in: *Eurasianet*, October 28, 2009, <<https://eurasianet.org/kazakhstan-a-showpiece-of-energy-wealth-rises-in-the-western-desert-0>> [January 3, 2022].
169. World Nuclear Association, “Uranium and Nuclear Power in Kazakhstan,” updated December 2021, <<http://www.world-nuclear.org/information-library/country-profiles/countries-g-n/kazakhstan.aspx>> [January 3, 2022].
170. This is one of the core arguments of the socio-natural sites paradigm pioneered by the Vienna school of environmental historians. See Verena Winiwarter/Martin Schmid/Gert Dressel, “Looking at Half a Millenium of Co-Existence: the Danube in Vienna as a Socio-Natural Site,” in: *Water History* 5 (2013), 101–119, 114.

3 Radiation Expertise in the Nuclear Landscapes of the Southern Urals in the 1950s and 1960s

Laura Sembritzki

Introduction

Until Chernobyl, the knowledge of radiation in the Soviet Union was restricted to the past achievements in nuclear physics and the promotion of future benefits of nuclear power. Besides nuclear energy, the application in agriculture and medicine promised to fight world hunger and diseases. Accordingly, nuclear physicists were declared heroic in their contribution to the country's defense and progress.¹ Nuclear physicists became a scientific elite with access to the Soviet political elite and were often honored by the Soviet government.² The scientific director for Arzamas-16, Iulii B. Khariton, for example, held several honors including three times the Stalin Prize, as well as the Lenin Prize. Furthermore, he received – among other honors – three times Hero of Socialist Labor and received the Order of Lenin six times. Even though, as David Holloway pointed out, he was a “surprising choice” since he spent two years in the West, was Jewish, and his parents lived abroad.³

At the same time, parts of the Soviet atomic program were, to a great extent, kept top secret. Physicians, radiologists, and radiobiologists among others handling the radiant legacy of the Soviet nuclear program could hardly be included in the celebration of the Soviet atom. Its promises outshined its perils.⁴ However, radiation dangers moved into the light of an assumed nuclear attack in the Cold War context and the received growing significance in the securing of national security. Within the nuclear test ban debate, the Soviet Union stressed the dangers of even small doses of radiation and launched a campaign to disseminate the knowledge about health and genetic effects thereof.⁵

The origins of radiation safety in the Soviet Union can be traced back to the late 1940s and the context of the Soviet nuclear program. In 1946, leading scientists and managers of the atomic program reported to Beria on the progress of radiation safety in the Soviet Union. They outlined what was being done in this field abroad, primarily in the United States, and stressed the importance of radiation-related research in the Soviet Union. They specifically named the founding of the Institute of Biophysics in 1945 in the United

States as one important contribution toward radiation knowledge production.⁶ Thus, first considerations regarding biomedical radiation research and occupational radiation safety were tackled. However, facing basic problems to ensure a successful operation and to be eager to collect as much scientific data as possible, further problems like uncontrolled releases of radioactivity in the environment and long-term health effects were neglected. As the atomic program was introduced and implemented in a great hurry and under even greater pressure, the immediate aim – to develop a nuclear bomb as soon as possible – overshadowed the long-term consequences, such as radiation effects on public health and the environment.⁷

This chapter focuses on the evolving nuclear landscapes in the Southern Urals. Starting from the administrative management of domestic nuclear disasters in the Southern Urals, this chapter will discuss a window of opportunity of radiation expertise in the late 1950s and early 1960s and raise the question of to which extent the experience in the Southern Urals helped some scientists to make their carrier in Moscow.

Nuclear Disaster in the Southern Urals – Administration Challenged

In the Southern Urals, three secret cities belonging to the Soviet nuclear program were established in the end of the 1940s and in the early 1950s. One of those cities, then known as Chelyabinsk-40, and today known as Ozersk, housed the first uranium-graphite reactor “A” and a radiochemical plant “B” to produce weapon-grade plutonium. In the period from the end of the 1940s up to the end of the 1960s, three major nuclear disasters occurred, originating from the city’s nuclear industry.

In consequence of the regular procedure of the dumping of highly radioactive liquid waste into the local river system, conducted mainly from 1949 to 1956, the river Techa was heavily contaminated. Approximately 76 cubic meters of radioactive liquid waste with an activity of 2,750,000 Curie contaminated not only the river Techa but also the river system belonging to the rivers Karabolka and Iset’. On the river Techa, 37 villages with residents amounting to some 25,000 persons were affected by the radioactivity.⁸

The second and best-known accident in the region occurred in September 1957. Only five days before the successful launch of *Sputnik*, one of the greatest technological successes of the Soviet Union, which trumped the United States in the field of space travel and put the country in a state of ecstasy, one of the greatest technological catastrophes also occurred. The “radiant” legacy of this catastrophe still makes the affected areas in the Southern Urals to one of the most contaminated places in the world. On September 29, 1957, an explosion of nuclear waste led to a fallout with an overall activity of more than 2,000,000 curies. The explosion occurred in the underground nuclear waste storage from the radiochemical plant that processed weapons-grade uranium due to a failure of the cooling and surveillance system.⁹

Ten years later the third major accident occurred in 1967. The drying up of lake Karachai contaminated 2,700 square kilometers in the region heavily. The lake was instead used to store nuclear waste after ceasing to dump the nuclear waste in the local river system. Since then about 120 million Curie were accumulated.¹⁰

In Chelyabinsk, the regional authorities were confronted with the environmental and human consequences of massive artificial radioactive contamination. The extent and severity of the contamination were unprecedented, and thus, no example of how to deal with an evolving nuclear catastrophe was available.¹¹ However, the authorities did not respond to the unfolding disaster before the first reports of illness among the Techa residents in the early 1950s. Initially, they responded with the creation of forbidden zones, well digging, and the prohibition of any water use by the residents. Eventually, given the magnitude of the exposure, relocations of whole villages along the river Techa were carried out. In light of the 1957 accident, authorities reacted similarly: evacuations, relocations, forbidden zones, and prohibitions. Information clarifying the reason of those measures was withheld.¹² Adding to that, to maintain the secrecy of the Soviet nuclear program, the massive release – both the scheduled and the inadvertent of radioactivity in the environment – was to be kept secret by the authorities at all costs. Warning signs were to be installed on the boundaries of the forbidden zones to inform the villagers about the prohibitions. The enforcement of the prohibition, that is to say the use of the river water, hunting, hay harvesting, and livestock farming, was left to the executive committees of the oblasts Chelyabinsk and Kurgansk. Guards were selected by the village councils to hinder villagers from entering the forbidden zones, but this measure turned out to be insufficient in preventing villagers to continue their traditional way of life. However, many violations were reported to Moscow. After all, the reasons for the prohibitions, restrictions, and possible dangers remained strictly classified.¹³

Nevertheless, more importantly, only insufficient alternatives were provided to go along with the prohibitions. Without any other option, villagers continued to follow their traditional way of life. To ensure their livelihood, they used the river water, harvested hay, and collected firewood in the forbidden zones. Thus, the prohibitions did not meet the reality of the people on whom they intended to have an impact. Customs and everyday practices as well as needs were not considered in the measures taken. Indeed, this not only affected the rural inhabitants. Villagers offered goods with high concentrations of radioactive particles for sale on regional markets.¹⁴

To enforce these restrictions, a special police unit, subordinated to the secret city of Chelyabinsk-40, was introduced to guard the borders of the “forbidden zones” in January 1956 by the Council of Ministers USSR.¹⁵ However, there were no existing regulations on which basis the militia № 42 could have enforced the restrictions and prohibitions since criminal or administrative law did not cover actions like hunting, swimming, and picking berries

or mushrooms. To enforce the restrictions and prohibitions in the Oblast', the executive committee relied on a decree of the Central Committee of the Communist Party and the Council of the People's Commissars from 1931¹⁶ that permitted local or regional administration to impose fines, up to and including forced labor, on certain actions under certain conditions, such as combating natural disaster, epidemics and animal diseases. The conditions that were met in the Chelyabinsk Oblast' was to ensure public health regarding open water and water sources.¹⁷

This decree was released to prevent the all too common phenomenon of bypassing the prosecution by adding fines and penalties to local administrative measures in 1931. The results of overlaps of criminal and administrative responsibilities were addressed by the decree. The decree allowed local authorities, when empowered by central organs, to impose administrative sanctions.¹⁸ In relying on this decree, the village councils were permitted to impose penalties directly without including further authorities. To the given range of possible enforceable fines and penalties described by the *Postanovlenie* from 1931, the regional executive committee decided to implement the highest sentences possible to impose on violations. Thus, villagers who entered the forbidden zones faced the threat of being fined by local authorities up to 100 rubles and corrective work up to a month depending on the seriousness of the offence. Village councils were allowed to impose fines of up to 5 rubles, and after 1958, to 10 rubles as well as corrective work of up to five days. In case of repeated and more serious offences, a commission subordinated to the Raion executive committee decided on the penalty.¹⁹

However, due to the lack of alternatives and despite this guarding of the forbidden zones, villagers continued to enter into the forbidden zones to collect berries and mushrooms, for cutting timber, and harvesting hay. Moreover, the administrative commission hesitated in enforcing the fines and penalties and usually left it at a warning. However, many violations were even not reported to the commission by the village councils. Thus, violations – even repeated ones – against the restrictions often had no administrative consequences. The effect was, as reported by the sanitary physician L.M. Pavlova to the head of the regional executive committee, that the river water was even used as drinking water despite all efforts to stop the any use of it.²⁰

The Urgency of Radiation Expertise

The penetrability of radioactivity across the borders of the forbidden zones especially highlighted the urgency for a more adapted public health approach to radioactive releases in the environment. The lack of nuclear knowledge became apparent in the disaster relief management. The initial disaster response of well digging and prohibitions that relied solely on the prevention of the further usage of the contaminated source did not match the nature of radioactivity: the radioactive particles, which were released in the environment, were not only spreading, but also passed into soil, pastures, agricultural

products and livestock, and ultimately into the human body. In the early 1950s, little was known about the effects or behavior of radioactive particles in the environment.

Initial disaster response in the Southern Urals came from Moscow. Brigades consisting of employees of the USSR Ministry of Public Health, Ministry of Middle Machine Building (henceforth referred to by its Russian acronym Sredmash), and the Academy of Sciences supported the medical-sanitary unit 71 (henceforth referred to by its Russian acronym MSO-71) of the radiochemical plant “Mayak.”²¹ It can be said that in the early 1950s, nuclear expertise was “imported” to the Southern Urals. Specialized medical infrastructure emerged in the Oblast’ Chelyabinsk not before the mid-1950s and in the late 1950s, then boosted by the necessity caused by the accident in 1957.²²

Up until then, any radiation expertise was dependent on either representatives coming from Moscow to Chelyabinsk-40 or the combine’s specialized units. Thus, the process in formulating a decree regarding the extent and depth of relief measures in the affected areas was more or less dependent on assertions and data interpretation by representatives appointed by the combine or Sredmash respectively. Seeing that there were no assured nuclear knowledge or best practices as how to handle any emerging nuclear disaster in the early 1950s, the power of data interpretation assumed particular importance.

On the basis of the MSO-71 in 1953, the first branch of the Institute of Biophysics was founded (henceforth referred to by its Russian acronym FIB-1). Its parent institute, the Institute of Biophysics²³ of the Academy of Medical Sciences, was first established in 1946 as the Radiation Laboratory (*radiatsionnaia laboratorii*) on the initiative of Igor V. Kurchatov. The Institute of Biophysics was subjected to the 3rd Main Directorate of the Ministry of Public Health and carried out secret medico-biological studies on radiation effects within the Soviet atomic project. Headed by Avetik I. Burnazian, the secret 3rd Main Department oversaw the radiation protection of the military-industrial complex.²⁴

With respect to the emerging illnesses of Techa residents and the health monitoring and measures after the accident in 1957, the capacities of the medical infrastructure of the secret city were exhausted. It became apparent that additional radiation expertise was needed in the affected region. Churin, the Deputy Minister of Public Health and former Director of the chemical plant Mayak asked the local sanitary organs for help in June 1958.²⁵ On the one hand, they functioned to provide medical care and, on the other hand, to give a basis for administrative decision-making.

In 1955, a local dispensary in the city Chelyabinsk was established under the authority of the Union Ministry of Public Health. Furthermore, in August 1958, the Chelyabinsk branch of the Leningrad Institute for Radiation Safety of the RSFSR Ministry of Public Health was founded (henceforth referred to by its Russian acronym ChLenNIIRG). Its parent institute, the Leningrad Institute for Radiation Safety of the RSFSR Ministry of Public Health,

became the leading institute of Radiation Hygiene (*radiatsionnaia gigiena*) in the early 1960s. Together with the Institute of occupational diseases, it played an important role in the development of occupational radiation protection regulations.

Overall, research relating to radiation was a sensitive subject within the Soviet Union. When Paul R. Josephson stated that “although there were a great number of civilian and military laboratories connected to issues of radiobiology, radiochemistry, radiogenetics, and radiotoxicology, issues of secrecy and national security prevented any systematic study of classified materials and precluded publication even when there was a study,”²⁶ he points out one important trait of nuclear research: secrecy. However, although classified material and secretiveness prevented any form of the publication of research findings, not to speak of open research, many indications pointed to that within closed research institutes radiation-related research was conducted. Nonetheless, these institutes were closed, and the knowledge produced remained within a closed party, state, and scientific elite.

Nevertheless, in the region of Chelyabinsk, the regional branches of major institutions in radiation safety played a significant role in assessing risks and as a consultative capacity for a given period regarding questions such as: which measures should be taken immediately, which measures could be delayed, and which measures were not even necessary? Under which conditions could permanent residence be continued? Under which conditions could labor be carried out without endangering the workers? Risk assessment under the conditions of strict secretiveness based on scientific advice became a resource of political and administrative relevance. Thus, the following section will discuss – on the basis of the ChLenNIIRG – a window of opportunity in regional radiation expertise.

Regional Radiation Expertise – ChLenNIIRG

The ChLenNIIRG was established after the accident of 1957 with the primary purpose of taking care of the affected rural population. Besides this, its tasks included providing radiation expertise to assist the enforcement of occupational radiation safety in the region. Thus, the ChLenNIIRG and the oblast’s Sanitary and Epidemiological Station closely cooperated with its radiological group. Their cooperation went so far that Igor’ K. Dibobes, the director of the ChLenNIIRG and later the FIB-4, called himself State Sanitary Inspector or State Sanitary Inspector of the contaminated areas. He used that signature to sign reports written on the letterhead of the ChLenNIIRG. Furthermore, the radiological group was housed in the building of the ChLenNIIRG and used its laboratory and equipment.²⁷

In November 1959, Dibobes issued recommendations on how to proceed with relocations performed by workers of the special (de)construction unit of the oblast’ administration. This recommendation was based on the temporary health regulation SP № 233-57 that represented the first Soviet

comprehensive regulations concerning the use of radioactive materials simultaneously giving occupational permissible doses. In accordance with the health regulations, the recommendation included a medical entry checkup as well as regularly conducted medical examinations, education campaign on personal prevention, and the apparel with protective clothing (*spetsotdeshda*). In the case that an illness was diagnosed that excluded an individual from working with radioactive materials, the person should be immediately transferred to another task without any contacts with radioactive materials. Furthermore, workforces that lived in villages along the river Techa should be provided with food products which did not originate from the affected area to prevent the intake of radioactive particles by consuming locally produced food products.²⁸ The last recommendation goes beyond the union-wide health regulation № 233-57 but was still in accordance with it. Thus, it becomes clear that workers should be prevented from accumulating *unnecessarily* high doses by eating local products and therefore adding internal exposure on the external.

Considering that the first general permissible doses were released in 1960, the question arises if the workforce was better protected than local residents in the affected area. To prevent an increased intake of radioactive particles, temporary limits for certain products (milk, grain etc.) were established. The enforcement of those limits was problematic due to the lack of a specialized monitoring infrastructure and dosimetric laboratories in the region. Therefore, it was not possible to guarantee a comprehensive control of contaminated products after the accident in 1957.²⁹ However, radiation sickness occurred among Techa residents and the workforce.³⁰ The established limits raise the question on which ground risks assessment was performed and which reference values were applied in the contaminated areas.

In other cases, the institute issued recommendations with a more advisory nature. In March 1959, the ChLenNIIRG prepared a report about how the work could be continued in the contaminated area of government district Bagariakskii. They considered it possible that the logging of trees could be allowed if the wood would be used only as sellable wood (*delovoi drevesiny*). They explicitly excluded the wood as construction timber.³¹ In this case, no health regulation existed.

Furthermore, the institute was involved in dosimetric inspection and monitoring: in 1959, the institute in cooperation with the oblast' Sanitary and Epidemiological Station conducted dosimetric inspections of sheep wool in the affected kolkhoz in the government districts Kunashakskii, Kaslinskii, and Bagariakskii. In 1958, more than 80 tons of wool with a value of 5 million rubles were destroyed. The sheep were so heavily contaminated that according to the recommendation of the ChLenNIIRG, neither the wool nor the meat were usable.³² The results of the dosimetric inspection and the resulting recommendation prompted the authorities to release the *Reshenie* № 462s on the prohibition of sheep farming in particular farms in the named government districts.³³ In this capacity, the institute played an important role

in assisting the regional government to ensure radiation safety within the contaminated areas along the Techa and within the area that were affected by the accident in 1957. Nevertheless, the regional government also sought advice from the ChLenNIIRG with respect to the need to resettle several villages as in the case of the villages Tatarskaia Karabolka and Bagariak.

Both villages, Tatarskaia Karabolka and Bagariak, are located in areas affected by radioactivity. Tatarskaia Karabolka, as the name indicates, lies on the river Karabolka within the government district of Kunashakskii with an above-average population of Tatars. Bagariak lies in the government district Bagariakskii, the area affected by the accident in 1957. Medical and dosimetric staff monitored the health and living conditions repeatedly in both villages after the release of radioactivity in the environment.³⁴ Their reports caused E. Rask, the main engineer of the special (de)construction department on February 6, 1960, to send E.V. Mamontov, the deputy chairman of the Chelyabinsk regional executive committee, a request for more money: according to this letter, Churin, the deputy minister of Sredmash, should provide more money for the evacuation of the villages Tatarskaia Karabolka and Bagariak.³⁵

For his enquiry, Rask relied heavily on recommendations issued by the ChLenNIIRG. According to their analysis, high concentrations of radioactivity in the villages, meadows, and the river “K” [Karabolka] would make the continuation of living there dangerous. Cases of radiation sickness occurred among the villagers and requests about evacuation reached the local authorities. Therefore, the ChLenNIIRG had recommended the immediate evacuation of both villages, and, in addition, for the village Nizhne-Petropavlovskoe.³⁶

Rask further pointed out that despite a *Postanovlenie* by the Council of Ministers released in November 1957,³⁷ the USSR Ministry of Public Health, Sredmash, and the USSR Academy of Sciences should have indicated the further possibility to live in the territory of the river “K” [Karabolka] and “T” [Techa] within a year. However, since then – about two and a half years later – there was from not one of the named authorities a single recommendation on this specific issue. Accordingly, the regional executive committee had to rely completely on the recommendations issued by ChLenNIIRG.³⁸

Eventually, no resettlements were carried out. However, the regional administration used the radiation expertise of the ChLenNIIRG to confront Moscow and to request that actions be taken to prevent further harm. However, in this case, recommendations issued by the ChLenNIIRG were ignored in Moscow and not realized respectively. The whole issue is the subject of current discussion. Inhabitants from affected villages in the Oblast’ Chelyabinsk, after becoming aware of their exposure in the late 1980s and early 1990s, organized human rights activist groups to become informed about the scope and severity of exposure in the past, health effects, and (the lack of) evacuations.³⁹

A group from Musliumovo, another village in the contaminated area of the river Techa from which the Bashkir-Tatar population was not evacuated, called themselves “White Mice” and claimed to be used as human subjects in secret state biomedical experimental research.⁴⁰ Fauzia Baimarova, a Tatar nationalist leader, claimed that the Tatar and Bashkir population were particularly targeted by the Soviet authorities. Afraid of the high costs, the Soviet authorities shied away from the resettlement of the comparatively large villages Tatarskaia Karabolka and Bagariak.⁴¹ Garb and Komarova pointed out that there was no particular discrimination against Tatars by Soviet authorities, but rather a general contempt for all people.⁴²

However, the case of the villages Tatarskaia Karabolka and Bagariak seems to demonstrate that the regional government, with the support of the ChLenNIIRG, tried to convince Moscow of the need to resettlement. In addition, the regional executive committee issued the decision to resettle both villages.⁴³ Ultimately Moscow disagreed – unfortunately these documents are still classified, and the reasons why Moscow did not decide to resettle these villages remain unknown. It seems that a mixture of different factors had been the basis for the decision, including economic as well as risk assessment. To the present day, a resettlement of Tatarskaia Karabolka has not been planned despite the fact of the heavily contaminated environment.⁴⁴ These cases highlight the importance of new approaches in the science of history, such as environmental justice that develop a long-term view beyond political watersheds.

The ChLenNIIRG became a source of regional radiation expertise, and their recommendations played a significant role in an area where no regulation existed. Thus, the regional authorities asked for guidelines in cases where no regulation or best practices were known, and risk assessment was necessary. Furthermore, the cases of the villages Tatarskaia Karabolka and Bagariak show how the regional government used radiation expertise to pressure Moscow for action. However, the examples give no indication on which criterion decisions in Moscow or in the Oblast’ were eventually based. Documents that could answer these questions are still undisclosed and therefore the public, academic, and political discussion is open to expressions of opinion covering the whole spectrum from the denial of different treatment of villages⁴⁵ to the allegation of ethnic genocide.⁴⁶

In 1962, the dispensary № 1 and the Chelyabinsk branch of the LenNIIRG united to create the fourth branch of the Institute of Biophysics of the USSR Ministry of Health (henceforth referred to by its Russian acronym FIB-4).⁴⁷ With the establishment of the FIB-4, not only a shift in affiliation but also in tasks and responsibilities took place. Hence, as a research institute under the umbrella of the secret 3rd Main Directorate of the USSR, additional topics such as research on public health effects of peaceful nuclear explosion were pursued.⁴⁸ This became even more apparent when Dibobes left for a post in Moscow and Shvedov, with a career path within the 3rd Main Directorate and became the new director of the FIB-4.⁴⁹

Nuclear Knowledge beyond the Nuclear Landscapes

The changed institutional affiliations of the FIB-4 and the apparent importance of the tasks conducted by the staff of the ChLenNIIRG and the dispensary № 1 to the military underline the question what kind of significance was given to territories in the Southern Urals contaminated with artificial radionuclides within Soviet radiobiological, radio-ecological, and radio-medical research in the Cold War context. Marvin Goldman, participating in human experiments conducted within the Manhattan Project by the University of Rochester, portrays the Southern Urals as a big experimental laboratory:

And, what [were] they doing? Feeding people strontium-90 in Chelyabinsk, [an Asian city near the] Ural [Mountains and one of the Russian centers for plutonium production]. They'd been doing it since 1950, and [of course] they didn't know it [at the time and perhaps then] they didn't care. So I have now seen [a parallel] in the human studies in Russia. Unbeknown to me, they were doing in humans what I was doing in beagles. When Yuri Moskalev from Moscow came to visit me in 1960, he was taking pictures of my whole-body counter. I didn't know that when I visited Chelyabinsk in 1991, I would see my whole-body counter in this secret city, used to count people the same way I was counting beagles. And so, I have a kind of internal commitment now to reach closure, because I know about dosimetry and all of the basics [of what] they're doing from the other end, epidemiologically.⁵⁰

Of course, this serves also as a justification of his own work and is a contested view. Nonetheless, some of those scientists who became important experts in the field of radiation knowledge in Moscow started their career in Chelyabinsk in the early 1950s. At that time due to the influence of Trofim D. Lysenko, genetics were under general suspicion in the Soviet Union. However, recent research shifted from a focus on Lysenko and his ideological influence on genetics toward a paradigm that looked for niches in classic genetics. Mark Adams pointed out that the establishment of the Siberian Branch of the Academy of Sciences was such a niche. He states:

Kurchatov, Lavrent'ev, Kapitsa, and others had his [Khrushchev's] ear on other things, such as rockets, sputniks, and bombs. Their strategies: Open labs in areas under their own control. Maneuver to isolate Lysenko in the biology division, where they would, with Engelhardt's help, chip away at his stronghold. Open a new Siberian division, part of which would involve a genetics institute of their own design and create an administrative structure for it that closed Lysenkoists out. (...) ⁵¹

According to this, the nuclear complex can be seen as an umbrella that protected geneticists and their work against the influence of Lysenko and his followers.

The institutes that emerged since the radioactive contamination in the Oblast' Chelyabinsk resemble this explanatory model. In the 1960s, for example, Timofeev-Resovskii was regularly invited to present academic lectures at the institute when he was still unable to present in Moscow.⁵² Due to his history as an alleged collaborator with Nazi Germany, Timofeev-Resovskii was imprisoned in Germany in 1945 at the *Kaiser Wilhelm Institute* in Berlin-Buch by the Soviets and then lost in the Gulag system. Given the importance of his research, he was, by the request of Beria, found (almost dead) in 1947 and nursed back to health in an elite NKVD hospital. Recovered, he was brought to the secret laboratory "B" at lake Sungul',⁵³ where he worked and lived until 1955, when he was transferred to the Ural Branch of the Academy of Sciences. From 1955 until 1964, when he moved to Obninsk, he worked at the experimental station *Miassovo* in summertime and Sverdlovsk (today Ekaterinburg) during winter.⁵⁴

During his time in the secret laboratory, his research was devoted to the biological treatment of radioactively contaminated water.⁵⁵ At the FIB-4, he held lectures about radiation genetics and radiation-induced mutation.⁵⁶ However, the intellectual freedom granted to him was limited. In his memoirs, Timofeev-Resovskii commented on the secretiveness of the system and its impacts on research. He claimed that it was not the US-American scientists discovered the application of isotopes in medicine and water isotope biology, but the Soviet scientists. Unlike in the United States, as Timofeev-Resovskii pointed out, where the research results were published, in the Soviet Union, the reports were sent to Sredmash, the "abyss," where they were forgotten.⁵⁷

A number of secret research facilities were built in the vicinity of the Soviet nuclear complex to tackle the radiating consequences of the military-industrial complex. This combined with the intellectual freedom granted under the umbrella of the atomic project laid the foundation for various research in the field of radiation knowledge and radiation protection knowledge production. Scientists in these research facilities contributed to the emerging research fields of radioecology and radiobiology. However, due to secrecy, most of the research results had to be kept secret. Thus, personal experience became crucial. Among others, physicians and scientists like Angelina K. Gus'kova, Igor K. Dibobes, Yuri I. Moskalev and Pavel I. Moiseitsev made their careers based on their practical experience as physicians and conducted research in the Chelyabinsk region.

P.I. Moiseitsev was born in 1917 and became the head of the MSO-71 of the Mayak radiochemical plant, which was established in 1947 and later reorganized into the FIB-1. In the early 1960s, he was the head of the department of radiation safety of the USSR Ministry of Public Health. In performance of his duties, he was one of the organizers of measures and legal procedures of radiation protection in the Soviet Union.⁵⁸

Iuri I. Moskalev worked in the 1950s at the FIB-1 in Chelyabinsk-40 and was remembered in the above quotation by Goldman. After the 1957

accident, he, as the head of the toxicological laboratory, organized the first research surveys in the contaminated area. In the 1970s, he was a radiologist at the Institute of Biophysics in Moscow and Vice-Chairman and then Chairman of the Soviet National Commission of Radiological Protection.⁵⁹

I.K. Dibobes, a member of the Party office of the ChLenNIIRG and then the FIB-4 became in 1959, with the age of 28 years, Director of the ChLenNIIRG and later Director of the newly founded branch of the Institute of Biophysics. After 1967, he left Chelyabinsk for Moscow to become Deputy Head of the 3rd Main Directorate of the USSR Ministry of Public Health. In 1989, he became the head of the Expert Commission of the State Committee for the Environment to assess the risks of the planned construction of the South-Ural Nuclear Power Plant.⁶⁰

As these short biographies show, radiation knowledge was closely linked to the personal experience of individual physicians and scientists. This close link between radiation knowledge and experience was then translated into a knowledge advantage and special career opportunities. The experience in disaster relief management was thus for many young aspiring scientists and physicians the starting point for their career opportunities in the field of radiation protection, both in administration and research.

However, according to Kate Brown, satisfactory results also played a significant role in making a career. As Brown has pointed out, the career of Gus'kova arose along the popularity of her research results among the political elite.⁶¹ Furthermore, a party affiliation seemed to be helpful.⁶² If one has a closer look at the members of the party office of the FIB-4 in the early 1960s, it occurs that leading scientists were also members of the communist party and vividly engaged in institutes' party activities. To put it in numbers, in 1962, from 21 Party members within the Institute, 13 had a higher level education (4 kandidat nauk) – and most importantly hold scientific key posts – 5 members had a secondary education and just 4 members had not yet completed their secondary education.⁶³

Due to the linkage of radiation knowledge to personal experience, scientific knowledge and data stemming from the Chelyabinsk region became important beyond the nuclear landscapes. With its carriers, the radiation knowledge produced in the Southern Urals entered the scientific discussion of biological and genetic effects of exposure on the national (Soviet) and international level. It became crucial for the establishment of permissible doses and the assessment of the effects of low-dose exposure. Dibobes, Gus'kova, and Moskalev participated in the formulation of the union-wide Radiation Safety Standards (NRB-69) from 1969 to 1976 (NRB-76).⁶⁴

However, it seems that experts who had obtained their knowledge due to service within the secret city of Chelyabinsk-40 were not allowed to engage in an international scientific discourse about radiation effects before the mid-1960s. In 1954, Gus'kova and Grigorii D. Baisogolov were invited to submit an article for the International Conference on the Peaceful Uses of Atomic Energy that was to be held in Geneva in 1955.⁶⁵ Baisogolov was at that time

the director of the FIB-1 in Chelyabinsk-40. However, their paper, “Two cases of acute radiation sickness in man,” was not presented by Gus’kova or Baisogolov themselves but by Moisei P. Domshlak. Neither Gus’kova nor Baisogolov became a member of the Soviet delegation.⁶⁶ From other research, it is known that the Soviet Union refrained from sending specialists abroad if they were considered either disloyal or if the danger of kidnapping was assessed to be too risky.⁶⁷

In this case of the two representatives of a closed research institute in the Soviet atomic program in the Southern Urals, prevailing secrecy about both, the nuclear “object” and the radioactive contamination of the environment was probably the main reason that specialists were denied traveling abroad. Nonetheless, the knowledge produced in the nuclear landscapes was too crucial to not be presented on the international stage of scientific contest: mocked by the western countries for their low-quality products and living standards, the Soviet Union was eager to present themselves at an equal level to the United States. Even if this was not (always) the case, at least the CIA conceded in 1959:

While many of the claims advanced by the Soviets in this field [relative biological effectiveness of various types of radiation] are lacking support and are presently questionable, it seems quite certain that there are definite central nervous effects from irradiation, perhaps more than was thought previously in the West.⁶⁸

In fact, Gus’kova specialized in the study of the effects of (low-dose) radiation on the nervous system.⁶⁹ This indicates that the medical treatment and research conducted in the Southern Urals were a crucial part of the nuclear knowledge production in the Soviet Union. Furthermore, research findings that stemmed from the contaminated areas in the Southern Urals could be published within another context.

Gedeonov, the author of an article that was submitted to the newly founded journal *Atomnaia Energiia*, referred to an unpublished work by Kurchatov and Klechkovskii as well as to an article by Dmitrii I. Il’in⁷⁰ and Moskalev in an earlier volume of the same journal⁷¹ to suggest that current research showed the dangers of agriculture and livestock farming in radioactive contaminated areas.⁷² However, Gedeonov’s article dealt with fallout in the course of nuclear tests.

Conclusion

The radioactive contamination of vast territories in the Southern Urals that took place since the late 1940s was unprecedented as was the disaster relief measures to cope with the evolving disaster. Part of the measures was the establishment of sanitary-medical units in the contaminated and in the bordering areas. The facilities were to monitor the health status of the villagers,

carry out medical care, and support the regional administration. In the process of regional and local decision-making, radiation expertise by the ChLenNIIRG played an important role. The assessments and recommendations filled the gap of absent procedures. Sometimes, as the examples of the non-resettled villages, Tatarskaia Karabolka and Bagariak were demonstrated, at odds with Moscow.

At the same time, these institutions were also engaged in research. In the 1950s, new research branches such as radiobiology and radioecology evolved. A series of new professional journals bear witness to these evolving research fields.⁷³ Due to the fact that the Soviet nuclear program and its facilities were kept secret, personal experience was of particular importance. Thus, staff members moved up to high-profile positions. Radiation knowledge, produced in the nuclear landscapes in the Southern Urals, became crucial for the development of permissible doses and radiation protection standards. For further research, the exchange of knowledge and expertise between scientist, physicists, physicians, and sanitary staff that were deployed in the evolving network of institutions dealing with the *radiating* side of the nuclear program should be considered. Not only in Semipalatinsk, but also in Tomsk, Leningrad, and Angarsk, additional branches of the Institute of Biophysics were established as well as further closed institutions in the surroundings of other closed cities belonging to the atomic program.⁷⁴ Conferences held in the mid-1960s suggest that these closed institutions pursued an intense exchange of experience, knowledge, and expertise.⁷⁵

Notes

1. For the euphoria regarding nuclear power and the civil application of the atom as well as for the cult that arose in particular around nuclear physicists, see: Paul R. Josephson, "Atomic-Powered Communism. Nuclear Culture in the Postwar USSR," *Slavic Review*, 55, 2(1996), pp. 297–324; Paul R. Josephson, "Rockets, Reactors, and Soviet Culture," in *Science and the Soviet Social Order*, ed., Loren R. Graham (Cambridge: Harvard University Press, 1990), pp. 168–191; Sonja D. Schmid, "Celebrating Tomorrow Today. The Peaceful Atom on Display in the Soviet Union," *Social Studies of Science*, 36 (2006), pp. 331–365.
2. Mark B. Adams, "Networks in Action. The Khrushchev Era, the Cold War and the Transformation of Soviet Science," in *Science, History and Social Activism: A Tribute to Everett Mendelsohn*, eds., Garland E. Allen and Roy M. MacLeod (Dordrecht; Boston, MA: Springer Netherlands, 2001), pp. 266–267.
3. David Holloway, "Yulii Khariton (1904–96). Physicist, Instrumental in Developing Soviet Nuclear Weapons," *Nature* 385, 6614 (1997), p. 302.
4. This also relates to the lack of discussion of the role of forced labor in the nuclear program; Holloway pointed out that the missing memories are no coincidence, as most Gulag prisoners have not been released after their sentence had ended; David Holloway, *Stalin and the Bomb. The Soviet Union and Atomic Energy 1939–1956* (New Haven, CT: Yale University Press, 1994), p. 193.
5. A.S. Lebedinskii, *Sovetskie uchenye ob opasnosti ispytanii iadernogo oruzh'ia* (Moskva: Sovet Ministrov SSSR, 1959); Matthew Evangelista, *Unarmed Forces. The Transnational Movement to End the Cold War* (Ithaca, NY: Cornell University Press, 1999).

6. Lev D. Riabev, ed., *Atomnyi proekt SSSR. Dokumenty i materialy. Atomnaia bomba 1945–1954, Tom II Kniga 2*, (Moskva: MFTI, 2000), pp. 605–607.
7. On the priority given to the atomic program: Holloway, *Stalin and the Bomb*, p. 129.
8. Vladimir N. Novoselov and Vitalii S. Tolstikov, *Atomnyi sled na Urale* (Chelyabinsk: Rifei, 1997), p. 36.
9. Novoselov and Tolstikov, *Atomnyi sled na Urale*, pp. 87–100; especially pp. 89–90.
10. Novoselov and Tolstikov, *Atomnyi sled na Urale*, pp. 81–87; especially pp. 81–83.
11. Not before 1969, the Radiation Safety Standards (NRB-69) determined that in an accidental situation, the State Sanitary Inspectorate imposed temporary permissible doses due to their assessment of the actual situation. Normy Radiacionnoi Bezopasnosti (NRB-69), Moskva 1970; if a hazard did not reach 250 rad, no extreme measures were taken. If a hazard reached and exceeded 250 rad, extreme measures were taken; A.I. Burnazian, S.M. Gorodinskii, L.A. Il'in, V.M. Kozlov, A.N. Marei, G.M. Parkhomenko, and others, "Osnovnye itogi rabot po sozdaniiu sistemy radiatsionnoi bezopasnosti v SSSR," *Atomnaia Energiia*, 31 (1971).
12. Novoselov and Tolstikov, *Atomnyi sled na Urale*; Vitalii S. Tolstikov, *Sotsial'no-ekologicheskoe posledstviia razvitiia atomnoi promyshlennosti na Urale (1945–1998gg)* (Chelyabinsk: ChGIK, ChIPKRO, 1998); Natalia Melnikova, *Fenomen zakrytogo atomnogo goroda. Ocherki istorii Urala* (Ekaterinburg: BKI, 2006); for a US and Soviet Union comparative approach see, Kate Brown, *Plutopia. Nuclear Families, Atomic Cities, and the Great Soviet and American Plutonium Disasters* (Oxford: Oxford University Press, 2013).
13. Novoselov and Tolstikov, *Atomnyi sled na Urale*, p. 59; Galina A. Komarova, *Pred Techa Chernobyliia. Etnokul'turnye aspekty ekologicheskaiia katastrofy na r. Techa* (Moskva: Inst. Etnologii i Antropologii Ross. Akad. Nauk, 2002) p. 77.
14. OGACHO F. R-1644, op. 1, d. 4a, l. 32–33.
15. Cf., a letter from Burnazian and Sumtsov to Bezdomov, August 11/20, 1956 that elucidates on the corresponding order Rasporiazhenie Soveta Ministrov SSSR № 364rs from January 24, 1956; OGACHO F. R-274, op. 20, d. 43, l. 165.
16. Postanovlenie Vserossiiskogo Tsentral'nogo Ispolnitel'nogo Komiteta i Soveta Narodnykh komissarov RSFSR ot 30.03.1931 "Ob utverzhdenii plozheniia ob izdaniia mestnymi ispolkomami i svetami obiazatel'nykh postanovlenii i o nalozhenii za ikh naruzhenie vzyaskanii v administrativnom poriadke."
17. Andreas Bilinsky, "Sowjetisches Verwaltungsstrafrecht mit einem Überblick über das Recht andere Ostblockstaaten," *Jahrbuch für Ostrecht*, 19 (1978), pp. 9–64 (pp. 19–20).
18. Bilinsky, "Sowjetisches Verwaltungsstrafrecht."
19. Reshenie oblispolkoma № 309, August 4, 1956 "O zapreshchenii pol'zovaniia vodoi reki TEChA"; OGACHO F. R-274, op. 20, d. 43, l. 154–155.
20. OGACHO F. R-1628, op. 4, d. 2087, l. 40–41.
21. Cf. Arkhiv PO "Maiak" F. 1, op. 22, d. 4, l. 81 reproduced in Novoselov and Tolstikov (1997), *Atomnyi sled*, Prilozhenie № 5; OGACHO F. R-274, op. 20, d.53, l. 248–249.
22. In 1955, a medical dispenser was established for the medical care of the Techa population. In 1958, a department of the Leningrad Institute for Radiation Protection (LenNIIRG) was founded in Chelyabinsk in the aftermath of the accident in 1957.
23. Not be confused with the institute of the same name of the USSR Academy of Sciences in Pushchino.
24. In 1947, the medical-biological department of the First Main Directorate (PGU) was reorganized in the 3rd Main Department of the Ministry of Public Health; Postanovlenie Council of Ministries USSR № 2935–951ss "O mediko-sanitarnom obsluzhivaniia predpriatii Pervogo Glavnogo Upravlenie pri Sovete Ministrov SSSR," August 21, 1947, ed., Lev D. Riabev, *Atomnyi proekt SSSR. Dokumenty i materialy. Atomnaia bomba 1945–1954, Tom II Kniga 3* (Moskva: FIZMATLIT, 2002), pp. 307–309.

25. OGACHO F. R-274, op. 20, d. 50, l. 117.
26. Paul R. Josephson, *Red Atom. Russia's Nuclear Power Program from Stalin to Today* (Pittsburgh, PA: University of Pittsburgh Press, 2005), p. 279.
27. OGACHO F. R-1628, op. 4, d. 2087, l. 16.
28. OGACHO F. R-1644, op. 1, d. 4a, l. 76–77.
29. The decision to implement such an infrastructure was taken in March 1958: OGACHO F. P-288, op. 42, d. 70, l. 31–36; OGACHO F. P-288, op. 42, d. 70, l. 36.
30. OGACHO F. R-1644, op. 1, d. 4a, l. 74–75.
31. OGACHO F. R-274, op. 20, d. 53, l. 247.
32. OGACHO F. R-274, op. 20, d. 51, l. 107; Bezdomov referred to Polianskii about 57 tons of destroyed wool and 1,000 tons of sheep, OGACHO F. R-274, op. 20, d. 51, l. 109.
33. OGACHO F. R-274, op. 20, d. 51, l. 106.
34. “Otchet o sanitarno-radiatsionnom obsledovanii s. Tatarskoi Karabolki” June 25, 1959; published on the homepage mts.tatar.ru: Vypiska iz arkhivnogo gok-ta MAYAKA: Otchet o sanitarno-radiatsionnom obsledovanii s. Tatarskoi Karabolki <<http://nuclear.tatar.mts.ru/fa250659.htm>> [accessed August 10, 2018].
35. OGACHO F. R-1644, op. 1, d. 4a, l. 193–195.
36. *Ibid.*, l. 193–194.
37. Postanovlenie № 1282–587, November 12, 1957, to which is often referenced in the accessible archival material but is itself not even in extracts available.
38. OGACHO F. R-1644, op. 1, d. 4a, l. 194.
39. Brown, *Plutopia*, pp. 282–286, pp. 297–305, and pp. 319–323; Kate Brown, “The Forsaken. The Unfinished Business of Making Plutonium in Russia,” *International Labor- and Working-Class History*, 78, 1 (2010), pp. 137–144; see further on this topic Paula Garb, “Complex Problems and no Clear Solution: Radiation Victimization in Russia,” in ed., Barbara Rose Johnston, *Life and Death Matters. Human Rights, Environment, and Social Justice*, 2nd edition (Walnut Creek: Left Coast Press, 2011), pp. 381–406; Paula Garb, “Russia’s Radiation Victims of the Cold War Weapons Production Surviving in a Culture of Secrecy and Denial,” in ed., Barbara Rose Johnston, *Half-Lives, Half-Truth. Confronting the Radioactive Legacies of the Cold War* (Santa Fe: Sarpress, 2007), pp. 249–275; Paula Garb and Galina Komarova, “Victims of ‘Friendly Fire’ of Russia’s Nuclear Weapons Sites,” in eds., Nancy Lee Peluso and Michael Watts, *Violent Environments* (Ithaca, NY: Cornell University Press, 2001), pp. 287–302.
40. Garb, “Russia’s Radiation Victims,” p. 269; Garb and Komarova, “Friendly Fire,” p. 299.
41. Fauzia Baimarova, *Tatarskaia Karabolka – 50 Let v Ob’iatiiakh Smerti* (Kazan: Aiaz, 2007), pp. 4–8 and p. 11.
42. Garb and Komarova, “Friendly Fire,” p. 302; Garb, *Russia’s Radiation Victims*, p. 269; Brown describes the procedure as a crime of opportunity, Brown, *Plutopia*, p. 300.
43. Reshenie № 546ss “O provedenii dopolnitel’nykh meropriiatii v zone radioaktivnogo zagriazneniia”; OGACHO F. R-274, op. 20, d. 51, l. 148.
44. <http://bellona.org/news/ukategorisert/2006-03-techa-2006-competition-hit-by-legal-problems-and-environmentalists-doubts> [accessed September 21, 2016].
45. Novoselov and Tolstikov explain the delay with the inexperience of the authorities; Novoselov and Tolstikov, *Atomnyi sled*, p. 120.
46. Fauzia Baimarova, *Iadernyi archipelag ili atomnyi genotsid protiv Tatar* (Kazan: Aiaz, 2005).
47. OGACHO F. P-2039, op. 1, d. 1, l. 150.
48. Novoselov and Tolstikov, *Atomnyi sled*, pp. 174–175.

49. OGACHO F. P-288, op. 160, d. 390, l. 3–5, l. 7–8; OGACHO F. P-288, op. 160, d. 390, l. 8.
50. Department of Energy Ed., Human Radiation Studies. Remembering the Early Years. Oral History of Radiation Biologist Marvin Goldman, Ph.D., Conducted December 22, 1994, p. 34.
51. Adams, *Networks in Action*, p. 267; Gerovitch pointed out that the cyberneticists Liapunov hold private *krushok* on biology inviting Dubinin, Timofeev-Resovskii, Sakharov and others, Slava Gerovitch, *From Newspeak to Cyberspeak: A History of Soviet Cybernetics* (Cambridge, MA: MIT Press, 2002), p. 183.
52. Although in the second half of the 1950s the isolation of Timofeev-Resovskii dis-integrated, his academic and social isolations still prevailed.
53. Also known as “Sungul.” The laboratory was closed in 1955, and based on the laboratory, the secret city Chelyabinsk-70 was established.
54. Nikolai V. Timofeev-Resovskii, *Vospominaniia. Istoriia, rasskazannye im samim, s pis'mami, fotografiami i dokumentami* (Moskva: Soglasie, 2000), p. 350, p. 360, and p. 367; Timofeev-Resovskii was not in his lifetime vindicated from the allegations of collaboration with Nazi Germany.
55. ARAN F-1955, op. 1, d. 178, l. 1, 2, 3–6, 7, 8, 9–45.
56. OGACHO F. P-2039, op. 1, d. 1, l. 174; see also Novoselov and Tolstikov, *Atomnyi sled*, p. 175.
57. Timofeev-Resovskii, *Vospominaniia*, p. 372.
58. Angelina K. Gus'kova, *Atomnaia otrasl' strany glazami vracha* (Moskva: Real'noe Vremia, 2004), p. 35.
59. Novoselov and Tolstikov, *Atomnyi sled*, p. 167; cf. Normy Radiatsionnoi Bezopasnosti (1970); Normy Radiatsionnoi Bezopasnosti (NRB-76), Moskva 1979.
60. OGACHO F. P-288, op. 160, d. 390, l. 3–4.
61. Brown, *Plutopia*, p. 175.
62. Adams suggests a functional approach adopted by scientists: “they wanted respect, they wanted ideologists and bureaucrats off their backs, and they wanted intellectual control over their own enterprise” but at the same time when “testimonials about the superiority of Marxist or dialectical materialist approaches to science were called for, fine – they would be happy to produce what was required themselves, thank you very much”; Adams, *Networks in Action*, p. 267.
63. “Otchet o rabote partiinogo biuro p/o № 443 s ianvaria 1962 goda po ianvar' 1963 god”; OGACHO F. P-2039, op. 1, d. 1, l. 171–172.
64. Normy Radiatsionnoi Bezopasnosti (1970); Normy Radiatsionnoi Bezopasnosti (1979).
65. Grigorii D. Baisogolov, “Vospominaniia,” in *Kamerton*, 37, 38, 39 (2003) <<http://www.libozersk.ru/pbd/Mayak60/link/278.htm>> [accessed April 5, 2017].
66. The lecture was published in the series on the International Atomic Energy Conference: Angelina K. Gus'kova and Grigorii D. Baisogolov, “Dva sluchaia ostroi luchevoi bolezni u cheloveka,” in *Doklady predstavlennye SSSR na mezhdunarodnuiu konferentsiiu po mirnomu ispol'zuvaniuu atomnoi energii*, Moskva 1955; Seven years later Gus'kova and Baisogolov wrote a follow-up article to their contributions of 1954: Grigorii D. Baisogolov, and Angelina K. Gus'kova, “Eshche dva sluchaia ostroi luchevoi bolezni u cheloveka,” *Klinicheskaiia Meditsina*, 11 (1961), S. 43–56. Not before 1967 Gus'kova became a Soviet delegate in the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR).
67. Zhores A. Medvedev, *Soviet Science* (Oxford: Oxford University Press, 1979), p. 87.
68. Soviet Research on Radiological Safety | CIA FOIA (Foia.Cia.Gov), p. 13 <<https://www.cia.gov/library/readingroom/document/0005310539>> [accessed October 30, 2017].
69. Gus'kova, *Glazami vracha*, p. 176.

70. Il'in was the head of the external dosimetry group of the TsZL (Tsentral'naia Zavodskaiia Laboratoriia) that became an independent laboratory after the accident in 1957 that was integrated in the newly established radio-ecological research station ONIS (Opytnaia Nauchno-Issledovatel'naia Stantsiia) in the oblast' Chelyabinsk in 1958.
71. D.I. Il'in and I.I. Moskalev, "K Voprosu ob obmene tsesiia, strontsiia i smesi γ -izliuchatelei u korov," *Atomnaia Energiia*, 2 (1957), pp. 163–168.
72. Gedeonov, L.I., "Radioaktivnoe zagiaznenie atmosfery", *Atomnaia Energiia*, 2 (1957), pp. 260–271 (p. 270).
73. The journal *Biofizika* has been published since 1955 and the journal *Radiobiologiia* has been published since 1960.
74. Gus'kova, *Glazami vracha*, p. 124 and p. 189
75. OGACHO F. P-2039, op. 1, d. 2, l. 82; OGACHO F. P-2039, op. 1, d. 3, l. 55; OGACHO F. P-2039, op. 1, d. 4, l. 18.

4 Between Profession and Politics

Specialists in Radiation Medicine at the plutonium Plant No. 817 in the Chelyabinsk Region

Olga Nikonova

The atomic project, within the framework of which medical and biological radiology was born and formed in the USSR, embodied the scale, inconsistency, and tragedy of the Soviet history of the twentieth century. As David Holloway writes, the atomic project “became a peculiar combination of the best and the worst in Soviet society – enthusiastic scientists and engineers, educated under the Soviet regime, and prisoners who lived in inhuman conditions of camps.”¹ The accelerated pace of construction and commissioning of weapons-grade plutonium production plants led to technological errors in the production and disposal of radioactive substances and to accidents at one of the first nuclear facilities in the USSR – the Plant No. 817 in 1949–1951, 1957, and 1967. These events resulted in the radiation exposure of builders, workers of the combine, and the population of nearby settlements, as well as the serious radiation-contamination of a part of the territory of the Urals’ region. The risks and consequences of accidents at nuclear production plants prompted the formation of specialized expert communities, including in the fields of radiation, medicine, and biology. How these expert communities functioned, how they obtained, accumulated, and used knowledge demonstrate the specificity of interrelations between science and politics in Soviet society, as well as the importance and role of experts in solving political and social problems in the Soviet period.

The focus of this chapter is on the physicians who were engaged in radiation medicine at the Plutonium Plant No. 817, and specifically, the most prominent figures among them – Grigorii Baisogolov and Angelina Gus’kova. The total number of the group of Ural experts in the field of radiation medicine is currently impossible to determine due to the lack of access to the archives of the closed enterprise. The presence of memoirs, including memoirs about the individuals, and scientific and popular literature, which were authored by Baisogolov and Gus’kova themselves, determined the choice of personages for this chapter. All sources are publicly available and appeared mainly at the turn of last century, from the 1990s to the early 2000s. The memoirs of Baisogolov and Gus’kova often take the form of interviews or are built into literary or journalistic essays about them. Many of the texts have a “jubilee character,” which has led to a specificity of the narrative – fragmentation, the

glorification of events, and a one-sided positive image of the protagonists. As all texts involved in the analysis are a retrospective view of the events, it is necessary to take into account the distortion of the perception of events associated with the “functioning” of memory and the effects of nostalgia for the Soviet Union.

Toward a Sociocultural Approach to Radiation Medicine

The history of the medical service for the workers at the main complex of the nuclear industry in the Urals, as well as the development of radiation safety standards in the plutonium Plant No. 817, and the eradication of the consequences of accidents from the 1940s to the 1960s is a historiographical “patchwork blanket,” collected from the research on the history of the nuclear industry in the USSR² and the history of the plutonium Plant No. 817,³ radiation medicine and radiological facilities in the Chelyabinsk region.⁴ The authors of the texts are not only professional historians, but also physicians, journalists, eyewitnesses to events, and accident clean-up workers (liquidators), who tried themselves in the genres of historical journalism and popular history. The research works concerning medical subjects, as a rule, are written in line with the classical history of medicine and the Soviet-Russian history of the atomic project: they are notable for their descriptive nature and desire to glorify the atomic project and nuclear scientists. The source base of the research is furthermore very limited due to the secrecy surrounding the corpus of documentary materials.

This chapter suggests a new perspective on the sources that have already been put into circulation – to analyze them from the point of view of the sociocultural history of medicine. At the same time, the emphasis shifts from studying the process of accumulation and progress of medical knowledge (mainly through the prism of medical discoveries and biographies of great scientists) to the exploration of medical practices in their political, social, and cultural context, the interactions within expert communities, the relationship between the doctor and the patient, the disease as a social and cultural phenomenon, etc. For Russian historiography, this is still a relatively new trend, and there is no such account of the history of Soviet radiation medicine that presents a sociocultural approach to this field. The main reason for this is the limited access to sources, as well as the fact that the majority of the media and scientists working in this field, have been and still are, bound by nondisclosure agreements.

In order to “place” the analyzed medical radiologists in the context of the epoch and its inherent power relations, this chapter will analyze the specific characteristics of the institutionalization of the community of experts, their professional communication and ethos, questions about the possibilities of self-fulfillment in Soviet science of the period of the 1940s and 1950s, and the specifics of scientific careers in the “secret” branches.

The Expert Community in the Field of Radiation Medicine

The formation of modern radiological disciplines in the USSR began in 1945 as part of projects to develop nuclear weapons.⁵ The groups of enthusiastic scientists who were engaged in radiology before World War II developed into structured, hierarchical communities of experts. On the one hand, the formation of radiological disciplines was a continuation of prerevolutionary practice, when scientists were united in special committees under certain ministries.⁶ On the other hand, ideology and mobilization techniques had a huge impact on expert communities, their professional culture, and communication.

During the period when the atomic project in the USSR was at the stage of experiments and laboratory research, a small group of leading specialists in the field of radiation biology and medicine was formed mainly in Moscow and Leningrad. In the course of the development of the nuclear industry, the Institute of Biophysics of the Third Directorate of the Ministry of Health of the USSR became the central organization of the radiation medicine expert community.⁷ At the same time, a number of research institutions concentrated on the problems of radiation impact on living organisms, occupational health and safety at nuclear facilities, and radiation safety issues.⁸ In the late 1940s and early 1950s, their directors and employees made up the scientific and managerial top of the system of medical and biological protection in the USSR and carried out not only experimental research, but also the development of measures and practices to protect workers in the nuclear project and the standards of maximum allowable doses of radiation and treatment schemes for occupational diseases.⁹ Many of them were reputable scientists with experience in administration and organizational work. Representatives of Soviet science, such as Academician-Secretary of the Academy of Medical Sciences (AMN) and biophysicist Vasili Parin,¹⁰ Professor Gleb Frank (Scientific Secretary), Academicians Leon Orbeli and Nikolai Anichkov, cancer specialists Moisei Domshlak and Nikolai Petrov,¹¹ director of the Institute of Occupational Diseases of AMS, Academician Avgust Letavet, head of the Special Department at the Ministry of Health (MZ), Avetik Burnazian, and others, were a group of so-called opinion leaders and organizers of medical and biological radiology.

The development of the nuclear industry has required the expansion of the expert community and the study of new conditions and threats that have arisen in the industrial production of radioactive plutonium. This forced the formation of a new group of experts, whose relations with the “opinion leaders” were not simple, reflecting both the generational conflict in science and the organizational specifics of the centralized and classified Soviet nuclear industry.

At the stage of construction of Plant No. 817, the medical care of the personnel was fully under the responsibility of military doctors and medical institutions of the Ministry of Internal Affairs.¹² In May 1947, the civil

authority joined the organization of medical services. By order of the Ministry of Health, the medical and sanitary department No. 71 (MSO No. 71) was created at the plant, which was staffed not only by military doctors, but also by graduates of the residencies of the Chelyabinsk, Sverdlovsk, Moscow, the Leningrad medical institutes, and the Troitsk Medical College.¹³ The staff of MSO No. 71 became the core of the group of experts in the South Urals, which later became the first branch of the Institute of Biophysics (FIB-1). Most of this expert community consisted of young scientists and medical practitioners, whose professional development coincided with the formation of the nuclear industry. Grigorii Baisogolov (1921–2003) headed the second therapeutic department of MSO No. 71, and since 1953, the FIB-1. Baisogolov graduated from the medical faculty of the Tbilisi Medical Institute, and during the war, he worked as a doctor in an evacuation hospital. After graduating, he was trained in the hemotherapy clinic of the Central Institute of Hematology. Angelina Gus'kova (1924–2015), a world-renowned radiation medicine specialist, came from a family of doctors, graduated in 1941 from the Sverdlovsk Medical Institute, remained for residency at the Clinic of Nervous Diseases and Neurosurgery, studied malignant brain tumors, and finally found herself in a “closed city.” Initially, the small scientific group dealing with radiology included the therapists V.N. Doshchenko, V.I. Kiriushkin, dermatologist E.L. Emanova, and radiochemists T.N. Rysina and V.I. Petrushkin.¹⁴ After the creation of FIB-1 from 1953 to 1955, specialists of the secret laboratory “B” in Sungul – physicists taken from Germany¹⁵ and famous prisoners such as geneticist and biologist Nikolai Timofeev-Resovskii – joined the team. In particular, Lev Buldakov became the head of the FIB-1 toxicology laboratory.¹⁶ In her book, both written as a generalizing work and partly as her recollections of the past, Gus'kova referred to the Ural specialists in the field of radiology as “surprisingly brave and professional, highly competent youth collectives.”¹⁷

It should be noted that the abovementioned expert communities of medical and biological radiology embedded within a specific scientific organization of the USSR where, starting from the 1920s, a personified model of scientific knowledge production emerged. Government funding and administering of science, as it was noted by N. Kremontsov, tended to paternalism and concentration of “power” within a certain scholarly environments in the hands of several well-known persons: “this kind of policy often turned to the ‘monopoly’ of these leading men on the development of their disciplines.”¹⁸

This point is important for understanding the inner relations within the expert community of radiation medicine.

Reflection of Political Processes in the Memoires of Ural Medical Professionals

The group of radiological experts working in the nuclear industry was originally a closed corporation bound by general secrecy, nondisclosure signatures, or military oaths. The principle of strict secrecy applies to this expert

community up until today. In their memoirs, written and published in the late 1990s to early 2000s, as a rule, radiological doctors practically did not touch upon actual topics of the Soviet history of the late 1940s or early 1950s, which at that time were actively discussed in the mass media, historical journalism, and by the general public. Nevertheless, even taking into account the fact that the texts of our protagonists are full of “the utmost silence,” they contain unique evidence of the era and its understanding.

The central problem of the postwar period – the frustrated hopes for the liberalization of the regime and the new wave of repressions¹⁹ – is occasionally reflected in the recollections of the physicians, but is also present in the texts of different genres, for example, in an interview with Baisogolov and Gus’kova and in Gus’kova’s popular scientific work, “The Nuclear Industry in the Country through the Eyes of a Doctor,” published many years after the first public statements.

The texts of Baisogolov and Gus’kova testify to the fact that the professional development of the group of specialists in radiation medicine and biology was closely connected with the political processes that took place in the postwar USSR. Thus, an integral element of their “entry into the profession” was coercion. After completing her residency, Gus’kova was placed under “distribution,” meaning that the Soviet authorities were free to send her where they saw fit. She remembered: “I had no desire to go to Chelyabinsk, I did not want to change the present fate. I worked in Sverdlovsk, in the Clinic of Nervous Diseases, and was already preparing my thesis. At that time, the ‘recruiters’ arrived... I resisted as much as I could and finally agreed to go only to the Urals – since we have to deal with ‘nuclear affairs.’”²⁰ Gus’kova does not explain who the “recruiters” were, to whom she refers, or how she was persuaded to go. Only the words “resisted as much as I could” hint at coercion, which was an integral component of the experts’ biographies. Like Gus’kova, Grigorii Baisogolov was forced to change his professional trajectory. After the war, he intended to write his PhD thesis in Moscow. Baisogolov went to the South Urals after a personal conversation with the Deputy Minister of Health of the USSR, A.I. Burnazian, who promised him every assistance in a future in interesting scientific work. In the short memoirs, published by local historians in Ozersk in 2003, Baisogolov noted with bitterness that the majority of the promises were never fulfilled.²¹ Among those who “at the request of the country” had to “‘throw everything away’ and rush into the unexplored field of new science – radiobiology” was the future deputy director of FIB-1, and later its head, Vladimir Lemberg. If it had not been for the sharp turn of his professional career that brought him to the Plant No. 817, Lemberg could have, according to Gus’kova, become a renowned pathologist.²²

The German physicist Nikolaus Riehl,²³ who worked near Lake Sungul at Laboratory B, characterizes in his memoirs the different levels of coercion in the expert community of physicists, biologists, and geneticists, of

which he was a part: from the removal of choice with regards to one's "distribution" to nuclear enterprises to the status of prisoners, who were convicted political scientists working in the "*sharashka*."²⁴ This is how the "government voucher" was issued to Viktor Doshchenko, a graduate of the First Leningrad Medical Institute named after academic I.P. Pavlov, an honors student and a *Stalin's scholarship's holder*: "It seems that fate tested the young doctor's strength," he recalled after his arrival at the plant.²⁵ The most extreme form of coercion was, of course, work in the nuclear project as a prisoner. However, the strict secrecy of nuclear production led to the emergence of closed spaces of camp style for "free citizens," which was characteristic not only for the USSR, but also for the nuclear industry in other countries.²⁶ Based on her memories and the memories of her colleagues in the MSO No. 71, Gus'kova observed: "Our future beautiful city in 1948-1950 was blocked by wire, and prisoners worked behind it. We made our way to work between these barriers or along narrow forest paths."²⁷ Indeed, forced labor was widely used in the construction of Plant No. 817. By the beginning of 1948, the number of prisoners involved in the construction of the plutonium plant was about 20,000 people.²⁸ The work of the research laboratories involved prisoners with well-known names in science, for example, N.V. Timofeev-Resovskii²⁹ (Laboratory "B"), who was both prisoner and doctor among the enterprise.³⁰

The "camp" effect thus arose both in direct contact with prisoners and in restricting individual rights and freedoms. "When I was sent to this system in 1948, my parents thought I had been arrested because all my connections had been severed and I could not go home," explained Angelina Gus'kova in an interview with "*Atomnaia énergíia*" in 2005, expounding that "for two years I saw nothing, no family, just barbed wire. I was only sent to Moscow on business trips, but no meetings with my family. The first time they let me go home for several hours was when I accompanied B.L. Vannikov and E.P. Slavskii³¹... on their trip to the Urals. There was a detour around the base along the Urals past Nizhnii Tagil, and they let me go home for a few hours. For the first time in 1951, I met with my family."³² Baisogolov found himself in a similar situation. In 1950, when he was appointed head of the Second Therapy Department, it signified a decisive change of lifestyle: for three years he could not meet his parents living in Tbilisi, as "the departure from Chelyabinsk-40 [...] to the 'big land' was very limited. They did not even allow one to go on vacation, paying instead 150% of the allotted vacation pay."³³ In the early 2000s, Baisogolov recalled how he and his wife had their passports confiscated at the "*Dal'niaia dacha*," where specialists who were going to plant No. 817 lived for a short time. With regret, he wrote about friendships and friends that had been lost because of deliberate restrictions on contacts: "Taking into account the need to inform the plant's security department about all my meetings in writing upon my return (this was the order of the day), I tried to reduce them to people not related to the nuclear industry,

in order to avoid possible troubles for them, which led to the fact that I lost many friends and acquaintances.”³⁴

Lysenkoism³⁵ and the repressions against doctors,³⁶ which were gaining momentum in the years when the first nuclear reactor was being built and launched, contributed to the injection of an alarming atmosphere. Academy member V.V. Parin, member of the expert group, was also involved in the case surrounding professors Roskin and Kliueva. The echo of the persecution also reached the closed-door enterprise in the South Urals. In 1952, according to the memoirs of Baisogolov, V.I. Masliuk, a student of the arrested academician V.N. Vinogradov and candidate of medical sciences G.I. Markman, was “expelled” from the MSO No. 71. “Obviously, there were others,” added Baisogolov, “but I don’t remember them.”³⁷ For the second time, he recalled the threat of repressions in connection with one inspection visit to the plant from Moscow.

In the modern historiography of the nuclear industry, it is recognized that the construction and launching of the first industrial nuclear reactor was carried out under extremely tight deadlines, without proper approbation and in extremely dangerous conditions for human life and health. The commissioning of the reactor was accompanied by accidents, the restoration of which took place in conditions of increased radiation exposure.³⁸ This resulted in the overexposure of reactor operating personnel, engineers and management representatives.³⁹ As the head of the therapeutic department, Baisogolov, was soon faced with a significant number of overexposed plant workers, three of whom died of acute radiation sickness. Under the circumstances that there was no clear understanding of the clinical situation of acute and chronic radiation diseases, the scheme of their treatment was not known. The doctors of the Second Therapy were forced to act by trial and error based on their feelings and intuition. Clinical symptoms of radiation lesions from high doses of radiation were established by observation, and methods of disease control were found experimentally. Already in the first years of work, there were disagreements between experts of central institutions and doctors of the plant. Thus, an inspection from the Moscow Institute of Biophysics, consisting of the director of the institute, A.S. Arkhipov, and the head of the clinic, N.A. Kurshakov, came to clarify the circumstances of the deaths, and thoroughly checked the history of diseases of patients. Baisogolov recalled with displeasure that Arkhipov, a hygienist by profession, “tried to incriminate the lack of activity in the recovery of patients” at the time of clinical death, with which he himself categorically disagreed. The intercession of the second inspector, Kurshakov, did not find “any crime at all” in the actions of doctors, as Baisogolov recalled with happiness and explained: “We must remember that all this happened in early 1953, even before Stalin’s death, when the leading doctors of the country were in prison and a campaign to identify ‘enemies of the people’ among medical workers, including in our closed city, was already underway.”³⁹

How Secrecy Shaped the Professional Lives and Careers of Medical Radiologists

The regime of secrecy can presumably be attributed to one of the main “deforming” factors in the life of our protagonists. The isolation of the enterprise, where Baisogolov, Gus’kova, and other FIB-1 specialists worked, caused impenetrable barriers within the medical-biological community of scientists, and between Soviet specialists and the professional community of radiologists abroad. At the same time, this secrecy made the Plutonium Plant experts “invisible” for both world and domestic science, thereby undermining their careers. Many physicians and biologists in their texts recognize measures to ensure secrecy as exaggerated and harmful.

Extreme secrecy was intertwined with the almost absolute novelty of the phenomena faced by clinicians and researchers-experimentalists working in biomedical institutions of the plant. “The creation of the nuclear industry for the first time has faced mankind with a long repeated (chronic) general external influence of ionizing radiation on significant contingents of people with the possibility of radionuclides entering their bodies,” underlined Baisogolov, Doshchenko, and Koshurnikova: “Essentially, there was a complete lack of information at the clinic on such effects, pathogenesis, the possibility of restoring lost functions and their dependence on the volume of exposure...” they expounded.⁴¹ Both leading specialists of the Second Therapy Department in the early 1950s – Baisogolov and Gus’kova – point out that in the USSR, data on the analysis of the consequences of the US bombings of Hiroshima and Nagasaki,⁴² and clinical manifestations of acute radiation sickness was available in individual publications on the topics of interest to radiologists.⁴³ Articles from American and Japanese journals could be read by Soviet physicians in translation in collections compiled by the Third Department of the Ministry of Health. According to Baisogolov, the articles were important and interesting, but not very concrete: “... as far as I remember, they did not give a description of the mechanism of hematopoiesis disorders, and this is the main thing in radiation sickness.”⁴⁴ Moreover, even these translated articles could not be received freely. As Baisogolov writes, they, “...for some reason, were stored in the First Department and were not given out freely. Only after the intervention of A.I. Burnazian, who once again visited Chelyabinsk-40, were they made more accessible.”⁴⁵

It was not only the available scientific research that was difficult to access. The strict regime of secrecy complicated the very process of collecting empirical data. Medical workers were not allowed to keep diaries, records, or take photographs of dosimetry data. As Gus’kova points out:

in overcoming the regime’s prohibitions, physicians sought to know as much as possible about working conditions and radiation doses to workers. This was very difficult in terms of secrecy, and so much remained unknown. The memory of medical professionals was burdened with a

tremendous amount of factual data and figures, which were forbidden to record in writing.⁴⁶

One of the most important achievements of the plant's doctors was the establishment of uninterrupted operation of medical stations that in fact, performed the functions of "experimental laboratories" for the collection and accumulation of necessary information. V.N. Doshchenko, the head of the health center at the chemical-metallurgical factory, recalled:

...we conducted a thorough medical examination of all personnel every 2 months, although according to the instructions of the Ministry of Health it was to be done once a year. As the most accurate indicator of the harmful effect of radiation on the body, first of all, the blood was looked at, for which all the medical stations were equipped with such hematological laboratories, which were available only in regional hospitals. A detailed blood test was performed on each employee. To give an idea of the load that fell on doctors and nurses of medical stations, it is enough to name one figure: in the first five years alone, they conducted more than 100,000 (!) medical examinations. If it hadn't been for the medical stations, the number of illnesses and deaths would have been much higher.⁴⁷

Due to the secrecy regulations, the storage and systematization of the material obtained through the medical inspections was difficult. Medical staff and doctors had to invent "tricks and ciphers:" the patient's medical book number in the records meant his accumulated radiation dose, radiation sickness was designated in the documents as "astheno-vegetative syndrome," and the names of nuclides were indicated by numbers. "All this," explained Gus'kova, "undoubtedly made it difficult to read documents, especially in subsequent years."⁴⁸

Professional Ethos, Career, and Conflictual Spaces of Communication

The group of radiological medical experts of the plant No. 817 represented clinicians who performed the functions of medical practitioners and researchers at the same time. The duality of professional duties determined the main "areas" of conflict that arose in interaction with the leadership of the enterprise and in communication with scientists-experimentalists of central medical, biological, and radiological institutions.

At the initial stage of the nuclear project, plant workers were removed from hazardous workshops only after clinical signs of disease appeared. Medics were only able to withdraw people based on the accumulated dose of radiation after fatalities had occurred. Gus'kova recalled that the doctors of the Second Therapy have literally "won" this right.⁴⁹ Thus, Efrosin'ia Emanova,

who arbitrarily gave one of her employees a labor ballot that allowed them to work only in “clean” conditions, was summoned to her boss. There she was told that “we don’t need doctors like that, who interfere with production”⁵⁰ and then lost her factory pass. The authors of the analyzed memories do not deny that they often had to compromise but always emphasize that they were on the side of the patients. Firm moral and ethical principles and professionalism are the subject of special attention in the texts of the protagonists. “More than 50 years passed, and I still remember our first occupational patients, whose lives we could not save,” recalled Emanova. She continued that, “of the five shift supervisors of the 25th plant, only one, who received a total of more than 1000 X-rays, lived to 2001. It is not only the destiny of our patients, but ours too, because we literally put our souls into each of them, felt sorry for them, even arranged their personal affairs.”⁵¹

The main specialized diseases that physicians faced during the construction and beginning of operation of the nuclear plant were acute and chronic radiation diseases, as well as various diseases caused by the accumulation of radiation in the body, such as plutonium pneumosclerosis. Gus’kova revealed, with regard to the first years of operation of the plant, that the most dangerous radiochemical plant (plant B) in the period of 1949–1953 diagnosed more than 1500 cases of chronic and 11 cases of acute radiation diseases.⁵² According to the doctor of the Second Therapy, N.A. Koshurnikova, there was no chronic radiation sickness before the establishment of the atomic industry in the USSR, and it was not known about at the American nuclear enterprises, because workers were not allowed to stay for a long time in the conditions of increased radiation.⁵³ This “purely Soviet acquisition” was related to the specifics of the Soviet nuclear project, which was carried out in an extremely short period of time, using mobilization technologies and forced labor. A clear clinical picture of the effects of radiation on humans did not yet exist, and a diagnosis proved difficult and often provoked controversy among experts. The diagnosis of plutonium pneumosclerosis could not be sustained until the number of deaths had reached four. South Ural physicians successfully managed to convince their colleagues from Moscow that the disease had nothing to do with tuberculosis.⁵⁴

Angelina Gus’kova notes that in order to solve complex medical problems in atomic cities, they often invited “scientists, founders, and hoped that this task would not present a great deal of difficulty for them.” However, the approaches of radiographers and radiologists, who dealt with local exposures, were not suitable for physicians at a closed plant, as the exposure there was total. The desire to transfer the patterns found in Moscow laboratories to the situation in the Second Therapy led to misunderstandings and conflicts. “Even such a prominent scientist as Tareev,” recalled Gus’kova,

who, it would seem, should have taught us, the young ones, and guided us on the right path (for this very purpose he was invited to the Urals), was unable to understand all the novelties of the observed phenomena

and take the right scientific position. When we saw the blood indicators fall to lower levels, we immediately began to worry: ‘There were 6,000 white blood cells, only 4,000 were left, a whole third less’, and he said that it was no big deal: ‘Well, you know, 2,000 less. Sometimes it happens. After a while, everything will recover by itself.’ And even made ironic notes in the margins of our notes: ‘It’s a passion for boys and girls.’⁵⁵

Tareev ironically compared Gus’kova and Baisogolov here with a little girl and boy, although they were both already practicing doctors at the time. They were indeed younger than he was, but his irony was intended to emphasize the superiority of his own research, as his scientific approaches differed in methods and results from those of Gus’kova and Baisogolov.

Many years later, already having won the Lenin Prize and having authored a “secret” monograph on radiation sickness, Baisogolov and Gus’kova once again indicate this problem in the first public edition of their book: “In the specialized literature, including in recent years, the gap between radiologists, clinicians and experimenters has not yet been bridged. Summarizing the accumulated clinical experience and taking into account the experimental data, from our point of view, should be one of the main sources of building a general theory of the effects of radiation on the body...”⁵⁶

The significant amount of empirical material compiled by the physicians of the Plant No. 817 became the basis for the first scientific classifications of human radiation injuries and methods of combating the effects of radiation exposure. The secrecy regime strictly observed by the Moscow leadership, however, became an obstacle not only on the way of spreading this knowledge, but also on the experts’ way of achieving international recognition. Baisogolov recalled that he and Gus’kova were asked to prepare a report on acute radiation sickness for the Geneva Conference in 1955: “The report was prepared, but neither Angelina Konstantinovna nor I were asked to go there. The report was read by M.P. Domshlak.” Baisogolov believes that one of the reasons for the replacement of the speaker was also his disagreement with the Deputy Director of the Institute of Biophysics, N.A. Kraevskii,⁵⁷ on scientific issues.⁵⁸

As leading experts in radiation medicine, Gus’kova and Baisogolov have long been in the shadow of Moscow academics. Their colleagues from the Second Therapy mentioned in their memoirs⁵⁹ that it was secrecy that became a barrier to international recognition and scientific status. Angelina Gus’kova managed to break the “curse of secrecy” after the Chernobyl disaster, when she became an expert on radiation exposure with international status. Grigorii Baisogolov, however, is still considered by many colleagues to be a specialist, whose merits are not sufficiently appreciated in science.

Gus’kova seeks to problematize their “invisibility” and lack of acceptance them as experts and, at the same time, argues that it was unreasonable classification of their findings that resulted with the mess during the Chernobyl accident when medical personnel proved unable to provide quality aid to the

victims. Later, she confessed in the interview with popular journal “Science and Life”:

I have bitter memories of our failed attempt, when in 1970s the nuclear physicist A.A.Moiseev and I proposed a book manuscript exploring the radiological emergencies and urgent measures after an open land nuclear explosion and after an industrial accident with nuclear core containment failure. The deputy minister A.M.Burnazyan grabbed it in anger and threw on the floor with the words—“you’re just planning this atomic accident, are you?!” And we were strictly prescribed to publish only the part with description of emergency aid to the victims of military explosions⁶⁰

Conclusion

Radiation medicine experts such as Baisogolov, Gus’kova, Buldakov, Emanova, Koshurnikova, etc. were talented clinicians whose development took place throughout the process of creating the nuclear industry. The regime of extreme secrecy, under which all doctors of the closed cities and the nuclear enterprises were held, “deformed” their daily lives, social relations, and professional activities to the greatest extent. A significant portion of their professional lives was “invisible” to the scientific community in the USSR and abroad, and in the historical perspective, they were hidden from the historiography of the atomic project and its effects and developments. In her monograph “The Nuclear Industry of the Country through the Eyes of a Doctor,” Angelina Gus’kova regrets the absence of information “about medical and biological support of the industry,” among new publications: “a view of the industry from the inside, from the point of view of ordinary people who have experienced a complex range of feelings: pride for their involvement in the great feat and anxiety for themselves and their loved ones, the joy of overcoming, and gratitude to those to whom they could entrust their experiences in that difficult time of secrecy.”⁶¹

In the post-Soviet era, the regime of secrecy has also influenced the collective memory of the events at plutonium Plant. The memoirs of the participants of the atomic project, published in Russia, form today a discourse built on the model of glorification of the past. The texts of the physicians clearly present the ideas of sacrifice, loyalty to professional duty, care for patients, and the maximum efforts undertaken to save them. There are only rare emotional references to alternative interpretations. For example, Gus’kova rejects the claims that doctors concealed the diagnosis of radiation lesions with “false evidence” and emphasizes that “the interaction between doctors and employees of the plant was especially strong, of course, in acute emergency situations. Well, at that time the doctors became one big family, selflessly struggling day and night to save the victims.”⁶² The texts of our protagonists bear the imprint of the ambivalence of memories – a phenomenon noted by

one of the participants of those events, Fedor Liass. Sent from the Institute of Biophysics to the South Urals in 1950–1951 to run a biophysical laboratory and who subsequently survived the arrest of his mother in the infamous “Doctor’s Plot,”⁶³ and after emigrating to Israel, he published a memoir–study of the trials against Jews. In it, he describes the phenomenon of ambivalence of the societal and moral atmosphere of the late Stalin period. The duality of the public consciousness, in which fear and joy, lack of freedom and creative flight coexisted, was especially evident in these memoirs. On the one hand, he mentions the deep fear on which the repressive Stalinist system was based, and on the other hand, the normal course of daily and professional life in the conditions of the unfolding repressions: “All this cuisine, cooked in the depths of Lubyanka, was naturally unknown to us, who were free. Life proceeded in its turn. Medical professors were busy with their own business: they treated the sick, gave lectures, conducted seminars and lived the usual life that the whole country lived with its worries, anxieties and joys.”⁶⁴ The “normality” of life, as described by Liass, was extremely unstable and disappeared at the first knock at the door by a NKVD officer. In the memoirs of radiologists, this instability and borderline existence is also described. In the texts of the doctors who lived in a closed city and worked at a nuclear enterprise, the “normality” and “abnormality” of social life coexist with each other, they are the same moments. Thus, the subjects about the discomfort caused by the deprivation of freedom of movement are replaced by descriptions of the beautiful nature of the Urals, complaints about the suffocating secrecy flow into admiration for the “communist” spirit of life, into stories about free and inspiring discussions on complex scientific topics in the FIB-1. The ambivalence of Soviet life is manifested in the memories of radiologists in all its brightness and expressiveness.

The questions raised in this chapter are a tiny fragment of a large unwritten story about the experiential dimension of the Soviet nuclear project. The reconstruction of this story is complicated by many factors – the continued secrecy of documentary materials, the departure of a generation of atomists and radiologists who are direct witnesses to the events, and the vigilance of today’s political elite with respect to this “painful topic” from the past. However, without the stories related to the actors of biomedical radiology, the history of the Soviet atomic project and its high risks remain incomplete.

Translated from Russian by Joshua R. Kroeker

Notes

1. David Holloway, *Stalin and the Bomb: The Soviet Union and Atomic Energy, 1939–1956* (Novosibirsk: Sibirskii khronograf, 1997), 232.
2. The complex of scientific, popular scientific literature, and sources is presented on Rosatom’s website: <http://elib.biblioatom.ru>.
3. Cf.: V.N. Novoselov, V.S. Tolstikov, *Tainy «sorokovki»* (Ekaterinburg: IPP «Ural’skii rabochii», 1995); I.A. Bochkareva, “Formirovanie i razvitie sistemy radiatsionnoi bezopasnosti na Urale v 1945–2011” (PhD. Diss, k.i.n. Chelyabinsk, 2018); V.N.

- Kuznetsov, *Atomnyi proekt za koliuchej provolokoi* (Ekaterinburg: Poligrafist, 2004); V.N. Kuznetsov, *Atomnye zakrytye administrativno-territorial'nye obrazovaniia Uralskoi istoriia i sovremennost'* (Ekaterinburg: Bank kul'turnoi informatsii, 2015), vol. 1: Sovetskii period. 2015 i dr.
4. A.K. Gus'kova, *Atomnaia otrasl' strany glazami vracha* (Moskva: Real'noe vremia, 2004).
 5. R.M. Aleksakhin, *Problemy radioëkologii* (Moskva: Rossel'skhozakademiia, GNU VNIISKHRAË, 2006), 730–731.
 6. N.L. Kremmentsov, *Stalinist science* (Princeton, NJ: Princeton University Press, 1997), 15–16.
 7. Cf.: L.D. Riabeva, ed., *Atomnyi proekt SSSR. Dokumenty i materialy. Vol. II. Atomnaia bomba. Book 1.* (Moskva: Nauka Fizmatlit, 1999), 87; Gus'kova, *Atomnaia otrasl' strany glazami vracha*, 26; G.R. Ivanitskii, "Vremia rasstavliaet aktsenty: K 100-letiiu so dnia rozhdeniia akademika G.M. Franka" *Vestnik Rossiiskoi Akademii Nauk* 74, 4 (2004): 345.
 8. The Institute of Experimental Medicine and the Institute of Morphology and the Physiological Institute named after V.I. Lomonosov Pavlov Institute of Experimental Medicine, Physicochemical Laboratory of the USSR Academy of Sciences, Pavlov Institute of Occupational Diseases, Pavlov Institute of Morphology and Physiological Institute. Obukhovskaia hospital, various departments of the Military Medical Academy and other institutions of specialized management of the nuclear industry and structures of "civil" science, dealing with "closed" topics (academic and departmental institutes); Cf. Riabeva, *Atomnyi proekt SSSR, Vol 2.*, Book 4, 91, 93–95.
 9. Gus'kova, *Atomnaia otrasl' strany glazami vracha*, 33–35.
 10. L.D. Riabeva, ed., *Atomnyi proekt SSSR: Vol II, Atomnaia bomba, Book 2* (Moskva: Nauka Fizmatlit, 2000), 200.
 11. On the structure of the occupational safety section, cf.: Riabeva, *Atomnyi proekt SSSR: Vol II, Atomnaia bomba*, 201.
 12. The medical service was managed by the Sanitary Department (SANO) of base No. 10 of the Ministry of Internal Affairs. Major of the medical service L.B. Èpshtein presided over the Sanitary Service. Cf.: A.K. Gus'kova, "Meditsina vsegda byla riadom," in *Sozdanie pervoi sovetskoi iadernoi bomby* (Moskva: Energoatomizdat, 1995), 148–149.
 13. Gus'kova, "Meditsina vsegda byla riadom," 152–154.
 14. Gus'kova, *Atomnaia otrasl' strany glazami vracha*, 35.
 15. Christoph Mick, *Forschen für Stalin. Deutsche Fachleute in der sowjetischen Rüstungsindustrie 1945–1958: Abhandlungen und Berichte des Deutschen Museums in München, Neue Folge, Bd. 14* (Munich, Vienna: Oldenbourg Verlag, 2001).
 16. B.M. Emel'ianov, V.S. Gavril'chenko, eds., *Laboratoriia «B»*. Sungul'skii fenomen (Snezhinsk: Izd-vo RFIATS-VNIITF, 2000), 87.
 17. Gus'kova, *Atomnaia otrasl' strany glazami vracha*, 46. Specialists included in FIB-1 are also mentioned in: È.R. Liubchanskiĭ, S.A. Romanov, "Vklad IUzhno-Ural'skogo instituta biofiziki v likvidatsiiu i preodolenie posledstviia avarii v 1957 g. na PO «Mayak»," in *Regional'naia nauchno-prakticheskaia konferentsiia VURS-45. Trudy i materialy. Ozersk Chelyabinskoi obl., 26–27 sentiabria 2002 g.* (Ozersk: Redaktsionnoi-izdatel'skii tsentr VRB, 2002), 17–18.
 18. Kremmentsov, *Stalinist science*, 22.
 19. Cf. on this subject: E. IU. Zubkova, *Poslevoennoe sovetskoe obshchestvo: politika i povsednevnost'. 1945–1953 gg.* (Moskva: ROSSPËN, 1999).
 20. Typically, graduates were simply distributed and not asked about their wishes. In the case of Gus'kova, however, negotiations seem to have taken place. Cf. V. Gubarev, "Professor Angelina Gus'kova: na lezvii atomnogo mecha," *Nauka i zhizn'*, 4 (2007), 23.

21. G. Baisogolov, "Vospominaniia," Kamerton. – 2003. – № 37, 38, 39, <http://www.libozersk.ru/pbd/Mayak60/link/278.htm>.
22. A.K. Gus'kova, "Pamiati druga: k 80-letiiu so dnia rozhdeniia V.K. Lemberga/A. Gus'kova," *Voprosy radiatsionnoi bezopasnosti* (1999), 3, 74–77, <http://libozersk.ru/pbd/Mayak60/link/451.htm>.
23. Nikolaus Riehl had been brought from Berlin to the Soviet Union in 1945 together with other scientists and their families. He had previously worked as the director of uranium production for the so-called Auergesellschaft, a company in Berlin. In 1945–1955, Riehl was forced to work in the Soviet Union, where he led a working group of German scientists in the Soviet atomic bomb program. It was not until 1955 that Riehl was allowed to travel to the GDR and shortly afterwards to the FRG. From 1955 to 1957, together with Heinz Maier-Leibnitz, he supervised the construction of the research reactor of the Technical University of Munich in Garching near Munich. From 1957 to 1969, he worked as professor and director of the Institute of Technical Physics at the Technical University of Munich. Horst Kant, "Riehl, Nikolaus" *Neue Deutsche Biographie* 21 (2003), S. 587–588; Ulrich Albrecht, Andreas Heinemann-Grüder, Arend Wellmann, *Die Spezialisten: Deutsche Naturwissenschaftler und Techniker in der Sowjetunion nach 1945* (Dietz, 1992).
24. For example, Timofeev-Resovskii, who worked in Laboratory B as a prisoner. Cf.: N.P. Voloshin, V.N. Ananiichuk, eds., *Nikolaus Ril' v atomnom proekte SSSR: [sbornik]* (Snezhinsk: [RFIATS-VNIITF], 2011), 54.
25. V.N. Doshchenko, "U istokov radiatsionnoi meditsiny na PO «Mayak». Vospominaniia vracha," *Okhrana prirody IUzhnogo Urala: spetsial'nyi vypusk, posviashchennyi 50-letiiu avarii 1957 goda na PO «Mayak»*, Chelyabinsk: URAGs, 2007, 70.
26. Cf.: Kate Brown, *Plutopia: Nuclear Families, Atomic Cities, and the Great Soviet and American Plutonium Disasters* (Oxford: Oxford University Press, 2012).
27. Gus'kova, *Atomnaia otrasl' strany glazami vracha*, 67.
28. V.N. Novoselovi, V.S. Tolstikov, A.I. Klepikov, *Istoriia IUzhno-Ural'skogo upravleniia stroitel'stva* (Chelyabinsk: NIK, 1998), 54; V.N. Kuznetsov, *Atomnye zakrytye administrativno-territorial'nye obrazovaniia Urala: Istoriia i sovremennost'*, Chast' 1, Sovetskii period (Ekaterinburg: Bank kul'turnoi informatsii, 2015), 94–96.
29. Timofeev-Resovskii was a Soviet geneticist who worked at the Kaiser Wilhelm Institute for Brain Research in Berlin from 1925 to 1945 and established the genetic department there. In 1945, Timofeev-Resovskii was arrested by Soviet troops in Berlin, deported to the Soviet Union, and sentenced to ten years of forced labor in Kazakhstan. He was accused of not returning to the Soviet Union in 1937 and of collaborating with the Nazis. Two years later, a department of the Soviet secret service looking for experts in radiation damage located Timofeev-Resovskii in Kazakhstan, retrieved him from the labor camp, and brought him to the closed research project in Sungul in the Urals. See also the contribution by Laura Sembritzki in this volume.
30. Gus'kova, *Atomnaia otrasl' strany glazami vracha*, 65.
31. Boris Vannikov is the head of the First Chief Administration (PGU) and the head of the Scientific and Technical Council of PGU under the USSR SNK, the first head of the nuclear industry; Efim Slavskii is the first director of the Combine № 817.
32. <http://www.proatom.ru/modules.php?name=News&file=article&sid=214>
33. G. Baisogolov, "Vospominaniia."
34. G. Baisogolov, "Vospominaniia."
35. Lysenkoism was a theory founded in the 1930s by the Soviet agronomist Trofim Lyssenko, who assumed that the properties of living organisms were not determined by genes but by environmental conditions. Lyssenkoism thus contradicted

- all the basic principles of genetics known at the time and was scientifically untenable. However, under Stalin's rule and with his support, Lyssenko gained considerable political influence in the Soviet Union. William DeJong-Lambert and Nikolai Krementsov, eds., *The Lyssenko Controversy as a Global Phenomenon* (London: Palgrave, 2017).
36. The so-called Doctors' plot was an anti-Semitic campaign in late Stalinism. In 1952–1953, a group of predominantly Jewish doctors from Moscow were accused of conspiring to assassinate Soviet leaders. This resulted in numerous arrests and executions of doctors, among them both, Jews and non-Jews. After Stalin's death in 1953, the case was dropped. The new Soviet government declared that it had been fabricated by Stalin and his close circle. Frank Grüner, *Patrioten und Kosmopoliten. Juden im Sowjetstaat 1941 bis 1953* (Cologne, Weimar, Vienna, Böhlau Verlag [Forschungen zur Geschichte Osteuropas; vol. 43], 2008); Jonathan Brent and Vladimir P. Naumov, *Stalin's Last Crime: The Plot against the Jewish Doctors, 1948–1953* (New York, NY: HarperCollins, 2003).
 37. G. Baisogolov, "Vospominaniia."
 38. V.S. Tolstikov, "Usloviia truda proizvodstvennogo personala iadernogo kompleksa Urala," in *Promyshlennost' Urala v 19–20 vv.* Sb. nauch. tr., ed. V.P. Chernobrovina (Moskva: AIRO-XX, 2002), 298–325.
 39. For more information, see: I.A. Bochkareva, "Formirovanie i razvitie sistemy radiatsionnoi bezopasnosti na Urale v 1945–2011 gg" (PhD diss., kand. ist. nauk. Chelyabinsk, 2018), 27–31.
 40. G. Baisogolov, "Vospominaniia."
 41. G.D. Baisogolov, V.N. Doshchenko, N.A. Koshurnikova, "Iz istorii otechestvennoi radiatsionnoi meditsiny (khimicheskii kombinat «Mayak», Chelyabinsk-40)," *Radiatsiia i risk*, 5 (1995): 48–53, quote, 49.
 42. Fragments of the reports of the Soviet embassy delegation that visited Japanese cities were published in the journal "Rodina" in 2015. Cf.: A. Rudnitskii, "Ilyshev-Vvedenskii A. Xirosima-Nagasaki: vzgliad iz 1945 goda," *Rodina*, 12 (2015): 108–115.
 43. Gus'kova mentions in her texts the work of D.G. Schaefer "X-rays and nervous system" (1936), the translated monograph of L. Gempel'man, G. Lisko and D. Gofman "Acute radiation syndrome" (1954), written according to the results of observation and treatment of nine patients who suffered in the Los Alamos laboratory.
 44. Quotation from: V.G. Chernikov, "Baisogolov i drugie/V. Chernikov" in *Osoboe pokolenie*, ed. V. Chernikov, vol. 1 (Chelyabinsk: Chelyab. Dom Pechati, 2003), 276–323; *Ozerskii vestnik*, July 10, 17, 24, 31, August 7, 14, 22, 28, August 4, September 11, 2002, <http://www.libozersk.ru/pbd/Mayak60/link/284.htm>
 45. G. Baisogolov, "Vospominaniia."
 46. A.K. Gus'kova, "Meditsina byla vseгда riadom," *Ozerskii vestnik*, October 28, 31, November 1, 1995.
 47. V.G. Chernikov, "Baisogolov i drugie/V. Chernikov," in *Osoboe pokolenie*, ed. V. Chernikov, vol. 1 (Chelyabinsk: Chelyab. Dom Pechati, 2003), 276–323; *Ozerskii vestnik*, July 10, 17, 24, 31, August 7, 14, 22, 28, August 4, September 11, 2002.
 48. A.K. Gus'kova, "Meditsina byla vseгда riadom," *Ozerskii vestnik*, October 28, 31, November 1, 1995.
 49. Chernikov, "Baisogolov i drugie/V. Chernikov," 276–323; *Ozerskii vestnik*, July 10, 17, 24, 31, August 7, 14, 22, 28, August 4, September 11, 2002.
 50. *Ozerskii vestnik*, July 10, 17, 24, 31, August 7, 14, 22, 28, August 4, September 11, 2002.
 51. *Ozerskii vestnik*, July 10, 17, 24, 31, August 7, 14, 22, 28, August 4, September 11, 2002.
 52. Gus'kova, *Atomnaia otrasl' strany glazami vracha*, 82.

53. Chernikov, "Baisogolov i drugie/V. CHernikov," 276–323; *Ozerskii vestnik*, July 10, 17, 24, 31, August 7, 14, 22, 28, August 4, September 11, 2002.
54. V. Chernikov, "Strannoe schast'ie/V. Chernikov," in *Osoboe Pokolenie*, ed. V. Chernikov, vol. 1 (Chelyabinsk: Chelyab. Dom Pechati, 2003), 66–69; *PO Mayak*, June 8, 15, 29, July 6, 13, 20, 27, August 17, September 14, 20, 28, October 5, 12, 19, November 6, 2001, <http://www.libozersk.ru/pbd/Mayak60/link/541.htm>.
55. Quotation from: Chernikov, "Baisogolov i drugie/V. Chernikov," 276–323; *Ozerskii vestnik*, July 10, 17, 24, 31, August 7, 14, 22, 28, August 4, September 11, 2002.
56. G.D. Baisogolov, A.K. Gus'kova, *Luchevaia bolezn' cheloveka (sketches)* (Moskva: Meditsina, 1971), 6.
57. One of the representatives of the "opinion leaders" group.
58. G. Baisogolov, "Vospominaniia."
59. Chernikov, "Baisogolov i drugie/V. Chernikov," 276–323; *Ozerskii vestnik*, July 10, 17, 24, 31, August 7, 14, 22, 28, August 4, September 11, 2002.
60. V. Gubarev, "Professor Angelina Gus'kova: na lezvii atomnogo mecha," *Nauka i zhizn'*, 4 (2007), 23.
61. Emphasized by me. Cf.: Gus'kova, *Atomnaia otrasl' strany glazami vracha*, 8.
62. A.K. Gus'kova, "Meditsina byla vseгда riadom," *Ozerskii vestnik*, October 28, 31, November 1, 1995.
63. See endnote 37.
64. F.M. Liass, *Poslednii politicheskii protsess Stalina ili nesostoiavshiisia iudotsid*. Izd. 3-e, dop. (Moskva, Ierusalim: "FILOBIBLON," 2007), 98–104.



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Part II

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5 Environmental Relationalities

Contextualizing the Nuclear Production Sites in Khujand/Leninabad

Sophie Roche

Khujand (former Leninabad) lies at the entrance to the Ferghana Valley along the river Syr Daryo, which is one of the two “arteries” of Central Asia. It was one of the cities where Soviet modernization was realized through the establishment of factories, such as those of silk, cotton, and cane sugar. These factories diverted the local artisans from small-scale local production to factory production within less than a decade in the 1920s. A few kilometers away, the city of Chkhalovsk was founded in 1945 as part of the Soviet nuclear project, a closed city with the mission to enrich uranium in the Leninabad mill that went into production in 1946. Reports in the 1920s had already identified uranium in Taboshar and Adrasman, but it only began to be mined in the 1940s. Underground mining resumed in 1943 with Taboshar as the first deposit mined purely for uranium in the former USSR.¹ The population of Khujand felt proud to be part of Soviet progress and development and considered Chkhalovsk an example of Soviet modernity.

Generally, in Tajikistan, Khujand/Leninabad and Chkhalovsk were surrounded by an aura of admiration and mystery. In Chkhalovsk, one could live “as in Moscow,” with all of the luxuries and privileges that Muscovites enjoyed, whereas Khujand/Leninabad was “the civilized city” of Tajikistan. The northern region of today’s Tajikistan was integrated into the territory rather late in 1929 after the administrative change of the Tajik Autonomous Region into a Soviet Socialist Republic. Five years earlier, the Tajikistan ASSR had been carved out of the Uzbek Soviet Socialist Republic. After declaring Tajikistan an independent republic, the northern region was added to Tajikistan in order to give the republic a city with Khujand and the surrounding areas becoming part of Tajikistan.² Since the end of the Soviet period, most Russian and other foreign workers have left. Chkhalovsk has been gradually taken over by the Khujand population. The mythos of Khujand and Chkhalovsk being the cities of wealth and prosperity continues to attract more and more people from the south of Tajikistan, most importantly from Dushanbe.

How do people contextualize their city and their lives within the rural environment? What role do uranium plants play in the understanding of towns as advanced and privileged? In this contribution, I argue that nuclear

production in northern Tajikistan was submitted to a social hierarchy between urban citizens and their rural surroundings. Urban-rural environmental relationalities define how progress and pollution are integrated into narratives and practices of the contemporary population of Khujand. I refer to the rural environment as everything in the countryside and which relates to the town of Khujand. This includes people, natural resources, and agricultural products. The urban population of Khujand considers this rural environment to exist for the sake of urban developments from which social hierarchies develop. The inclusion of uranium waste into this social hierarchy is possible because of the politics of treating uranium solely as a valuable natural product and not as a nuclear threat. This perception resonates with Gabrielle Hecht's approach to uranium waste in Africa, which in the mid-twentieth century was mined for the nuclear programs of the colonial powers.³

Until now, research on uranium waste in Tajikistan in the social sciences has been scarce if not completely absent. The primary reason for this lack of scholarship is the secrecy with which the Communist Party and the military surrounded uranium mining and nuclear development. International projects of the Environment and Security Initiative (ENVSEC) have changed little regarding this perception, as their programs remain abstract and bureaucratic, thus lacking a popular dynamic. Radiological assessments were conducted in 2006 and 2008⁴ and on water contamination between 2009 and 2014.⁵ All studies confirm a level of contamination within the recommended limits of the World Health Organization (WHO), with few regions being at risk like Tabashar/Istiqlo.⁶ An increase of uranium in the main river, Syr Daryo, between 2009 and 2014 has been blamed on upstream uranium mines in Uzbekistan or Kyrgyzstan. Such statements are not surprising as they represent more the politics of uranium or nuclearity than the condition of those working and living in areas of nuclear pollution. The commonality between the radiological assessments is that they speak solely about uranium and not about nuclear waste. Unlike nuclear waste, the International Atomic Energy Agency (IAEA) regards uranium as a natural product with natural radiation, even after its enrichment as yellowcake.⁷ The aforementioned authors of these studies do not discuss the different effects on health after long-term exposure, nor do they include a discussion on the processing of uranium ore and the workers' working conditions⁸ or the role of uranium for Soviet politics.

Olga Kuchinskaya has wonderfully outlined the politics of nuclear pollution in the northern territories of the former Soviet Union.⁹ Working on Belorussia, the territory which was considerably affected by the Chernobyl accident, she shows that the visibility and invisibility of radiation and health issues is primarily a political matter. The disaster became a disaster only when disagreement emerged between scientists of the Soviet school and their vocal Belarusian opponents. Before this, pollution had been downplayed and made invisible in public discourses. International organizations such as the IAEA backed the processes of making radiation invisible. Kuchinskaya's observation

can safely be applied to Tajikistan with one crucial difference being that Tajikistan had no adequate scientific researchers who dared to raise a critical voice. In other words, visibility and invisibility of radiation in Tajikistan remained dependent on whether Tajikistan wanted international financial help to cover tailing dumps (which leads to a scientific increase of danger) or to build a new reactor (in this case, pollution appears in line with the IAEA requirements).

Consequently, the results of the research mentioned above conducted between 2006 and 2014 have neither been made accessible to the general population nor have they had an impact on local discussions. It is the nature of Tajik politics to withhold expert knowledge from the population when it does not serve the national narrative. Under these circumstances, I argue that it is not so much the lack of knowledge that is the main problem, but the way “nuclearity,” to use Hecht’s term,¹⁰ is integrated into social relationships. Therefore, I am not interested in compiling a catalogue of the negative effects of nuclear waste or identifying problems of the latter, but rather I will focus on how the population subjected the nuclear program to a narrative of progress and uranium waste within a hierarchy of society and the environment. Within the latter relationship (between urban peoples and the rural environment), uranium is a part of the rural environment that serves the urban population to develop and modernize. The rural environment is subordinate to urban technology. This relationship is not abstract but internalized, as the interviewees explained: “our bodies have become used to uranium.”¹¹ Bodies, my interlocutors anticipated, transform along with the rural environment and as the city’s modernizing path.

Researching the Social Dimensions of Uranium in Northern Tajikistan

Tajikistan is perhaps one of the least well-known regions globally for the production of uranium, including scientists of the IAEA. Gordon Lindsey, an expert with the IAEA, told Radio Free Europe (RFE/RL) that radioactive sources in Tajikistan have not yet been fully evaluated by the agency:

If the sources are big enough, that means in terms of their activity, in terms of the number of curies [units of radioactivity] and Becquerel [gamma rays given off by radioactive substances] they contain, and depending upon the radionuclide, yes, they could be used for that purpose. But in the case of Tajikistan, I don’t think we have a very good understanding at the present time.¹²

The aim of this contribution is to reflect on the relationship between people and their natural environment in one of the regions in Central Asia in which uranium was mined and enriched. I have lived with the people of Khujand each summer from 2013 to 2015 and paid attention to the social

configurations and their relations to the natural environment. The ethnographer Edward Bruner¹³ suggests differentiating between reality, experience, and expression. Whereas the reality eludes the possibility of recalling events because it is always mediated, expression is what most ethnographers, as per Bruner, have access to. The study of experience is challenging as it operates on participation and documentation of this participation. The social anthropologist Michael Jackson,¹⁴ who operates at this level of experience, has further developed this approach providing ethnographic examples. I followed his approach in conducting research and reflecting on the ethnographic material. Interviews within this approach are secondary, as they may unintentionally shape the narratives according to the political climate (and the many restrictions that it imposes). More interesting for the ethnographer is therefore how people act and talk among themselves and in daily conversations or which topics they avoid. This chapter is thus based on experiences, whereas factual data and public discourses have been taken from Tajik newspapers and reports.

The Context of Uranium Mining in Northern Tajikistan

In the atmosphere of the Cold War, the nuclear bomb became the ultimate goal for the Soviet Union. The project was based on Russian scientists working under the supervision of the secret police of the People's Commissariat of Internal Affairs (*Narodnyy komissariat vnutrennikh del, NKVD*), with Gulag prisoners and soldiers as the primary manual workforce erecting a plutonium plant in the midst of a swamp (Ozersk), and with uranium brought from as far as the mountains of Tajikistan, in order to test the bomb in the Kazakh steppes.¹⁵ Nuclear production was one of the truly pan-Soviet projects that ended only when the Soviet Union ceased to exist.

It was discovered that the mountains surrounding the Ferghana Valley in the heart of Central Asia held various mineral resources, including uranium. Hence, it was also here where the first uranium processing plant of the Soviet Union was built. Uranium from the Soviet Socialist Republic of Tajikistan was intended to provide the material for the USSR's first nuclear bomb.¹⁶ As of the 1940s, several plants had been opened by the Leninabad Mining and Chemical Combine (now the Vostochny Rare Metal Industrial Association, or Vostokredmet), including Tabashar, Adrasman, Mailuu-Suu, Uighur, and Tyuya-Muyun. According to Vinson, "Vostokredmet incorporated seven mines and five plants, including plant B, and processed up to one million tons of uranium ore per year to produce yellowcake for the Soviet nuclear power industry and Soviet military."¹⁷ The factory to process uranium ore was located in the municipality of Chkalovsk. The Leninabad Mining and Chemical Combine enriched yellowcake and produced uranium hexafluoride

in five plants.¹⁸ Over the years, approximately 550 million tons of radioactive waste were spread at nearby habitations, polluting at least 180 ha of land.¹⁹ The Digmai/Dehmoi tailing dump lies in the plains only a few kilometers from Khujand. According to Lespukh et al., “Digmai is one of the largest tailing dumps of U hydrometallurgical waste in Central Asia. The tailings dump was constructed by blocking a natural depression by a pioneer dam with a length of 1800 m and covering the bottom with a layer of bitumen.”²⁰ However, according to an IAEA summary from 2017, the Digmai (Dehmoi) tailing dump ranks as high risk and hence high priority for environmental remediation.²¹

The population of Chkalovsk was unaware of the risk of uranium and used the waste areas to feed their animals. Villagers living near Tabashar had experienced the dangerousness through their animals and recalled that if a sheep would go to drink from the pond, it would fall dead on the spot. Areas of danger (rather than pollution) were determined by experience rather than knowledge. These experiences included direct interaction with polluted areas such as the pond, which was called the “death pond,” as well as through less obvious or secondary experiences, such as engineers’ wearing of protective clothing when visiting simple workers who wore no protection at all.

The most important experience, however, was that uranium seemed to have the power to modernize the city. Secrecy is a tool through which rampant imaginations develop to the best as to the worst. Neither the workers nor the population knew details about uranium and its health risks, but they were well aware of the military importance that their labor represented and proud of their relevance. The mythos that uranium produces wealth and prosperity has not (yet) been broken.

The independent state of Tajikistan treated the uranium plants as a secret and made it impossible for many years to obtain basic information about the production and waste in order to estimate the social and health consequences of the polluted area. In 2009, five employees of the Vostokredmet plant in Chkalovsk were convicted of committing espionage for Uzbekistan and received prison sentences of up to 22 years.²² This was a way to claim the Soviet factory on Tajik soil as a Tajik project signaling to the much stronger neighbor Uzbekistan that Tajikistan has control over the factory’s personnel. While Russia keeps an eye on the uranium production in the region, the different production sites in Central Asia went into national properties.

Only in February 2017 did Tajikistan sign the Basel Agreement in order to receive financial help in managing the problem of the uranium waste. However, this went rather unnoticed by the population, who has still only a vague idea about the health impact of nuclear material and radiation. According to a gynecologist from Khujand, health problems, childlessness, cancer, and many other diseases are widespread in families, yet no research has been conducted on whether these are connected to pollution or other reasons. At times during the second decade of the 2000s, the government of Tajikistan had even allotted polluted pieces of land around Khujand to

poor families (Luli),²³ in order for them to build homes. In addition to the argument of bodily adaptation, such stories document that the perception of pollution exists but are integrated into a history of social hierarchy.

In order to understand how Tajikistan was integrated into the wider Soviet and post-Soviet debate, we need to look at the tension between the classification of a country that mines uranium minerals and a nuclear country: “The *nuclearity* of a nation, a program, a technology, or a material – that is, the degree to which any of these things counts as ‘nuclear’ – can never be defined in simple, clear-cut, scientific terms. Rather, nuclearity is a technological spectrum that shifts in time and space.”²⁴ Similar to the way in which Gabrielle Hecht has identified “Africa as the dark continent” that provides the raw material to its former colonizers,²⁵ Central Asia has been the periphery to Moscow from which raw material was exported. However, unlike in the work of Hecht, Tajikistan and the other Central Asian republics were integrated into a Soviet project of modernization, which accorded the periphery strategic military importance. From this emerges the integration of the production of uranium ore into local perceptions as an investment for the future and a step toward modernity. Central Asian society followed a Soviet modernity for which urbanization, electrification, and technological developments were important markers. The uranium plants were key to this progress, a promise recently (2015) renewed by Russian President Vladimir Putin, who promised considerable help in building a nuclear reactor for research purposes in Tajikistan.²⁶ The new nuclear reactor will elevate Tajikistan from a uranium producing country to a country of nuclear capacities. To a certain degree, this secures the financially and politically weak government a respected position among world politicians.

The Central Asian societies have formed independent nation states for the first time in the 1990s. Despite the asymmetric relationship under which the Central Asian societies lived during the Soviet Union, they have rejected the notion of considering themselves as simply vulnerable or exploited populations but rather conceptualize their position within the Soviet Union within ethnic debates. Possessing a nuclear power reactor means to participate in the most powerful global discourse today.²⁷

Khujand and Its Environment

Khujand is an ancient city, the center of which was organized into mahalla neighborhoods.²⁸ The aristocracy of Khujand from around the sixteenth century until the Soviet era is referred to as khuja or tura. Before the Soviet Union, much of the aristocracy were rich landowners living in urban centers and among their farmer dependents (muruds, murids), from whom they collected taxes. The farmers provided cities with agricultural products. The relationship between this aristocracy and the rural farmers was further strengthened through religious ties. The khuja were the religious tabaqa (caste) to those farmers. Until today, elderly farmers come to their bond khuja

family when a child is born, and a few families even continue to collect taxes from their muruds (dependents).

The city of Khujand was constantly recalled as being surrounded by apricot gardens, fertile lands, and water from the Syr Daryo (and fish being caught in the river). Those narratives embedded the city into a wealthy environment that contributed to the prosperous lives of the local population. When the famine of the 1930s²⁹ hit the farmers of Central Asia, parents sent their children to Khujand, where they were gathered in orphanages or dormitories. They were integrated into the newly built factories. The town became the political and economic center of Northern Tajikistan. The new elite that was to create Tajikistan with the capital Dushanbe was recruited to a large degree from Khujand.³⁰

It is less interesting, however, whether the above accounts that were given to me by urban people are factually correct, but more importantly, that these descriptions frame a hierarchical relationship between those living in the town and those supplying the town. It is necessary to understand Khujand as part of a social and rural environment in order to contextualize the way in which uranium waste has been integrated into the narratives. The city was not simply an urban center to the rural villages, but its population maintained bond relations and religious dependencies; the aristocratic families spread over rural and urban centers in the whole of the valley. Families administered their land, while their farmers supplied the towns and cities.

With the emergence of the Bolsheviks in the Ferghana Valley, the ruling aristocracy lost much of its privileges. While many were arrested and deported to the Gulags because of their religious leadership, those who had fled either retreated into the villages of their muruds or made it to the new capital Dushanbe, where they were urgently needed because of their relatively high level of education (compared to the southern mountainous regions that before had been part of the Bukharian Emirate). The former loan workers and artisans of Khujand became the new leadership. The factories and combines also demanded more labor, which was taken in from the surrounding villages. Despite the heavy social changes that transformed former labor niches, the memory of *tabaqa* was maintained and even reproduced through the teachers in schools or at working places, and most importantly, in marital practices.³¹ Until today, urban *tabaqas* avoid marriage with people from rural places despite the dissolution of pre-Soviet labor hierarchies. It reflects the way in which the environment of Khujand is integrated not only in narratives of the past but also in the very practice of social relations.

Hierarchical Relationships between Towns and their Rural Environments

Development and modernity are not just abstract terms or empty promises but rather go along with visible proofs such as urban construction developments, technical developments or industrialization, and electrification. In contrast to

the invisible risks that radiation has caused, the visible aspect of Soviet modernity influenced the societies and workers living in areas of uranium or nuclear power plants much more. Whereas the invisible consequences are the same to all workers, the integration of the modernity discourses varies not only culturally but is also contingent on the composition of workers and the relationship in which the nuclear power plants are geographically positioned. The social and natural environment are crucial for the long-term integration of the risks and damage that accompany nuclear production sites. In the following pages, I will begin by giving two examples from the Urals and from Semipalatinsk in Kazakhstan, before moving to an in-depth discussion of the Khujand case.

In her book comparing nuclear production sites in the United States and the USSR, Kate Brown shows how the site of Ozersk in the Urals was constantly framed as individual responsibility for the sake of communism.³² Generals received the full responsibility for the nuclear project and put all their energy into its success. Ivan Tkachenko, for instance, was personally responsible for providing permission to technical workers to leave the zone, a control pyramid that placed success and failure in the hands of individuals. Beria, the head of the NKVD, personalized responsibility and pressure in order to meet deadlines, a system that was employed at all levels of Soviet administration.³³ The individualization of responsibility toward the Soviet Union within a politically shaped worker hierarchy is well exemplified in the following description:

Muzrukov in his forties, was in poor health. After the war, Muzrukov had fallen ill with tuberculosis, and in 1947 he was still weak and had only one lung. Beria ordered that either Muzrukov or Tsarevskii be on the job night and day, overseeing construction of the reactor, Site A1 and the plutonium processing plant, Site B.20 He made the two men personally responsible for the new deadlines, and in so doing put in motion an administrative engine that finally managed to transform the muddy anthill of human exertion and misery into Europe's first plutonium plant. Beria did so by cementing the fate of the plant to the personal destiny of his leadership. He made it clear that if the plant failed, so would they. The big bosses, fearing arrest, then rushed to attach the same consequences to their harried subordinates. They placed foremen in charge of distinct projects—lumber mill, tool factory, water treatment plant, reactor, processing plants—and made it clear that failures to meet deadlines, as well as mistakes or accidents, would be criminally prosecuted.³⁴

The use of the Gulag in a context of technological advancement was not so much thought of as a system of slavery, although it had cost dearly in human lives, but the media made it a success: “an icon of how the Gulag penal system could reconfigure geography, human beings, and society itself in service to socialism.”³⁵ The “labor caste system” established a dynamic of work progress that was to turn an uninhabited place into the most technologically

advanced space of the Soviet Union. Despite the many negative experiences that Brown highlights in her book regarding radiation and the consequences, the workers do experience their work as crucial to communism and feel downgraded when sent out of the zone as a result of increased radiation: “Many people experience termination as form of deportation or forced resettlement, a reversal of the promise of social mobility.”³⁶ While Brown follows a clear agenda that works out the vulnerability of workers vis-à-vis nuclear enterprises, her sources are controversial within the tension to contribute to modernity and victims of this process. What matters for the discussion is the contextualization of modernity as lying in the hands of individuals to master difficult and impossible conditions for the sake of an idea of “future” – designated as communism. This promotion of individual responsibility for the “construction site of socialist modernity” is not restricted to the nuclear project, as the analysis of the diaries from the times of Stalinism written by Jochen Hellbeck shows.³⁷ Instead, the project in Ozersk was integrated into a concept that linked the individual to communist success.

This is, however, not to be applied to the whole Soviet Union, or at least not in the context of nuclear production sites. The tension between pollution, difficult working conditions, and communism, as this chapter will assert, is contextualized in different relationalities. If Ozersk was integrated into Stalin’s individualization of responsibility for socialist modernity, this was not necessarily how other sites became integrated into local worker’s discourses in other parts of the Soviet Union. Magdalena Stawkowski has shown how in the immediate surroundings of the Semipalatinsk nuclear test site, people continue to use a vocabulary of progress rather than disaster when reflecting on their lives today.³⁸ Thus, the Soviet Union did not produce one homogenous discourse and certainly no classic orientalist discourse and positioning. Rather, it is argued that nuclear production and uranium mining shared the same space of secrecy on the all-Union level but were locally integrated into the relationship which the working populations had to the environment through political discourses that may go back into history. For instance, uranium mining and nuclear fuel production sites in the Urals were conceptualized as the development from the Bronze Age to the Soviet atom, a success of individual investment in transforming the environment into a technological space: “The low mountains rose like a purple bruise in the distance. The men came across a collective farm on Lake Kyzyltash next to the ruins of a nineteenth-century mill. The twentieth-century villagers, living more primitively than their ancestors, fished from dugout canoes with grass nets. This was the spot, the scouts reported back to Moscow. Such were the Bronze Age beginnings of the Soviet atom.”³⁹

In contrast to the above quote, Stawkowski describes how the affected population of the Kazakh steppes transforms along with their (polluted) environment.⁴⁰ She relates how people believe that they can eat the wheat grown on the polluted fields, keep animals, and live with the environment, even if others (who arrive with protective clothing and instruments to measure the

radiation and who usually leave as fast as possible) could or would not. In the words of Stawkowski's interviewees, the bodies would physically change as the environment changed: "I am a radioactive mutant."⁴¹ Their bodies not only adapted to the pollution, but they could not live outside the zone anymore, as per her source. As Stawkowski has argued, the people of Koyan consciously think of themselves as part of an ecosystem, as organisms that have learned to thrive on a polluted landscape.⁴² This argument of adaptation has been recalled in other polluted contexts as well. The examples share a commonality that demonstrates how people integrate into environments through cultural narratives. To summarize, in the Kazakh example, humans adapted to their agriculture-based environment by "mutation." In Tajikistan, the entire production cycle was integrated into a rural-urban developmental narrative. These three possible relationships are rooted in local conceptions of human-environment relationalities and therefore differ, although the three sites share the same Soviet frame of modernity.

Khujand and Chkalovsk relate to their environment in a historical continuity, which considers the rural environment responsible for supplying the city. Rural regions provide the raw material for urban progress, or in other words, rural areas are hierarchically subservient to cities. Regarding the relationship between Khujand/Lenindabad and Chkalovsk,⁴³ they equally stand in a hierarchical relationship in which the Leninabad population would be "a step lower than those in Chkalovsk." Such conceptualizations of the new neighboring Soviet town and its people follow the evolutionary concepts and rural-urban relationalities introduced above.

Khujand/Leninabad is one of the historical towns along the Syr Daryo with a long history of being an artisanal, trade, and at times political center. Its educational elite served as the Tajik leadership in Dushanbe, where a capital was created out of a village when the Tajik SSR was founded in 1929. The discovery of uranium in the nearby mountains made the city and its environment of special interest to the Soviet leadership and became part of the plan to produce a nuclear bomb. The sub-district Leninabad (today Nohiyai Bobojon Ghafurov) enclosed the mines and the main mining town Tabashar, the Sovkhoz of Palas and Chkalovsk, with the Leninabad Mining and Chemical Combine responsible for the enrichment of uranium before transporting it by train to the north. This relationship between the different regions is not only based on a division of labor, but rather they relate to one another through the hierarchical relationships of the environments. These are narrated and are often ethnically colored because of the many groups that came as deported populations, prisoners, or elites: Tabashar was built by Germans who came from the Volga region and had been deported to Siberia before coming to Tajikistan. In the first decades after their deportation at the end of World War II, they were not allowed to work in the mines, but were responsible for the construction of the new town. Later, this group was joined by prisoners of the Great Patriotic War (World War II). Consequently, Germans entered local narratives as excellent architects and construction

workers who built houses for the workers entrusted with the confidential work of mining. Besides Germans, Russians and other minorities were settled in Tabashar in order to work in the different mines.

Palas was the main Sovkhoz (Soviet state farm) responsible for supplying the mining towns' population with agricultural products. The multi-ethnic village Palas was known to the local population to have the best Sovkhoz, growing the finest legumes and best grapes. This narrative was mixed with envy because Palas received subsidies directly from Moscow. Palas was "the farm of Chkalovsk and Tabashar," the private garden for the military towns. The infrastructure of the nuclear production in the Leninabad district followed the same rural-urban hierarchy as the city of Khujand/Leninabad maintained with its rural dependents.

Chkalovsk hosted mainly Russian professionals and engineers. As mentioned before, they were supplied with goods directly from Moscow and hence felt to be "better humans" than the local population. "We used to buy ice cream, bread or even *Lebkuchen*" in Chkalovsk, a Tajik from Khujand recalled. "But the people were arrogant in Chkalovsk [...] we always felt to be one step lower" (woman 29.01.2018). Even in YouTube memory videos, the "best ice cream of Chkalovsk" continues to be praised along with the many leisure facilities that the town possessed (cinema, pool, theaters, children's parks, a planetarium, etc.).

The experience of Chkalovsk as a place with luxuries and good conditions downplayed the risks that the work in the combine posed. The people of Chkalovsk were proud to be part of the great Soviet military secret and felt valued by Moscow. This translated into a social hierarchy between the two cities that lay only a few kilometers apart.

Hence, we have two systems of life that developed independently and yet interdependent on one another. Tajikistan, being at the outmost southern border of the Soviet Union, was well suited to receive the many populations that Stalin wanted to resettle far from the war zones. The result was the emerging of highly inter-ethnic communities in many villages and towns that developed in the region.⁴⁴

I suggest that it is this hierarchy of places and the relationships between urban centers and their environment that set the stage for the narratives and practices of integrating uranium production with all its positive and negative side effects. This also explains why danger or pollution could be silently accepted within a cultural narrative that submitted rural environments to the industrial centers. This does not preclude rumors and experiences among workers of the danger and pollution, but most importantly, it prevented local citizens from asking how their health and the environment are affected by the nuclear industry.

The scholarly focus on uranium tailing dumps and pollution overshadows the experience that people make independent of expert knowledge and the modes to submit the nuclear production to a sociocultural narrative. In order to understand how people react and cope with uranium waste and

uranium mining after the cessation of Soviet Union, we need to look at historically rooted social and cultural relationships between people and their environments.

The Earth Mountains of Ghafurov

When a guest arrives from the airport and is brought to the city of Khujand, he or she passes the city of Chkalovsk, and just before entering Khujand, passes a heap of earth (which is not directly linked to the Dehmoi tailing dump). One can see a small path that is used to cross the heap in order to save time by avoiding walking around it. It does not fit into the landscape, is too big to be a construction site, and too small and evenly shaped to be a natural mountain. When I asked what this “mountain” was, I was told “some uranium waste is buried here” or simply “I don’t know, some waste.” Understandably, the populace walks over the waste, drives by it, and lives with it as part of their geography. According to informal talks, every year another two meters of earth need to be added in order to keep radiation from penetrating the mound. The grass growing over the mountains does not suggest that this is done at yearly intervals, however.

The waste fields between Dehmoi and Khujand, according to RFE, are among the largest tailing dumps of Central Asia and the first that were used as such. On 90 ha, more than 38 million tons of radioactive waste are spread. The waste still has the radioactive strength of about 3000 $\mu\text{R}/\text{h}$. The journalist claims that much of the waste was covered under one-and-a-half meters of earth.⁴⁵

In similarly unspecific ways, people talk about other places where the uranium combines are located, which were used before to enrich yellowcake. One worker that is employed at one of the factories does not even know what substances she is working with. As she recalled, “we have to walk through water without protection, although our supervisors receive money for protective clothing” (woman, 24.08.2015). While these may not be radioactive substances, she and her colleagues do not know what the substances are that they have to process or what implications they have on their health. They merely notice that their supervisors visit them only in special clothing and they overhear conversations that outline how the workers should be wearing protective clothing as well. Such experiences turn into rumors that are articulated in the same cultural logic. Simple workers have their place in the social hierarchy and are responsible to work as employees in factories that process uranium for the benefit of the city and the country.

From another angle but within the same hierarchy, villagers dig in uranium waste because they heard that precious metals can be found. They expect to find treasure within.⁴⁶ Apparently, the highly radioactive waste was earlier put into some “highly precious metals” that would not rot. Suhrob Rahimov had told the press that “I have repeatedly seen 10 to 12-year-old boys searching for iron waste. They still don’t know that walking over that

place can affect their health.”⁴⁷ Rahimov used to sustain himself from the income of selling this metal before becoming aware of the health consequences. According to Hotam Murazoev, who is professor of physics at the University of Khujand, people who live near the waste receive 200 $\mu\text{R}/\text{h}$:

If a person stays from morning until evening in their neighborhood, he/she will receive radiation comparable to 200 micro-roentgens. They work or use stones or iron to build their houses, it is very likely that their lives are threatened.⁴⁸

The environment is said to hold precious items that can be accessed by ordinary people. This relationship to a valuable environment cannot be explained through pollution narratives, but only through the cultural notion that whatever Chkalovsk produced, must have been of high value, since people were directly provided by Moscow and part of a military secret. This hierarchical relationship between the city and the rural environment affects the rural marginalized poor who hope to find wealth in the uranium waste.

The earth mountains of Khujand and Chkalovsk were part of the rural landscape and were internalized to the degree that some people did not even remember whether some of them were still there – they had cut them from their memory. One of the larger earth mountains along the main road between Khujand and Chkalovsk was eliminated in order to establish large bazars at this place. No one ever thinks of pollution when going to the Somon Bazar built on the location where uranium waste had been gathered.

We need to understand the ignorance of danger by looking at the relationality that the local population has to its environment and the hierarchies established through the nuclear infrastructure. Upon my question why Tajikistan – unlike Kazakhstan and Russia – has never protested or discussed the uranium issue, the answer of my interlocutors was pragmatic and clear: “we were busy with the civil war, we simply didn’t have time.” This answer uncovers much of the tragedy of pollution in this region. When the civil war erupted in the early 1990s, most foreigners left the country, abandoned their homes, and left things as they were.⁴⁹ This abandoning of places and workplaces not only led to unemployment, but more importantly, those who could have provided information and raise discussions left or withdrew in order not to be targeted. Khujandi has bought the flats in Chkalovsk, still convinced that they are better than in Khujand. Even the university has made it to some prominence and the hospitals continue to work. Chkalovsk was hence not deserted but taken over by the Khujand population.

I have been to Chkalovsk many times. For those who have accompanied me, it was the city of development and progress. I was told how it looked some 20 years ago, the cultural life it had, including a theatre group “just for Chkalovsk” with plays “just as in Moscow,” cinemas, a hospital, “excellent schools,” and all facilities needed for a city. Khujand tried to achieve the level that Chkalovsk represented, but never succeeded. It was difficult for me to

identify this past glory of Chkalovsk, as the town was just like most abandoned and neglected cities of the former Soviet Union: houses were without colors, hospital walls were losing their plaster and some of the buildings were taken over by reptiles and insects, and small shops were no longer selling goods from Moscow, but rather the same goods as in the nearby city of Khujand. The university is said to be excellent. It was repainted and renovated especially for the president's daughter, who decided to study medicine in this town. The appropriation of the former town by Khujandi has turned Chkalovsk into an extension of Khujand rather than a town engaging with its nuclear history. Only an atom model at the entrance of Chkalovsk indicates the city's bygone past.

The name Chkalovsk was changed to Buston in 2016 despite another village some fifty kilometers away already having this name. For many Russians, this was the end of their former home, the end of a past, which they remembered as wonderful:

[I] lived in Chkalovsk for some part of my childhood. These are the best and sunniest memories of all the exciting life that I have lived for 30 years. This news was like a knife to the heart. Chkalovsk is forever in my heart ... I will wait until all this dirt settles down and I can return "home." Again, to feel the warm wind on my cheeks, the lake at the hotel glittering as it again receives tourists ... To see how the children play in the courtyards and at the stadium and sports grounds – and adults ... go to the cinema and buy the biggest melon they can find on the market ... I just want a world without borders, where I can live not in a metropolis, but in the center of my world – Chkalovsk. A city of anomalous attraction ...⁵⁰ (emphasis in original)

These memories shared via social media resonate with the imagination that Khujandi still cultivates toward Chkalovsk. My interlocutors in Khujand integrate Chkalovsk as the progressive extension of their own city. In this regard, the natural resources that the surrounding mountains have are seen to be part of the urban-rural relationality. For the urban population, this rural environment satisfies their needs, whether it is the "Kairakum sea" (dam) used for bathing and electricity, or the farmers producing products and selling them on the city markets. In this rural-urban environmental relationality, uranium naturally integrates into this hierarchy, just as carrots, tomatoes, and other agricultural products that are cultivated and brought to town. This perspective does not include the villagers as an independent population, but as submitted to a social hierarchy.

A Nuclear Reactor for Tajikistan

The Tajik government has negotiated with Russia to build a nuclear reactor – a plan originating in the 1980s but never finalized. On November 2, 2015,

however, Russia and Tajikistan signed the necessary documents in order to build the reactor “Argus” by 2020, which will cost about 35 million dollars.⁵¹ The agreement includes cooperation on constructing research reactors, production of radioisotopes to be used in nuclear technology in industry, medicine and agriculture, and the management of radioactive waste, as well as rehabilitation of tailing storage areas. This development confirms Hecht’s argument that post-colonial/post-socialist countries demand their own atomic power plants to participate in the “nuclearity” of the world order.⁵² It challenges the early developments of nuclear power, when being nuclear was synonymous with being colonizer, while being nonnuclear (but providing the raw material for nuclear production) meant being colonized. Under the protection of Russia and with Chinese finances, Tajikistan will receive its own atomic power plant for research purposes.

Russia likely has the best evaluation of whether the mountains of Tajikistan still hold enough uranium to be mined. The project suggests that the lack of material is not an issue. Interestingly, the articles in the online news media Ozodi (Tajik Radio Free Europe) since 2015 have engaged little in environmental discussions, despite the Chernobyl accident. The danger of new waste is not an issue. On the contrary, some of the commentators even seem proud to “finally get their own reactor.” As during the Soviet period, Moscow will be the provider of knowhow to establish the first reactor, as they will train the Tajik specialists⁵³ and Russia will be the primary investor:

Officials of the Physics and Technological Institute of the Academy of Sciences of Tajikistan said that there is the possibility to use this reactor effectively in the medical domain, in geology and agriculture. [...] Regarding the field of medicine, equally it will help doctors to diagnose and treat cancer.⁵⁴

The discussion about the negative impact of radioactive radiation has now turned into a discussion about medical treatment and, though not wrong, appears out of place in a country where there are hardly any doctors who have a training in nuclear medicine and even fewer who have dealt with the impact of radiation on people.

Ozodi first reported on the uranium waste in 2010 and since then has done only so occasionally. A real discussion is, however, nonexistent, since the Tajik state has declared all issues of uranium a “national secret.” Ozodi’s first article began to name various problems, such as water pollution, the need to cover the waste fields, health issues, and the inability of Vostokredmet to deal with these issues.⁵⁵ The discourse is repeated in two articles from 2012 when a specialist of the Academy of Tajikistan, Abdujabbor Salomov, assured that the Russian Federal Agency “Rosatom” would take care of the waste field if only they had extra money. It is obvious they had never seriously considered

dealing with pollution and now blame their inaction on missing finances.⁵⁶ Hence, this is not the beginning of a critical discussion, but rather the politics of nuclearity. They do, however, have plans for further mining in the region: Qaiyomjon Kahmudov, the leader of the state enterprise “Zarya Vostoka” told Ozodi that in Tabashar, specialists from Tajikistan and Russia are discussing the revival of this enterprise and its production of various materials for the Tajik and Russian markets. “Now we are negotiating with Russian companies so that they will help us with technology and specialists. Tajikistan is looking for possibilities to provide the raw material, at least 50 percent.”⁵⁷

A blog comment below the chapter remarks that even if they received external help, only twenty percent of financial support would finally reach the fields, whereas the other eighty percent would simply disappear. The commentators in the blogs do not raise environmental concerns, nor have news agencies such as Ozodi promoted environmental discussions in Tajikistan. All discussions remain on financial issues (and corruption) and relationships to Russia (no longer the center of Soviet power, but rather the suspicious neighbor). This discussion preceded the law on radioactive waste, a step toward the integration of Tajikistan into international treaties. The critical environmental discussion was not the factor that required Tajikistan’s integration into international treaties, but simply the need for cash to deal with the waste. One reason for the absence of environmental activism in and around Khujand until now, I maintain, is the hierarchical integration of the natural environment and the people who work in it. Thus, Russia is blamed for exploitation and corruption, but not for pollution, whereas it is “naturally” expected that the rural population work to improve urban centers.

Conclusion

In this contribution, I have suggested to contextualize uranium mining into the wider relationship between the urban center and its natural and rural environment. Against such a background, the idea that people adapt to their environment is understood as a constant interplay, whereas people do not necessarily ignore the pollution that nuclear waste causes but situate themselves into a geographical landscape in which pollution is secondary to the progress and advancement of nuclear power. Pollution, I have argued, is developed through experience and integrated through available – and hierarchical – discourses. This process of engaging with natural environments along with politics of invisibility, to use the terminology of Kuchinskaya, explains the lack of environmental activism that has taken place in Tajikistan (rather than the civil war argument). Knowledge exists about the advantages of a nuclear reactor for research, but not about its side effect, that is, the production of waste.

Experience is not the same as knowledge, as it is rooted in everyday reasoning and is culturally processed. As demonstrated in this chapter, experiences with the natural environment (and its pollution) are submitted to social relations and may take considerable time until they are integrated into the discourses of health and claims for political responsibility.

The transformation from the viloyat Ghafurov, the former military secret zone, into a national nuclear landscape has been less a top-down process than the redefinition of the environmental relationships by the citizens that remained after the many Russians, Germans, and other nationalities had left in the 1990s due to the civil war. The latter was also responsible for nuclear waste still being treated hesitantly and with the simple goal of making things invisible in order to remove them from public perception.

Khujand is today (just as before in the Soviet Union) directly supplied by farmers who come to the main market in the city center. The order of the environmental relationship regarding this primary provision seems to be re-established. Sovkhozes have ceased to exist and therefore small farmers have taken over the supply of the town. Chkalovsk has lost its privileges but kept an aura of modernity. Its citizens live just as in most other towns, dependent on small farmers. Palas is becoming the central garrison for soldiers. Regarding the mines of Tabashar, China and India received concessions to mine the nearby mountains.⁵⁸

Protest that is at most phrased through anonymous comments in Ozodi does not warn of environmental disasters, but of a corrupt regime that may soon lose track of money and security.⁵⁹ A nuclear research reactor, 6.6 million dollars in 2014 for rehabilitation of legacy tailings from the IAEA, and an additional eight million from the European Bank for Reconstruction and Development to manage radioactive contaminated material, is a good deal for the Tajik government and renders a certain degree of disclosure of the pollution problem on the international stage beneficial.

The relationalities between urban citizens and the environment are rooted in social and natural environmental relationships, whereas the rural is subordinated to the urban. This is not an invention of the Soviet period, but the Soviet period has changed the quality of this relationship from agricultural and religious interdependencies toward mining and political relationships. Raw material was mined in different uranium plants and the more it was moved to the urban space, the more processed it became. Uranium waste was returned to the rural spaces, whereas the highly valuable material was loaded on trains in the Leninabad plant and transported further to Kazakhstan and Russia. The urban citizens continue to shape their identity in relation to their environment in a hierarchical way. In this relationship, they integrate uranium as part of the environment and not as a danger per se. It has yet to be researched how the new nuclear reactor and the international attention of the nuclear waste will impact the relationship between Khujand, Chkalovsk, and the rural environment.

Notes

1. Franz J. Dählkamp, *Uranium Deposits of the World: Asia* (Heidelberg: Springer, 2009).
2. Dählkamp, *Uranium Deposits of the World: Asia*; The primarily Persian speaking cities Bukhara and Samarkand came to be located in the Uzbek SSR. The Tajik SSR had no urban center until Khujand was transferred from the Uzbek SSR to the Tajik SSR.
3. Gabrielle Hecht, *Being Nuclear: Africans and the Global Uranium Trade* (Cambridge, MA: MIT Press, 2012).
4. P. Stegnar et al., "Assessment of the Radiological Impact of Gamma and Radon Dose Rates at Former U Mining Sites in Central Asia," *Journal of Environmental Radioactivity* 123 (2013): 3–13; G. Strømman et al., "U Isotope Ratio in Water and Fish from Pit Lakes in Kurday, Kazakhstan and Taboshar, Tajikistan," *Journal of Environmental Radioactivity* 123 (2012); L. Skipperud et al., "Environmental Impact Assessment of Radionuclide and Metal Contamination at the former U Sites Taboshar and Digmai, Tajikistan," *Journal of Environmental Radioactivity* 123 (2013): 50–62; Lespukh et al., "Assessment of the Radiological Impact of Gamma and Radon Dose Rates at former U Mining Sites in Tajikistan," *Journal of Environmental Radioactivity* 126 (2013): 147–155. Interestingly, the test sites in these studies are limited to the main fields of mining and tailing dumps in Taboshar and Digmai but do not include tailing dumps near to the habitations of Khujand and Chkalovsk. Only the next expeditions of 2015 were able to assess more tailing dumps. The results of these studies suggest that "a low to relatively low radiological risk [...] within the range expected for such environment," Lespukh et al., 154. Yet these studies are limited and help little in understanding how people engaged with the substances during work (even today) and in their spare time.
5. P. Zoriya et al., "Monitoring of Uranium Concentrations in Water Samples Collected Near Potentially Hazardous Objects in North-West Tajikistan," *Journal of Environmental Radioactivity* 181 (2018): 109–117.
6. Until very recently, the principal ontological border of nuclearity for health purposes was the notion of the "permissible dose": the idea that below a certain threshold, health effects of radiation exposure are statistically negligible. Always controversial, this notion now seems conclusively refuted. A National Research Council report released in June 2005 concludes that there is "no threshold of exposure below which low levels of ionizing radiation can be demonstrated to be harmless or beneficial." Gabrielle Hecht, "Nuclear Ontologies," *Constellations* 13/3 (2006): 328.
7. The exclusion of uranium ore from the category of "source material", that is nuclear, took place in 1972, Cf., Gabrielle Hecht, "Nuclear Ontologies"; Declaring uranium ore as natural made it a commodity that could be sold for peaceful use, which was one of the main interests of the IAEA, as Gabriele Hecht has shown.
8. Usually workers in uranium enrichment facilities face higher exposure levels than miners (Hecht, *Nuclear Ontologies*, 322).
9. Olga Kuchinskaya, *The Politics of Invisibility: Public Knowledge about Radiation Health Effects after Chernobyl*, (Cambridge, MA et al.: The MIT Press, 2014).
10. Hecht, *Being Nuclear*; Hecht, *Nuclear Ontologies*.
11. See the interviews I conducted in the region between 2013 and 2015.
12. Farangis Najibullah, "Tajikistan: Limiting Exposure of Citizens, Terrorists to Radioactive Waste A Struggle," *RFL* April 07, 2003, <https://www.rferl.org/a/1102841.html>.
13. Edward Bruner, "The Opening Up of Anthropology," in *Text, Play and Story: The Construction and Reconstruction of Self and Society*, ed. E.M. Bruner, (Washington, DC: American Ethnological Society, 1984) 7; *ibid.* "Experience and its Expression" in *The Anthropology of Experience*, ed. V. Turner and E. Bruner (Urbana, Chicago, IL: University of Illinois, 1986) 6.

14. Michael Jackson, *Lifeworlds: Essays in Existential Anthropology* (Chicago, IL: University of Chicago Press, 2013).
15. E.g., Kate Brown, *Plutopia: Nuclear Families, Atomic Cities, and the Great Soviet and American Plutonium Disasters* (Oxford: Oxford University Press, 2013).
16. James Martin, "Tajikistan," Center for Nonproliferation Studies (NCS), Middlebury Institute of International Studies, Monterey, 2015, <http://www.nti.org/country-profiles/tajikistan/>.
17. Mark Vinson, "The Legacy of Soviet Nuclear Industry in Tajikistan: Opportunities and Challenges," *Eurasia Daily Monitor* 9 No. 8, (April 2012) <https://jamestown.org/program/the-legacy-of-soviet-nuclear-industry-in-tajikistan-opportunities-and-challenges/>.
18. "Uranium in Tajikistan," World Nuclear Association, March 2017, <http://www.world-nuclear.org/information-library/country-profiles/countries-t-z/tajikistan.aspx>.
19. "Partobgohhoi radioaktivii faromūshuda," *Ozodi*, March 11, 2010, <https://www.ozodi.org/a/1980738.html>.
20. Lespukh et al., "Assessment of the Radiological," 150.
21. "IAEA Annual Report for 2017," IAEA, accessed 24.12.2018, <https://www.iaea.org/opic/annual-report-2017>, 34.
22. IWPR, December 21, 2009 quoted in Mark Vinson, "The Legacy of Soviet Nuclear Industry in Tajikistan," *Eurasia Daily Monitor* 9/81 (2012), accessed 18.01.2018, <https://jamestown.org/program/the-legacy-of-soviet-nuclear-industry-in-tajikistan-opportunities-and-challenges/>.
23. The Lulis belong to a peripatetic population who lives at the margins of Central Asian populations. Today many of them have settled in distinct villages avoided by the surrounding population. Some of them engage in begging, which they do less out of tradition than because of the marginalization on the job market.
24. Hecht, *Nuclear Ontologies*, 322; cf. Kuchinskaya, *The Politics of Invisibility*.
25. Hecht, *Being Nuclear: Africans and the Global Uranium Trade*.
26. Nurmuhammadi Kholzoda, "Tojikiston sohībi nakhustin reaktori hastaī meshavad," *RFL*, *Ozodi*, January 28, 2016, <https://www.ozodi.org/a/tjk-to-build-its-first-nuclear-reactor/27517287.html>.
27. Hecht, *Being Nuclear: Africans and the Global Uranium Trade*.
28. Muhiddin Faizulloev, "Mahalla in Northern Tajikistan, from the End of 19th and Beginning of the 20th Centuries: The Case of Khujand and its Suburbs," in *The Family in Central Asia: New Perspectives*, ed. Sophie Roche (Berlin: Klaus Schwarz, 2017) 53–83.
29. For a study of the famine in Central Asia, see: Sarah Cameron, *The Hungry Steppe: Famine, Violence, and the Making of Soviet Kazakhstan* (Ithaca, NY: Cornell University Press, 2018).
30. Barnett Rubin, "Russian Hegemony and State Breakdown in the Periphery: Causes and Consequences of the Civil War in Tajikistan," in *Post-Soviet Political Order: Conflict and State Building*, eds. B. Rubin and J. Snyder (London: Routledge, 1998), 149; Christian Bleuer and Kirill Nourzhanov, *Tajikistan: A Political and Social History* (Canberra: ANU E Press, 2013), 61; Olivier Roy, *The New Central Asia: The Creation of Nations* (London: I.B. Tauris, 2000), 18; Peter Bergne, *The Birth of Tajikistan. National Identity and the Origins of the Republic* (London: I.B. Tauris, 2007); H el ene Thibault, *Transforming Tajikistan: State-building and Islam in Post-Soviet Central Asia* (London: I.B. Tauris, 2018).
31. Sophie Roche, "Tabaqas in Khujand: Maintaining, Dissolving and Remaking Group Boundaries through Marriage," in *Intermarriage in Eastern Europe and Eurasia: Ethnic Mixing Under Fascism, Communism, and Beyond*, eds. A.L. Edgar and B. Frommer, (Lincoln: University of Nebraska Press, 2020).
32. Brown, *Plutopia*.
33. Brown, *Plutopia*, 107.
34. Brown, *Plutopia*, 108.

35. Brown, *Plutopia*, 87.
36. Brown, *Plutopia*, 175.
37. Jochen Hellbeck, "Working, Struggling, Becoming: Stalin: Era Autobiographical Texts," *The Russian Review* 60 (2001): 340–59.
38. Magdalena Stawkowski, "I am a Radioactive Mutant: Emergent Biological Subjectivities at Kazakhstan's Semipalatinsk Nuclear Test Site," *American Ethnologist* 43/1 (2016): 144–157.
39. Brown, *Plutopia*, 87.
40. Stawkowski, "I am a Radioactive Mutant."
41. Stawkowski, "I am a Radioactive Mutant," 145.
42. Stawkowski, "I am a Radioactive Mutant," 154.
43. Chkalovsk was renamed Boston in 2016 but this official nomination has not yet turned into practical use. The renaming caused an outcry in the media by former inhabitants now living across the world. Ludmila Korina, "Konets Chkalovska. Tadjikistan izmenil poslednee russkoe imia goroda," *AIF*. February 2, 2016. http://www.aif.ru/realty/city/konec_chkalovska_tadjikistan_izmenil_poslednee_russkoe_imya_goroda_comments#all_comments.
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6 The Satanic Cosmic Force

Nuclear Arms Technology in Soviet Fiction

Bettina Kaibach

On July 23, 1962, Vasilii Grossman was summoned to meet party ideologue and hardliner Mikhail Suslov, who was to decide on the publication of Grossman's epic novel *Life and Fate* (*Zhizn' i sud'ba*).¹ Suslov's verdict was unequivocal: "Why should we add your book to the nuclear bombs that our enemies are getting ready for us? Its publication will only help our enemies [...]." ²

Suslov's comparison of *Life and Fate* with an intellectual bomb of sorts that would bolster the US nuclear arsenal not only bespeaks his Cold War mentality, but it is also highly ironic, when held against Grossman's own thoughts on the topic as professed in his novel and elsewhere. Among its many other provocative ideas, *Life and Fate* contains a fundamental critique of nuclearism³ that precisely transcends the attitude of "if you're not for us, you're against us," professed by Suslov.⁴ In his novel, as well as in some of his stories, Grossman questions the "nuclear culture" that in the Soviet Union began to emerge in the immediate postwar years and crystallized into a cult of the atom that would only subside with the Chernobyl disaster and the demise of the Soviet Union.⁵ His voice was probably the most articulate and outspokenly critical among the Soviet writers who addressed the nuclear issue in their writings, and much of Grossman's thinking coincides with that of Günther Anders and other prominent critics of nuclearism in the West. Yet it was a voice that was not heard outside a limited circle of friends and those who acted as censors of his works.

Vasilii Grossman was a scientist by training and possessed a profound knowledge and understanding of the developments in nuclear physics. He was acutely aware of the dangers of nuclear warfare and radiation and, in 1961, planned to meet with Manhattan Project participant turned anti-nuclear bomb activist Eugene Rabinovitch during the latter's visit to Moscow.⁶ Nuclear physics and the specter of nuclear war figure prominently in several of Grossman's works. Viktor Shtrum, the protagonist of the novel dilogy *For the Right Cause* and *Life and Fate*, is a nuclear physicist, who plays an important role in the development of the first Soviet atomic bomb. In the story *Abel* (*August 6th*), (*Avel' [shestoe avgusta]*), Grossman depicts the nuclear devastation of Hiroshima. In the essay *The Sistine Madonna* (*Sikstinskaia Madonna*),

he envisions humanity on the path to wholesale nuclear destruction. Of the four texts, only the novel *For a Just Cause* (*Za pravoe delo*) was published during Grossman's lifetime. In the Soviet Union, both *Life and Fate* and the two shorter texts appeared in print only in the late 1980s.⁷ Yet Grossman's both subtle and scathing analysis of nuclearism testifies to an undercurrent of thought that, although never allowed to enter the Soviet mainstream and hidden from the Soviet readership at large, existed in a narrow segment of society and certainly was not lost on the authorities.

In order to assess the audacity of Grossman's banned writings on nuclear technology and nuclear war, one has to read them against those texts that could be published in the Soviet Union. According to Rosalind Marsh, post-Stalin literature expressed "a remarkably consistent attitude towards nuclear policy."⁸ From the end of World War II to Stalin's death in 1953, during the frantic race to catch up with the American nuclear lead and produce a Soviet nuclear and then hydrogen bomb, the topic was largely absent from the public debate. This changed from the mid-1950s onward. The American nuclear tests at the Bikini Atoll, the development of the neutron bomb, and the Kyshtym disaster led to a heightened awareness of the effects of radiation and raised the specter of wholesale nuclear destruction.⁹ In alignment with Khrushchev's doctrine of peaceful coexistence, Soviet writers were encouraged to address the nuclear war threat and paths to its solution. Their task was an intricate one and remained so until the end of the Soviet Union. Writers who took up nuclear issues were expected to advocate peace without risking being suspected of pacifism. They were supposed to denounce the bombing of Hiroshima and Nagasaki as a heinous crime against humanity, while playing down the effects of radiation just enough so as not to undermine the status of Soviet nuclear science as panacea to social and political problems, and they had to evoke the horror of nuclear war without being suspected of defeatism.¹⁰ It is not surprising that only in Science Fiction did Soviet writers find a rare niche, where nuclear war could be imagined in a manner relatively unrestrained by these considerations, due to the distant settings and the fact that the genre itself was not deemed weighty enough to merit full-fledged censorship.¹¹

Grossman wrote *Abel* (*August 6th*) in 1953 and *The Sistine Madonna* in 1954. In 1960, he submitted *Life and Fate* for publication in the journal *Znamia*, where the novel was rejected. Grossman's writings on nuclear technology thus span the transition from the relative silence of late Stalinism to the emergence of the nuclear topic in the mid-1950s and early 1960s. Some of the thoughts on nuclear war and nuclear physics in general that Grossman broached in his unpublished writings would become commonplace in the literature of the Thaw, albeit in a severely watered-down form: Hiroshima as a symbol of the human capacity of destruction, an overall concern about nuclear war, and skepticism as to science unfettered by ethical constraints. Yet Grossman was unique in that he approached these issues under quite different auspices

and completely untrammelled by ideological considerations. (The same is true with respect to his treatment of the Shoah. Here, too, Grossman anticipated thoughts that in a much tamer form and far more cautiously were later to be articulated in Evgenii Evtushenko's controversial poem on the Babii Iar massacre, and here, too, Grossman took a stance that transcended not just Soviet, but any ideology.)¹²

Vasilii Grossman's writings on nuclear technology and nuclear war raise the interesting question of the relationship between the authorities and the critical intelligentsia in the Soviet Union. The late 1950s marked the beginning of an unofficial sphere, with writers and artists who consciously stayed at the periphery and preferred to work outside of the state-sanctioned cultural institutions.¹³ Yet Grossman was by no means an "unofficial" writer. Until the banning of *Life and Fate*, he had been a literary celebrity, despite repeated attacks from the authorities. He did not write for the drawer but intended to publish his works in the Soviet Union, and even after the confiscation of *Life and Fate* never seriously considered publication abroad. Grossman's reflections on the nuclear theme did thus not take place in a hermetically sealed sphere. His writings were read and dismissed by censors not always unsympathetic to his thoughts, who had to weigh their options against the party line, and they were taken notice of, if not read, by the highest authorities: when *Life and Fate* was banned, Grossman appealed directly to Nikita Khrushchev for a revision of the ruling. The domain, where in the privacy of his desk and in private conversations Vasilii Grossman developed his uncompromising thought on nuclear issues, and that of the highest echelons of power were thus to some degree interpermeable. Given this fact, one may ask to what extent a writer like Grossman could have had an impact on the emergence of certain themes in the literature of the Thaw. Did he pick up on ideas that were already in the air and think them through with a subversive consistency unforeseen and unwelcomed by the authorities? Or did Grossman's writings on nuclear technology function as some kind of catalyst that prompted those in charge to extend a certain leeway to writers to incorporate his ideas into their own work in a manner deemed politically innocuous?

The first part of this chapter discusses the treatment of the nuclear bombing of Hiroshima and the nuclear threat in official Soviet literature from the 1940s to the 1960s. The second part shows how in his story *Abel (August 6th)*, Grossman presents the bombing of Hiroshima from a perspective that runs counter to the official stance and to some degree anticipates Günther Anders' *Theses of the Nuclear Age*. The third part discusses the topic of nuclear technology in Grossman's essay *The Sistine Madonna* and his novel *Life and Fate*. It will be shown how in both texts the danger of nuclear warfare is debated within the context of Grossman's experience of both the Stalinist crimes and the Shoah as well as his confrontation with anti-Semitism in the Soviet Union.

Optimistic Tragedy: The Bombing of Hiroshima and the Nuclear Threat in Official Soviet Literature from the 1940s to the 1960s

In 1953, Vasilii Grossman wrote the story *Abel (August 6th)*, his only work devoted solely to the topic of nuclear warfare. The story depicts the fictitious crew of the *Enola Gay* as they experience the bombing of Hiroshima. Grossman was by no means the first Soviet writer to address the topic. In Soviet literature from the late 1940s onward, Hiroshima figured prominently as a symbol of the American aggressors' unscrupulous brutality. Grossman's choice of subject would thus suggest his text to be in keeping with the official Soviet stance on nuclear war. Yet a close reading of *Abel (August 6th)* will show that the story breached just about any taboo connected with the topic of nuclear war. It is therefore not surprising that it was first published as late as 1989.

Over decades, the treatment of the bombing of Hiroshima in official Soviet literature remained relatively constant, with slight shifts of rhetoric that mirrored the vacillations in the Soviet-American relationship as well as a growing, if only cautiously admitted, awareness of the omnicidal potential of nuclear war.¹⁴ Not surprisingly, the fact that the Americans had been the first (and so far only ones) to employ nuclear weapons lent itself to propagandistic exploitation. The first literary responses to Hiroshima coincided with the production of the Soviet nuclear bomb, which restored the balance of power that in the Soviet perspective had been breached by the American demonstration of its nuclear prowess in Hiroshima and Nagasaki.¹⁵ In these texts, the bombing of Hiroshima is submitted to a "striking ideologization"¹⁶ that, as will be shown below, abated somewhat during the Thaw but was never fundamentally challenged.

Early literary treatments of Hiroshima were unanimous in that the strategic considerations of World War II, which, however spurious, prompted the United States to the nuclear attack on Hiroshima, were ignored. (This did not change over the years.) Instead, Hiroshima was viewed exclusively through the lens of the Cold War as an alarming milestone in the United States's attempt to defeat socialism and subjugate the world to its power. At the same time, in a somewhat paradoxical twist, this very Cold War appeared as but a new culmination in the ongoing struggle against the forces of evil that, after the defeat of fascist Germany, reemerged in the guise of American bankers and diplomats, guided by the same vicious blend of capitalism, imperialism, and racism that had instigated the Nazis to their crimes. In a particular "logic of accumulation,"¹⁷ Soviet writers established a direct link between the mass murders of the Nazis and the bombing of Hiroshima. The poem *Speech to the United Nations (Slovo k ob"edinennym natsiiam)* by Belorussian writer Arkadii Kuleshov, which appeared in *Novyi mir* in 1948, provides a striking example.¹⁸ Kuleshov denounces the chorus of atom-lovers ("atomshchiki") who boast about the power of a bomb that can wipe out an entire city and

“burn up the fruits of human labor” in one strike. By condemning the bomb primarily for its capacity to destroy human labor, he clearly situates the destruction of Hiroshima within the ongoing ideological struggle between capitalism and socialism, and he makes clear that while the fascist-capitalist foe has remained essentially the same, his destructive power has reached an altogether new dimension: by comparison with the American bomb, “the ovens of Majdanek and Auschwitz pale into oblivion” (“*Bledneiut pred neiu pechi/Maidaneka i Osventsimal!*”).¹⁹

In Roman Kim’s novel *The Girl from Hiroshima* (*Devushka iz Khiroshimy*), published in the 1954 volume of *Oktiabr’*, the organ of the Soviet Writers’ Union, the link between the bombing of Hiroshima with the Nazi crimes is not stated overtly but is insinuated throughout the novel, and it is specifically racism that connects Hitler’s henchmen with their American counterparts.²⁰ Under the American occupation after the bombing of Hiroshima and Nagasaki, the Japanese find themselves trapped in a racist regime that does not distinguish between Blacks, Japanese, and Japanese Americans: “to them,” one of the Japanese characters says, “[W]e are all colored” (“*My te zhe tsvetnye*”).²¹ It is when Kim describes the treatment of the radiation victims by the occupation forces that the true nature of American racism is exposed. In *The Girl from Hiroshima*, the facts about the racist underpinnings of the war against Japan and the encumbrance of proper treatment of the Hiroshima victims by the American occupation forces are stretched to a point that the Americans mutate into worthy successors to the Nazis.²² The American doctors, who examine the survivors of Hiroshima, bear a striking resemblance to Dr. Mengele and his medical cronies. To them, the Japanese radiation victims are no more than guinea pigs for potentially lethal medical experiments. They strip their “patients,” who they treat with racist contempt, both of their clothes and individuality: like in the Nazi camps, the Japanese are given numbers instead of names.²³ At a time, when the topic of the Nazi mass murder directed against the Jews was practically taboo for Soviet writers, Nazi racism was invoked in more vague terms to insinuate an evil affinity between the anti-Semitism of the fascist foe and the racism directed against Blacks and others in the United States.

A similar conflation of Nazi racism, American capitalism, and a culture of death that first manifested itself in Auschwitz and allegedly culminates in the willingness to use nuclear weapons for future mass killings can be found in Il’ia Selvinskii’s play *Reading Faust* (*Chitaia Fausta*), written in 1947 and first published in 1952. In this play, set during World War II in the laboratory of a German nuclear physicist, the positive characters get to voice the opinion that Auschwitz is a direct outcome of capitalism (“*Kapitalizm—eto Osventsim*”) and predict the merging of Nazi ideology with American commercial culture as a logical development.²⁴ For the soon-to-be-Americanized Nazis in Selvinskii’s play, nuclear fission is but a means to further enhance their technological capacity for the mass killing of both Jews and Slavs (as Selvinskii is careful to point out), which was demonstrated in the gas chambers of

Auschwitz and will, so they predict, be brought to a triumphant conclusion by nuclear warfare against the Soviet Union.²⁵

In the literature of the Thaw, the linkage between the Nazi camps and Hiroshima seems to become less prominent. Yet the conglomeration of Nazi mass murder and the nuclear devastation of Hiroshima remained commonplace enough to merit entry in Dmitrii Prigov's "sociopolitical ideological dictionary" of the socialist motherland. In a poem entitled *Alphabet 1* (*Azbuka 1*) from 1980, Prigov, known for debunking Soviet propaganda clichés by repeating them ad nauseam, lists some of the most stereotypical dogmas of Soviet life. Under the letter "kh," we find the following verse: "Hitler, the beast from the dark, the brute/Hiroshima his very fruit" ("*Khitler – èto zver' iz t'my/Khirosima – vot ego plody*").²⁶

Prigov's sardonic verses implicitly point to an ethical assumption inherent in the official Soviet approach to Hiroshima: the Hitler-Hiroshima equation, as mocked by Prigov, is based on a clear-cut distinction of good and evil. What links the Nazis to the perpetrators of Hiroshima is their demonic will to destroy what is good in humanity and for which the Soviet Union stands as a safeguard. The idea, propelled by Günther Anders and other thinkers, that in the nuclear age, the technology of mass destruction has reached a stage, where on some level the line between perpetrators and victims becomes blurred, and traditional concepts of good and evil are seriously challenged, was not something to be discussed in Soviet literature. A recurrent motif in Soviet poetry on Hiroshima is the prophecy of a secularized final judgment of sorts, which after an apocalyptic fight between the righteous Soviet Union and the evil West will seal the ultimate triumph of socialism over the capitalist-imperialist forces and their nuclear arsenal. In his 1947 poem *Raise Your Voice, Decent People* (*Vozvys'te golos, chestnye liudi*), Aleksei Surkov scoffs that the world's uranium, here exclusively exploited by the Americans, will not suffice to alter history's course and predicts that the power of the atom will not prevent the aggressors from their just punishment before a universal court of the righteous and free.²⁷ Evgenii Dolmatovskii, in a poem entitled *Trial/Judgment* (*Sud*), published in the renowned journal *Novyi Mir* in 1949, sees the Nuremberg trials as but a tame prelude to a future apocalyptic tribunal that will indict American imperialism. The new forces of evil have armed themselves with both financial and nuclear weapons: "the engraved dollar, the coin of betrayal/the evil bomb that carries the atom" ("*gravirovannyi dollar – moneta predatel'stva, zlaia bomba, v kotoruiu atom zazhat*"). In heavy anapestic verse, Dolmatovskii has the righteous from all over the world gather to bring to justice the successors to "Rippentrop and Göring." And this, so the last verse announces, will be the "last death sentence administered on earth" ("*... Èto budet posledniaia kazn' na zemle*").²⁸

Up to the mid-1950s, the concept of Hiroshima as a prelude to a universal battle that would end with the ultimate defeat of the nuclear-armed enemy was prevalent in Soviet literature, in accordance with Lenin's still virulent idea

of inevitable war and Georgii Malenkov's theory that World War III would result in the final downfall of capitalism.²⁹ Writers on Hiroshima oscillated as to the role of the Soviet Union with respect to nuclear weapons in this prospective war. More often than not, in Soviet literature on Hiroshima, it is exclusively the Americans and their cronies who insidiously resort to nuclear bombs, while the Soviet Union fights with fairness, relying on the strength of its ideological superiority, and uses nuclear technology only for peaceful purposes. In the above-mentioned *Speech to the United Nations*, Arkadii Kuleshov appeals to the United Nations to ban all nuclear arms and proclaims socialism to be the true nuclear weapon. Roman Kim, in the novel *The Girl from Hiroshima*, implicitly employs the cliché of American cowardice, which, as Christoph Garstka has shown, was customary in postwar Soviet literature and rested on the idea that while during World War II the Soviets fought in honest combat, the American military "preferred to hide behind the Red Army just like it was now hiding behind the bomb."³⁰ Kim's novel leaves no doubt that Hiroshima is but the beginning of a universal war between the American fascists and the insulted and oppressed of the world. Both the development of the hydrogen bomb and the human experiments that the American Atomic Bomb Casualty Commission (ABCC) is alleged to be carrying out with the Japanese radiation victims can mean but one thing: the Americans are preparing for nuclear war on a hitherto unimaginable scale in order to grant their racist-capitalist regime everlasting dominance of the world. The novel's heroine Sumiko, herself a survivor of Hiroshima, and her leftist friends embark on an almost bare-handed partisan battle against the atom-bomb-carrying "Ame" and their Japanese collaborators, a battle that is depicted as a class struggle, as an anti-imperialist war of liberation, and as a fight for world peace. The passages when the Japanese youngsters attack their "fascist" foe read like any combat scene from the average Soviet socialist realist novel about the "Great Patriotic War," seasoned with some extra ingredients from the spy genre to fully accommodate the taste of the Cold War readership.

As the examples show, in Soviet literature, nuclearization is frequently presented as a phenomenon exclusively pertaining to the American enemy. If the Soviet nuclear program is alluded to at all, the implicit threat to the ideological foe is clad in a decidedly unmartial posture. In the poem *Your strength (Tvoia sila)* published in 1949, the year that the first Soviet nuclear bomb was produced, Evgenii Dolmatovskii strikes the tone of an idyllic lullaby: when a baby girl is awakened by a nightly shock wave from the distant Taiga, her father soothingly hints at an unspeakable explosive of unprecedented power, tested by Soviet geologists for the sole purpose of granting the child sleep unharmed by an enemy that lurks behind the borders of the socialist empire.³¹ In Il'ia Selvinskii's above-mentioned play *Reading Faust*, the Soviet Union uses the peaceful atom to fulfill its vision of a just and prosperous society, while the Nazis are preparing for a nuclear war to be carried out by their American successors.³²

On the tenth anniversary of the bombing of Hiroshima, *Literaturnaia gazeta* published an article on the visit of a delegation of nuclear survivors from Japan to a festival in Warsaw. The report clearly mirrors a shift from the belief in the inevitability of war to the doctrine of peaceful coexistence. The bombing of Warsaw in World War II and that of Hiroshima are still located on a continuum of horror, the fascist-capitalist perpetrators of which are essentially the same, but the idea of Hiroshima as a prelude to a universal apocalyptic battle is now abandoned. Instead of striking a confrontational tone, the author invokes Hiroshima and Warsaw to appeal for peace.³³ Remarkably, the text also makes extensive mention of the effects of radiation on the survivors of Hiroshima, a question that had long been delicately skirted.

Not coincidentally, in the mid-1950s, the issue of radiation sickness began to surface in Soviet literature on Hiroshima. Clearly, writers who addressed the sensitive topic were expected to reconcile the horrors of long-term consequences of exposure to radioactive fallout with the forced optimism of socialist realism. The above-quoted 1954 novel *The Girl from Hiroshima* by Anatolii Kim is a showcase example of this. Kim makes it clear that with the correct (socialist) attitude, any damage, moral as well as physical, can be undone. In *The Girl from Hiroshima*, even the problem of radiation is solved along ideological lines (and thereby the Soviet nuclear program is implicitly and conveniently vindicated). “One shouldn’t pin everything on radiation” (“nel’zia vse valit’ na radiatsiiu”),³⁴ a Japanese doctor assures the heroine, who herself has received a lethal dose of radiation, and insinuates that the long-term casualties of Hiroshima are not so much bomb-related as caused by the American capitalist practice to grant medical treatment only to the rich. In fact, it is even hinted that there exists a Russian method for treating radiation damage.³⁵ While Western capitalism is thus denounced as a cynical culture of death, Soviet Russia appears as a beacon of life-saving hope. (It should be pointed out, however, that such grotesque nonchalance toward fallout dangers was by no means confined to the Soviet side, rather it was in fact professed far more blatantly by American bomb advocate Edward Teller).³⁶

In *The Girl from Hiroshima*, the optimism in the power of socialist ideology to take the lethal edge of radiation is vindicated by the outcome of the story. Eventually, Kim’s heroine rises like a phoenix from nuclear ashes.³⁷ Not only does she join the Japanese Reds and, buttressed by the late Stalin’s spiritual support, helps topple the evil forces of American capitalism and imperialism, but she does so as a reborn, socialist person, who manages to cast off her old oppressed self as a woman, a member of a “colored” race, a peasant held down by a feudal system, and prepares to forge a new society forever immune to capitalist ills and, so it seems, to radioactive radiation.

Soviet writers of the 1960s tended to have a somewhat more realistic take on the problem of radiation, yet they, too, adhered to the optimism imperative, albeit in a subtler form. In 1965, Mikhail Matusovskii, author of the worldwide hit *Moscow Nights* (*Podmoskovnye vechera*), devoted a whole cycle of poetry to Hiroshima. Matusovskii does not spare his readers the gruesome

details of death by radiation, the long-term effects of exposure to radioactive fallout, and the mutilations and mutations. He leaves no doubt that for the individual victims of decades to come, the damage will be irreversible. For those individuals, even the conquering spirit of the socialist motherland cannot provide any healing. In the poem *Little Girl Sakaia is Dying* (*Umiraet devochka Sakaia*), Soviet cosmonaut Valentina Tereshkova, whose photograph is placed like an icon above the bed of a child patient in the atomic hospital of Hiroshima, looks helplessly on as the little girl succumbs to radiation sickness, while in some distant laboratory, an evil Doctor Oppenheimer performs his heinous experiments.³⁸ In *A Human Being is Born* (*Chelovek rodilsia*), the birth of a child turns from a joyful event into a nightmare, as for many generations Hiroshima parents will produce a “chain of unknown mutations” (“tsep’ nikomu ne izvestnykh mutatsii”).³⁹

Matusovskii clearly presents Hiroshima as a tragedy, for which even socialism cannot provide an immediate cure, but here, too, it is, to borrow the title of Vsevolod Vishnevskii’s play, an “optimistic tragedy,” which absorbs the fate of the individual victims and the horror of atomic warfare in an overall tenor of hope. A flower, planted by historical Doctor Shigeto in the ruins of Hiroshima or a concert by Soviet violin virtuoso Leonid Kogan in the Hiroshima atomic hospital suffice to restore in the doomed inhabitants of the devastated city faith in a better world, even though they themselves will not participate in the bright future adumbrated by such virtuous deeds.⁴⁰ Even radiation turns from a real danger into a metaphor of humanity’s unabating indignation at the bombing of Hiroshima, an indignation that will save the world from future such atrocities.⁴¹

Curiously, it seems to be predominantly girls, clearly modeled after Sadako Sasaki, and young women that in Soviet literature (and film) figure as Hiroshima radiation victims.⁴² While Roman Kim has his “Girl from Hiroshima” overcome radiation sickness through ideological valor, Mikhail Matusovskii in one of his poems melodramatically contrasts the oriental beauty and perfect self-possession of a “Miss Hiroshima” with the fact that she is secretly suffering from leukemia. These heroines can be seen as striking Soviet counter-images to the so-called Hiroshima Maidens, who in the early 1950s shaped the perception of the radiation victims in the United States. Both the Soviet iconization of the “girl from Hiroshima” and the American media reports on the young Japanese women who received treatment in the United States reverse the shock of Hiroshima into a triumph of humanity by reassuring their audiences that the moral and physical wounds struck by the first nuclear bombing can be healed. Both cater to the myth of Soviet and American, nuclear victimhood, respectively, while both states are in fact amassing an arsenal of nuclear weapons. Needless to say, neither the Soviet nor the American version of the “Hiroshima Maiden” could be more remote from the experience of the actual victims.⁴³

The above examples have shown that in Soviet literature, the bombing of Hiroshima and Nagasaki is seamlessly integrated into the continuous

narrative of the socialist fight against a fascist-capitalist enemy that under a different guise essentially remains the same, while his arsenal of destruction becomes ever more deadly.⁴⁴ The horrid facts of nuclear devastation are channeled into an all-embracing optimism about the salvational force of Soviet ideology. Roman Kim's *The Girl from Hiroshima* is particularly interesting in that it implicitly negotiates how Hiroshima should not be presented: as an emblem of a technological civilization that shattered the ethical foundations of human society. In Kim's novel, a young Japanese law student, who knows to have received a lethal radiation dose, gets to voice the opinion that with the bombing of Hiroshima "[...] our machine-based civilization has reached the last stage of barbarism" ("*Mashinnaia tsvilizatsiia nyne vstupila v posledniuiu stadiiu varvarstva*"). On the morning of August 6, 1945, "something far worse happened than the death of hundreds of thousands of people. That morning human morality was burnt to ashes... and humanity has lost the right to existence" ("*V to utro proizoshlo to, chto neizmerimo strashnee gibeli soten tysiach chelovek. V to utro ispepelilas' moral' chelovechestva... i ono utratilo pravo na sushchestvovanie*").⁴⁵

For the student, Hiroshima is the initial spark to a chain reaction that upturns the very basis of humanity's moral and factual existence and will ultimately lead to a global nuclear apocalypse.⁴⁶ Not surprisingly, these ideas are shown to be the foul fruits of Western capitalist thinking: the young man is inspired by an unnamed "voguish French philosopher" ("*modnyi frantsuzskii pisatel*").⁴⁷ Kim's heroine, herself lethally ill, is quick to repudiate such defeatist nihilism and instead vows to defeat those responsible for initiating the nuclear age: "They won't throw any more bombs" ("*Bol'she ne budut brosat*").⁴⁸

The idea of the nuclear destruction of Hiroshima as a caesura that fundamentally challenges not only humankind's existence but also traditional notions of good and evil, guilt and responsibility lies at the core of Vasilii Grossman's story *Abel (August 6th)*. In *The Sistine Madonna* and *Life and Fate*, he integrates these thoughts into a general critique of a society in which bureaucratization and technology cooperate to produce mass murder. In doing so, Grossman does not succumb to the defeatism, so anathemized by official Soviet culture,⁴⁹ but does something far more outrageous: as a remedy for the menace of the nuclear age, he raises the imperative to forsake any ideology at all as the driving force for the annihilatory tendencies inherent in modern civilization.

Repentant Pilots: Grossman's *Abel (August 6th)* and Günther Anders' *Theses on the Nuclear Age*

In *Abel (August 6th)*, Grossman explores the mindset of the (fictitious) crew of the *Enola Gay* on the eve of, during, and immediately after the dropping of the atomic bomb. Here, the Cold War agenda, so prominent in official literature on Hiroshima, is remarkably absent. The hazards inherent in the

nuclear age are discussed in a philosophical manner that transcends both strategic and ideological considerations. The Americans in Grossman's story are not presented as heinous crypto-fascists, who pursue the destruction of Hiroshima as part of their insidious plan to conquer the world. They perform their task with a sense of duty and to some degree are even guided by a moral impetus. When they grasp the full scope of their deed, several of the men are ready to confront their guilt over myriads of deaths. Yet the story shows that in light of technological mass annihilation on the scale of Hiroshima, traditional notions of guilt and responsibility, good and evil no longer suffice to comprehend and explain the role of the individual in the murderous apparatus of modern warfare.

In the previous chapter, I have shown how official Soviet literature establishes a direct link between the German concentration camps and American nuclear policy, thus denigrating the United States as successor to Nazi Germany, while presenting the Soviet Union as moral beacon in the fight against the ultimate evil of fascist capitalism. In *Abel (August 6th)*, the Nazi crimes are invoked in a different way: as potential moral justification for the bombing of Hiroshima – a rather astonishing historical contextualization, given the Soviet context. For the crew of the *Enola Gay* as well as for the world public in Grossman's story, the nuclear destruction of Hiroshima is part of the common fight against fascism, against the evil forces behind both Auschwitz and Pearl Harbor (both places are named explicitly).⁵⁰ In this respect, the agenda of Grossman's American protagonists concurs with that professed by the Soviet Union. When, in a narrator's comment, Grossman takes care to refute such reasoning, he does not argue along ideological lines, but based on fundamental considerations that apply to any use of weapons of mass destruction, whatever the rationale behind it. For him, the moral justification of Hiroshima through Auschwitz is problematic in two ways. First: innocent civilians should not be collectively punished for crimes they did not personally commit:

In the immediate aftermath of the bombing, politicians, philosophers, military people, journalists, publicists, argued that the powerful blast of the uranium bomb, by avenging the fascist crimes against humanity and significantly paralyzing Japan's resistance, would hasten peace so coveted by every mother for the sake of the life of her children. Their arguments were instantly grasped both by the Japanese military staff and the Tokyo imperial court. All of this could not be grasped by a four-year-old Japanese boy. He awoke at dawn and reached out his chubby arms to his grandmother. [...] The boy knew that he brought a lot of joy to his grandmother, who took pleasure in waking up and seeing her grandson. [...] So neither the boy nor his grandmother nor hundreds of other children, their mothers and grandmothers, could grasp why they of all people should pay the price for Pearl Harbor and Auschwitz.⁵¹

Second: the sheer scope of nuclear annihilation precludes any moral justification of Hiroshima through Auschwitz. The fact that with a mere pressing of a button one can achieve an unprecedented totality of destruction puts atomic bombing on a different plane from even the horrendous efficiency of the Nazi gas chambers. For Grossman, the quantitative leap in destruction thus results in a qualitative leap from genocide to omnicide.⁵²

In a most subtle and differentiated way, Grossman analyzes the moral quandaries involved in the atomic bombing. His story exposes the defense mechanisms that make such an act possible by enabling the men of the *Enola Gay* to block out the moral implications of their deed. It specifically focuses on two psychological mechanisms often referred to as “doubling” and “dissociation” (or “splitting”).⁵³ Barrens, the (fictitious) first pilot of the *Enola Gay*, provides us with a prime example of doubling. To his colleagues, Barrens is known for his unemotional, never-failing efficiency in the deadly business of bombing. To his friends and family, he is a passionate gardener with a deep love for creaturely life. Never do the two aspects of his personality interfere. In fact, the small-handed man in an oilcloth apron seems physically incompatible with the master of the joystick capable of killing thousands of people.⁵⁴

Those who visited him at home and those who flew tactical flights with him found themselves unable to mentally unite the little man with his oilcloth apron and green watering can, who eloquently dwelled on the specifics of color and shape of the tulips grown by him, with the outstanding pilot, a tight-lipped and tough man, who showed neither nerves nor emotion.

This professional schizophrenia allows both gardener and bomber to go about their business as if the respective other were non-existent.

The factual distance that modern warfare, with its reliance on highly developed technological weapons, puts between killer and victim allows Grossman’s protagonists to distance themselves both emotionally and morally from their deed, a process often described as dissociation. The crew of the *Enola Gay* acts as if technology and guilt were in inverse proportion. One of its members likens their perspective to looking through the reverse end of binoculars: the greater the distance, the less the moral responsibility.⁵⁵ (Significantly, the crew does not even know the name of the city they are about to wipe out.)

For most of the men these mechanisms work: the dropping of the bomb fills them with professional satisfaction, and they look forward to a well-deserved vacation. Grossman makes sure, however, that both doubling and dissociation are exposed as fallacy: they may soothe one’s conscience, but they do not exonerate from responsibility for one’s acts. The question of individual guilt remains unsolved.

After the Hiroshima bombing, the first pilot Barrens, who so conveniently alternated between benign gardener and ruthless bomber, suddenly finds the

line between the two aspects of his personality blurred. Now it dawns on him that gardening might not be so innocent an activity after all: by weeding out unwanted plants, the gardener not only supports but also annihilates life. The garden thus no longer serves as moral refuge where one finds peace from the machinery of war. It becomes, on the contrary, a metaphor for this very machinery itself. By implicitly comparing the bombing of the enemy with weeding a garden, Barrens presents it to himself as a necessary evil. The art of gardening thus serves him as justification for the art of killing in the name of improved life.⁵⁶ This attempt at vindication, however, does not put him at ease. With the bomber intruding into the garden and the gardener entering the cockpit, the mechanism of doubling no longer shields Barrens from the moral implications of his participation in the bombing. For the first time, he is beginning to take responsibility for his deeds as a full, undivided person. When Barrens realizes that the youngest crew member is having trouble coming to terms with their deed, he, too, betrays a sense of guilt: “So we’ve drunk a toast to gardening [...]. I used to think that this was the most sincere and nonviolent activity of all. But now it has occurred to me: let’s better drink to monasteries instead, right?”⁵⁷ Once the innocent refuge of the garden is closed the bomber can only do penance within monastic walls.

In a striking image, Grossman debunks the idea that by delegating the task of killing to a technological apparatus, one can evade the problem of individual guilt. Joseph Connor, the youngest of the crew, has the task to press the button that releases the bomb. So seemingly insignificant is this act and so remote from its impact that it is easy for Connor to see himself as but a tiny cog in the machine without any real responsibility. But this strategy of dissociation, too, is shown to be treacherous. This becomes evident when Connor expresses his emotions during the act of pressing the button in strangely physical terms:

[...] this moment was always a pleasant one for Connor—it was a soothing moment, the release of a severe tension. At such moments, it seemed to him that the bomb was not released from the belly of the plane but from his very own bowels.⁵⁸

Here, the dropping of the bomb is described as an act of defecation and is thus intimately linked with the man who presses the button. Grossman makes clear: it is the man, not the machine that kills.

Ironically, it is Joseph Connor, the youngest and most innocent member of the crew – whom the defense mechanisms of doubling and dissociation fail to shield from the implications of his deed after the Hiroshima bombing. Eventually, he is the only one to confront the question of responsibility and fully accept his guilt. Before the bombing, Connor is depicted as being in a kind of prelapsarian state: he drinks milk instead of alcohol, has no interest in women, and spends his spare time writing letters to his beloved mother. Connor experiences the bombing as a fall from grace from which he will

never recover.⁵⁹ He falls into utter despair over the fact that he has contributed to the death of so many people and eventually tries to commit suicide. For him, not even the argument that the murder was committed for the sake of good (the Auschwitz-Pearl Harbor argument) is valid anymore. The sheer scope of destruction renders the traditional categories of good and bad worthless. “Abel, Abel, where is your brother Cain?” (“Abel, Abel, gde brat tvoi Kain?”),⁶⁰ says one of the crew members jokingly when Connor talks about his despair over the dead civilians. It is not accidental that here the roles of Cain and Abel are reversed. What Connor’s colleague wants to imply is that sometimes the good brother has to commit an evil act for the sake of the general good. For Connor, this does not suffice to explain the moral quandary of the crew. He carries the reversal of Cain and Abel to a radical extreme: “Cain was an ordinary guy, not much worse than Abel, and the city [i.e. Hiroshima] was full of people just like us. The difference between them and us is that we exist, and they no longer do.”⁶¹ For Connor, after the atomic bombing of Hiroshima, the traditional categories of good and evil have lost their validity. The question of intent (evil committed for the sake of good) becomes negligible. The ancient fight between good and evil is superseded by the question: “Is life on this earth still possible?”⁶²

By reversing the prototypical story of good and evil within human history, Grossman marks the Hiroshima bombing as rupture in civilization, after which we need to fundamentally rethink the tenets of this civilization.⁶³ Grossman nurtures no illusions about society’s response to this perspective. The fictitious crew members of the *Enola Gay* make it clear that there are only two places for people like Connor: a monastery or a mental institution.

In the late 1940s, the legend spread around the world that, in an act of atonement, one of the pilots involved in the bombing of Hiroshima had retreated to a monastery. In 1953, the year, when *Abel (August 6th)* was written, Major Claude Eatherly, who had performed the reconnaissance flight that preceded the bombing of Hiroshima, was tried before a New Orleans court for a financial misdemeanor, the profit of which he had forwarded to a fund for the children of Hiroshima. After several attempts at suicide and a series of crimes, Eatherly committed himself to a mental institution. In the late 1950s, Eatherly became world famous through his correspondence with Austrian-Jewish philosopher and anti-nuclear activist Günther Anders, who stylized the repentant pilot as “the world’s first martyr for Nuclear Disarmament,” in the disapproving words of Ronald Bryden.⁶⁴

Interestingly, in *Abel (August 6th)*, Grossman anticipates in the form of a fictional narrative many of the thoughts that Anders was to develop in his letters to Eatherly and his essays from the late 1950s and early 1960s. First: Grossman’s fictional crew experiences what in Anders’ *Theses on the Nuclear Age* is termed “schizotopy” – a total spatial as well as mental separation of cause and effect that is, according to Anders, typical of modern bureaucratic-technological culture and results in a suspension of human agency: individual agency has been replaced by the pressing of a button, a mechanism of

“triggering” that can result in a whole chain of consecutive triggering yet shields the perpetrator from the consequences of his action: “Not one presser of buttons (if such a presser is at all still needed) senses anymore that he performs an action, and since the site of the crime [*Tatort*] and that of suffering no longer coincide, since cause and effect have been severed, nobody sees what his action entails.”⁶⁵ Both the fictional pilot Joseph Connor, as depicted by Grossman, and the real pilot Claude Eatherly, as stylized by Anders, strive to overcome this blindness and restore individual agency, even if this means to confront themselves with an unbearable guilt. Ironically, for both, the metamorphosis from the proverbial cog in the machine to a human being with an integrated sense of morality results in their being no longer considered socially acceptable.

Second: in *Abel (August 6th)*, Grossman explores the challenge to humanity’s moral existence posed by the nuclear bombing of Hiroshima in terms similar to those of Günther Anders. For Anders, the “‘technification’ of our being” results in an upheaval of traditional notions of good and evil, guilt and responsibility:

[...] the fact that to-day it is possible that unknowingly and indirectly, like screws in a machine, we can be used in actions, the effects of which are beyond the horizon of our eyes and imagination, and of which, could we imagine them, we could not approve—this fact has changed the very foundations of our moral existence. Thus, we can become ‘guiltlessly guilty,’ a condition which had not existed in the technically less advanced times of our fathers.⁶⁶

Like Anders, Grossman, too, diagnoses the replacement of “conscience” by the “conscientious,” which for Anders is a trademark of a technological culture based on a division of labor and competence. Grossman’s fictional crew members of the *Enola Gay* are highly specialized men with a profound sense of responsibility, yet theirs is merely professional responsibility that confines itself to the flawless performance of the technical task. As the philosopher of the crew, a man who in his spare time muses about ways to improve the world, puts it: “in this matter, technology frees us from moral responsibility” (“*tekhnika osvobozhdaet nas v ètom dele ot moral’noi otvetstvennosti*”).⁶⁷

None of Grossman’s crew members nurtures any hostility toward the people they are about to kill. His men of the *Enola Gay* detest racism and do not perceive the Japanese as enemies; Joseph Connor professes to never even have seen a Japanese in uniform. On the eve of their murderous flight, the crew goes about their hobbies and philosophizes on moral matters. In depicting the perpetrators as decent human beings, devoid of any hatred for their victims, Grossman illustrates what Anders will later call the “macabre peacefulness” of nuclear warfare, where the lack of hostility toward the victim is not an expression of true kindness, but of the fact that the victim is simply not visible.⁶⁸

The story of the Hiroshima pilot turned monk was a myth, but, as Robert Jungk wrote in his foreword to Anders' correspondence with Claude Eatherly, this was a myth much needed: "It had invented an act of repentance which, in any case, had, sometime or other, to become a reality."⁶⁹ In the eyes of Günther Anders, through his seemingly insane acts, Eatherly claimed for himself the guilt denied by society as a whole and thus attempted to restore the moral foundation that is being lost in the age of industrial mass annihilation. With Joseph Connor, the protagonist of *Abel (August 6th)*, Vasilii Grossman had created a Soviet version of the repentant pilot, who through his uncomprehending participation in the devastation of Hiroshima becomes guiltlessly guilty, both perpetrator and victim of the nuclear age, and who takes upon himself the responsibility for his unquestioning service to the technological apparatus that produces mass murder. Grossman's fictional pilot was neither relegated to a monastery, nor to an insane asylum, but to the writer's drawer, from where he would be released only in 1989, shortly before the demise of the Soviet Union.

The Satanic Cosmic Force: Nuclear Technology as a Signature of Twentieth-Century Totalitarianism in Vasilii Grossman's *Sistine Madonna* and *Life and Fate*

In *Abel (August 6th)*, Vasilii Grossman uses the historical bombing of Hiroshima to explore the moral implications of technification. In a prefiguration of Günther Anders' *Theses on the Nuclear Age*, he shows how the suspension of individual responsibility and the replacement of human agency by a mere functioning of the bureaucratic-technological apparatus provide the prerequisite for industrialized mass murder on an unprecedented scale. In the essay *The Sistine Madonna* and the novel *Life and Fate*, the focus is on the impending arms race. Here, too, Grossman departs from the concrete historical situation to general thoughts on the human potential for mass murder. The threat of wholesale nuclear annihilation is located on a continuum of totalitarian violence that started with the Stalinist war against the so-called kulaks and culminated in the genocidal policy of the Nazis, with nuclear omnicide looming ahead. In both texts, the Shoah appears as a kind of negative epiphany in that it fully reveals the horror of industrial mass murder carried out by a seemingly faceless bureaucratic-technological apparatus. In both *The Sistine Madonna* and *Life and Fate*, nuclear processes are invoked as metaphor for the inhuman tendencies that make this horror possible.

In *The Sistine Madonna*, Grossman presents human history as based on a precarious balance of inhuman cruelty and suffering on the one hand, and what he terms "what is human in man" ("chelovecheskoe v cheloveke")⁷⁰ on the other. It is this human spirit that even in the most adverse of circumstances is capable of unexpected acts of kindness, thus preventing human civilization from permanently lapsing into barbarism. For Grossman, the human spirit is embodied in Raphael's *Sistine Madonna*, which he saw in a

Moscow exhibition of looted art about to be shipped back to the Dresden Gallery. The expression on the Madonna's face as she knowingly gives up her child to his fate of torture and suffering embodies the very kindness that miraculously prevails in the face of tyranny and oppression and preserves our humanity.⁷¹

It takes one single word to cut short Grossman's eulogy on the human spirit: Treblinka. The memory of the eyewitness accounts he collected on the site of this annihilation camp when advancing into East Poland with the Red Army reminds Grossman that there are moments in history when the already tenuous balance that lies at the base of human civilization is disrupted, when the message of the Sistine Madonna is unheeded, and the human spirit is crushed by beast-like cruelty. While the "wolf age" ("*volch'e vremia*")⁷² of Nazism is the most radical of such disruptive moments, it was neither the first nor will it be the last. In a bizarre parade, Grossman has both Hitler and Stalin file past Raphael's painting. Hitler, the failed artist, has to avert his eyes from the Madonna and her child, because "they were human beings" ("*ved' oni byli liud'mi*").⁷³ Stalin looks at her, "but did he recognize her?"⁷⁴ The implicit question here is a provocative one: did he recognize her in the eyes of the starving kulaks and those who perished in the Gulag during the Great Purges?⁷⁵ From here, Grossman has the Madonna continue her journey through the ages to future sites of genocide (among others, in an eerie premonition, to Sudan). But how does the present era, which Grossman defines as the age of nuclear reaction, stand the test, when confronted with the Sistine Madonna?

For Grossman, the nuclear age, and specifically the advent of thermonuclear weapons, possesses a disruptive potential on an altogether different scale. While the totalitarian regimes aimed at crushing the human spirit, the nuclear age threatens to unhinge the earth itself, the very foundation of human (and not only human) life. With this leap from genocide to omnicide, for the first time in human history, the possibility arises that the human spirit, embodied by the Madonna and her child, will be destroyed for good:

Every now and again the post-war silence is disrupted by the thunder of explosions, and a radioactive cloud spreads across the sky.

And then the earth on which we live shudders; the atom bomb has been replaced by the hydrogen bomb.

Soon we must see the Sistine Madonna on her way. She has lived with us; she has lived our life. Judge us then, judge us all – along with the Madonna and her son. Soon we will leave life; our hair is already white. But she, a young mother carrying her son in her arms, will go forward to meet her fate. Together with a new generation of people she will see in the sky a blinding, powerful light: the first explosion of a thermonuclear bomb, a super-powerful bomb heralding the start of a new, global war.

What can we, people of the epoch of Fascism, say before the court of the past and the future? Nothing can vindicate us. We will say, 'There

has been no time crueller than ours, yet we did not allow what is human in man to perish.⁷⁶

In *The Sistine Madonna* Grossman does not mention Hiroshima (nor Nagasaki) but focuses on the ever-escalating arms race instead, thereby precluding any attempt to shift the blame for the global nuclear threat on one particular nation or system.⁷⁷ This time, it is not a dictator, but an entire generation that is about to avert its eyes from the gaze of the Sistine Madonna and embark on a path of self-destruction, while the wounds of the recent war have not yet healed. Significantly, 1954, the year when *The Sistine Madonna* was written, coincides with the appeal to Georgii Malenkov by a group of prominent Soviet nuclear physicists under the leadership of Igor' Kurchatov to ban testing of thermonuclear weapons, which spawned a short-lived revision of Soviet nuclear policy.⁷⁸

In *The Sistine Madonna*, Grossman celebrates in an almost ostensibly optimistic vein the capacity of art to overcome the forces that aim at annihilating the kindness embodied in Raphael's Madonna. The painting prevails in view of what is now termed the Holodomor, the Stalinist purges, and the Shoah. It may, Grossman hopes, even safeguard the human spirit in the global nuclear wars to come. What is more, the Madonna has the potential to reverse the thermonuclear reaction process, thus undoing the very foundation of the global atomic threat. While thermonuclear reaction transforms matter into energy, the maternal soul as the highest manifestation of the human spirit, embodied in Raphael's immortal painting, is energy materialized.⁷⁹

On closer inspection, however, there is a darker undertone to the upbeat tenor of Grossman's eulogy on the power of art. In a curious passage, long before he addresses the issue of nuclear war, Grossman envisions a world where the human spirit embodied by the Madonna still exists, but humans no longer do: "But maybe, when people have died, those creatures that will take their place on earth – wolves, rats, bears, and swallows – will come, walking or flying, to look at the Madonna..."⁸⁰ When humans have turned into beasts, thus becoming extinct as species, there remains only the hope that the surviving beasts become susceptible to the orphaned human spirit captured in the immortal gaze of Raphael's Madonna.

By having both Hitler and Stalin fail to recognize the Sistine Madonna, Grossman shows that it is secularized chiliastic ideology, be it National Socialism or communism that brings about rupture in what he perceives to be essentially human.⁸¹ That Grossman's critique aims not only at Stalinist totalitarianism but also at any ideology that claims to be moving toward an empire of Good, including communism, becomes evident in his *magnum opus*, the novel *Life and Fate*. In this novel, there is a character who witnesses the mass killing of Jewish women, children, and old people by German *Einsatzgruppen* in Berdichev (Grossman's mother was killed that day) and loses all faith in any salvation ideology, and in fact in any concept of an absolute good, since this absolute good always has the potential to change into

its opposite. This man with the telling name Ikonnikov voices the central message of the novel: “Human history is not the battle of good struggling to overcome evil. It is a battle fought by a great evil struggling to crush a small kernel of human kindness” (“Istoriia liudei ne byla bitvoi dobra, stremiashchegosia pobedit’ zlo. Istoriia cheloveka – èto bitva velikogo zla, stremiashchegosia razmolot’ zernyshko chelovechnosti”).⁸² For Grossman, this “small kernel of human kindness,” too elusive to ever crystallize into a doctrine, is the only icon that can endure in the age of secular salvational “-isms.” He is, however, less optimistic as to whether it will prevail against the new threat of what Lifton and Markusen have termed the ideology of nuclearism.⁸³

Life and Fate is set during World War II. Its complex web of narrative strands centers around the battle of Stalingrad, which in some way or other affects most of the novel’s characters. *Life and Fate* depicts die-hard Bolsheviks as well as critics of communism, high-ranking Nazis as well as common German soldiers. It explores the mindset of both Hitler and Stalin, and presents the Shoah as a watershed event in history, while at the same time implying that the Nazi crimes and those committed in the name of Stalinism spring from the same totalitarian mentality. This alone, apart from numerous other taboos breached in *Life and Fate*, made the novel unacceptable for the authorities.⁸⁴

One aspect that is seldom discussed, but central to the novel, is its focus on the nuclear topic. In *Life and Fate*, the twentieth century is not only characterized as the age of global war and industrialized genocide on a hitherto unimaginable scale. It also marks the beginning of the atomic era, which for Grossman is an outgrowth of the same bureaucratic-technological culture that made the genocidal policy of the Nazis possible. The novel’s protagonist Viktor Shtrum is a Jewish scientist, who is initially convinced that nuclear physics will solve humanity’s cardinal problems. Like in *The Sistine Madonna*, where thermonuclear reaction becomes a metaphor for what is opposed to the human spirit, in *Life and Fate*, too, annihilatory and totalitarian tendencies in twentieth-century culture are discussed in terms of atomic and molecular physics. After the death of his mother at the hands of the German *Einsatzgruppen*, Viktor Shtrum begins to discern a “terrible analogy” between fascism and modern physics: with its contempt for the individual human being and the annihilation of entire communities along ethnic and other lines, fascism pursues a kind of “quantum policy” that follows the same mechanical laws as twentieth-century physics.⁸⁵ Throughout the novel, the metaphorical tie between totalitarian violence and modern physics is sustained. For the Nazi Liss, deputy to Heinrich Himmler in the concentration camp administration, entering the mind of a communist Soviet prisoner is like experiencing the attractive and repulsive forces in an atomic nucleus.⁸⁶ Later in the novel, in a sheer unbearable passage, the movement of bodies soon to be asphyxiated in a gas chamber is compared to the Brownian motion of molecules.⁸⁷

In *Life and Fate*, nuclear physics figure not only in a metaphorical but also in a very concrete, political sense. In the course of the novel, Viktor Shtrum realizes with growing qualms that the implications of his theoretical research reach far beyond the realm of mathematical abstraction: together with his colleagues, he is contributing to the development of a Soviet nuclear bomb. Shtrum's considerations proceed from general doubts about science unfettered by moral restraints to the awareness that with the advent of nuclear technology, humanity has entered a stage where such questions gain an unprecedented, existential urgency. From early on, it dawns upon Shtrum that science may have become an "ally of the terrible century" that gave rise to fascism. With growing unease, he observes the self-contentedness of his physicist colleagues, who refuse to pay heed to the ethical aspects of their trade, while a writer like Lev Tolstoi never ceased to question the moral justifiability of his art.⁸⁸

For Shtrum, the nuclear age opens up what Günther Anders has termed the "Promethean gap,"⁸⁹ i.e. the discrepancy between humanity's capacity to create weapons of apocalyptic potential and its ability to comprehend, let alone deal with the consequences of its own creation. In a discussion with a sympathetic fellow physicist, Shtrum perceives moral evolution to be fatally lagging behind technological progress. While nuclear science will doubtlessly grant humanity omnipotence, this omnipotence could turn out to be satanic rather than divine.

For a time, the division of labor and competence inherent in technological culture makes it easy for Shtrum to ignore his own role in facilitating mass annihilation. The same mechanism of dissociation that in *Abel (August 6th)* keeps the crew of the *Enola Gay* from facing their responsibility for the devastation of Hiroshima also works for the nuclear physicists, who in *Life and Fate* rush to develop a Soviet bomb (although this is never explicitly mentioned) at Stalin's behest. There is "a long way" from the seclusion of the desks, laboratories, libraries of the few leading nuclear physicists to the "satanic cosmic force" that will become the "scepter of state power," and while this distance allows the physicists to pursue their goal with purely scientific zeal, it also casts a shadow on Moscow and New York that will soon thicken into darkness.⁹⁰ For Shtrum, these distancing mechanisms temporarily break down, and it is the Shoah that brings about this change. A letter from his mother, written shortly before her death at the hands of the German *Einsatzgruppen*, not only compels him to confront his lack of empathy during the Stalinist purges and the terror of collectivization but also brings into focus the potentially genocidal consequences of his own nuclear research.

Initially, Shtrum soothes his conscience with the belief that only those scientists who serve Hitler are subject to the moral quandary lurking in their field. When, however, he is personally confronted with the rising anti-Semitism under Stalin, his scruples as to the potential consequences of his own scientific activity are exacerbated to a point where they can no longer be ignored. More and more, Shtrum struggles with the awareness that while

the Germans are still murdering Jewish children, he himself may be helping prepare the way for turning the world into a “galactic concentration camp.”⁹¹

Interestingly, Grossman has Shtrum’s “Jewish accent” become more prominent, when he talks about his quandary,⁹² thus linking the qualms of his protagonist even more tightly to the Jewish catastrophe of the Holocaust than still unfolding, and the persecution of Soviet Jewry looming ahead. In *Life and Fate*, Grossman leaves no doubt that his protagonist is indeed witnessing the beginning of what ten years later could have become a Soviet genocide of the Jews, had Stalin not died. In a chapter that depicts Stalin at the height of his power, he implies that with his regime based on the suppression and murder of ever new contingents of alleged enemies, the Soviet leader may not be so far apart from Hitler. Alluding to both the doctors’ plot and the anti-cosmopolitan campaign of the 1950s, the narrator predicts that only ten years after the triumph of Stalingrad, “Stalin would be wielding against the Jews the sword of annihilation that he had ripped away from Hitler.”⁹³

Grossman makes it clear that once the mechanism of dissociation has broken down, there is but one way for the nuclear scientist to resolve his moral quandary without lapsing into cynicism, namely, to refrain from participation in what could amount to mass murder. In *Life and Fate*, Shtrum’s fellow physicists discuss the fact that Rutherford allegedly refused to collaborate with research on the neutron because of its potentially destructive consequences, and they suspect the colleague with whom Shtrum shares his innermost doubts of doing the same. While most of the men easily dismiss such high-mindedness as noble, but absurd and ultimately egotistical puritanism, Shtrum is secretly sympathetic to his renegade colleague. Eventually, however, his scientific zeal takes the upper hand over his moral reservations. When Stalin personally invites him to take part in the development of a Soviet nuclear bomb, he agrees and for the sake of his career even signs a document denouncing his Jewish colleagues. Grossman subtly exposes the mechanisms of self-delusion with which his protagonist attempts to justify his behavior.⁹⁴ While the repentant pilot in *Abel (August 6th)* by one pressing of a button becomes irrevocably and monstrously guilty, Shtrum, however, is granted a second chance to act in accordance with his convictions. As in *The Sistine Madonna*, in *Life and Fate*, too, Grossman presents the maternal principle as counterforce to the mechanisms that lead humanity on its path to potential omnicide. For Shtrum, the letter of his mother works like a moral compass that leads him to reconsider his decision. At the height of his scientific success, the mere thought of this letter awakens Shtrum to the realization that he can still revise his involvement in Stalin’s nuclear weapons program and thus preserve his moral integrity.

Conclusion

The comparison of official Soviet literature on nuclear war with Vasilii Grossman’s writings has shown that while official writers had very limited leeway in dealing with the topic, there was an undercurrent of independent

thought that was known to the Soviet authorities and anticipated much of the radical criticism of nuclear technology voiced by Western thinkers like Günther Anders. It is with respect to three aspects that Grossman challenges the official stance on nuclear arms technology and nuclear war. First: as the discussion of his story *Abel (August 6th)* in the second part of this essay demonstrates, for Grossman, the rationale of the Cold War plays no role whatsoever. Grossman's approach to the threat of nuclear war defies one-sided accusations, as they were common on both sides of the Iron Curtain. His story allows no distinction between US and Soviet nuclear policies. Similar to Günther Anders, Grossman treats the bombing of Hiroshima as a universal problem, the emblem of a culture of technification that fundamentally shatters basic concepts of morality. This is also true for his other writings on the topic of nuclear war, the story *The Sistine Madonna* and the novel *Life and Fate*, discussed in the third part of this essay. Nowhere does Grossman negotiate the argument of the merely defensive nature of the Soviet nuclear program nor the notion of the "peaceful atom" invoked in official Soviet literature in opposition to American nuclear warmongering. Nor does he address the problem of the effects of radiation that led official writers to a curious balancing act between concerned indignation and denial. Instead, Grossman discusses nuclear technology solely in terms of its genocidal or even omnicidal potential in the age of totalitarian power.

Second: in emphasizing the omnicidal potential of nuclear technology, Grossman disputes the optimism that official Soviet writers were expected to profess with respect to nuclear science. The analysis of the essay *The Sistine Madonna* and the novel *Life and Fate* in the third part of this essay shows that, much like Günther Anders, Grossman discusses nuclear technology exclusively in light of an impending apocalypse that, though stemming from the same mentality, could even overshadow the horrors of both the Stalinist murderous policy of repression as well as the genocidal policy of Nazi Germany.

Third: while in official literature of the 1940s and early 1950s, the threat of nuclear war was presented as an immediate outgrowth of fascism, Grossman took a more differentiated stance. In all of his writings on the topic, he, too, discusses nuclear war in the context of the crimes committed by the Nazi regime. As shown in the third part of this essay, for Grossman, it was the industrialized mass murder of the Holocaust, which in the 1940s and early 1950s was largely taboo in official Soviet literature, that prompted him to shun nuclear weapons technology, no matter its provenance, and he includes Stalinism in the list of ideologies that with their disdain for the individual and their inherent genocidal tendencies became harbingers of a future nuclear omnicide.

One aspect that would merit further consideration is the assumption implicit in Grossman's writings that traditional modes of representation fall short with respect to the threat of nuclear omnicide. In *Abel (August 6th)*, Grossman, like many other writers, describes the devastation of Hiroshima in terms of the biblical creation narrative.⁹⁵ It turns out, however, that together

with the city, these very terms have been annihilated, too. The bombing of Hiroshima is presented from the perspective of a mysterious passenger on board the *Enola Gay*, who with scientific interest follows the events through the windows of the plane. The nightly darkness over the ocean, reminiscent of primordial chaos, instills a visceral fear in the man. In a gesture of godlike hubris, he holds out his hand, only to be reminded of humanity's impotence before divine creation.⁹⁶ When light finally does rise above the ocean, it is without his doing. Daybreak over Hiroshima is described as a reenactment of Genesis: on the morning of August 6, 1945, the world arises from chaos in primeval splendor, as it has done countless times since the primal act of creation. Only this time will be the last. Grossman makes it clear that with the dropping of the first nuclear bomb, the biblical narrative is irreversibly suspended. The explosion of the bomb, too, is described as an act of creation,⁹⁷ only this time it is not the divine touch, but a human finger that sets it into motion. For a moment, it seems that thanks to technology, humanity has risen to godlike status. A ghastly vision disrupts the lofty spectacle. A cloud of debris and body parts rising from the epicenter of the explosion appears before the inner eye of the passenger and it dawns upon him that this is not an act of creation but the ultimate undoing of creation, the return to chaos: "humanity has closed the Book of Genesis."⁹⁸

The phrase can be read both literally and metaphorically. The book of creation is closed: life on this planet is about to end, and the biblical patterns that for more than two millennia have provided the basis of art in Judeo-Christian culture have lost their validity. It takes an altogether new book of books and new patterns of representation to grasp the nuclear age, but it remains doubtful whether humanity will have enough time to read it.

Some of Grossman's thoughts surface in the official literature of the Thaw, albeit in a mitigated form that never poses a serious moral challenge to the Soviet nuclear program. The general doubts that befall the protagonist of *Life and Fate* with respect to the fact that the hard sciences lack the self-criticism professed by the arts are at the center of the Physicists and Lyricists Debate launched by Il'ia Erenburg in 1959.⁹⁹ The vision, drafted by Grossman in *Abel (August 6th)*, of the bombing of Hiroshima as a foreboding of an irrevocable reversal of Genesis is also found in the official poetry of the 1960s. In Mikhail Matusovskii's aforementioned cycle of poems on Hiroshima, the nuclear bombing of the Japanese city is no longer presented, as was the case in the literature of the 1940s and 1950s, as the beginning of an apocalyptic battle that will end with the triumph of good over evil. Here, Hiroshima may well herald the end of the world altogether ("svetoprestavlen[e]").¹⁰⁰ Yet nowhere in Matusovskii's poetry are the moral implications of this insight and the measures to prevent wholesale annihilation discussed in universally applicable terms that transcend the Cold War agenda.

Interestingly, Matusovskii, too, employs the image of the repentant pilot, yet he does so in a completely different vein than Grossman. In *Ballad of Eternal Insomnia (Ballada o vechnoi bessonitse)*, Matusovskii has a sleepless

Claude Eatherly, unable to shake off the image of the defenseless women killed in Hiroshima, roam the nightly streets of an American city illuminated by neon signs and populated by prostitutes, barmen, and millionaires. Unlike Grossman, Matusovskii does not grant his pilot the capability of moral introspection and conscious repentance: his Claude Eatherly is possessed by an obscure feeling of torment, for which there are no words in the ghastly world he inhabits and which he can only vent by random acts of violence against the very society that made him a tool for mass murder. Matusovskii presents Eatherly as a “Raskol’nikov of the cosmic age” (“*Raskol’nikov / Kosmicheskogo sveta*”), whose crimes are but symptomatic of the general depravity of his capitalist environment.¹⁰¹ The predicament of Grossman’s repentant pilot, on the other hand, cannot be attributed to any specific political system or ideology. This is the predicament of humanity in the grips of a technology that has become a force unto itself. Grossman tells the story of his American protagonist in a way that leaves no doubt: if it were a Soviet pilot who, with the best of intentions and for purely defensive reasons, had pressed the button that releases a nuclear bomb, he would be doomed to roam the streets of Moscow in eternal insomnia over the masses of innocent victims.

Notes

1. For a slightly different analytical approach, see also Bettina Kaibach, “Abel, Abel, Where Is Your Brother Cain? Vasilii Grossman on Auschwitz and Hiroshima,” in *Images of Rupture in Civilization between East and West: the Iconography of Auschwitz and Hiroshima in Eastern European Arts and Media*, eds. Urs Heftrich, Robert Jacobs, Bettina Kaibach, and Karoline Thaidigsmann (Heidelberg: Universitätsverlag Winter, 2016), pp. 187–216.
2. Quoted from Alexandra Popoff, *Vasily Grossman and the Soviet Century* (New Haven: Yale UP, 2019), p. 275. Suslov’s statement was recorded from memory by Grossman.
3. For their concept of “nuclearism” as “total ideology” that is “inherently genocidal” see Robert J. Lifton and Eric Markusen, *The Genocidal Mentality. Nazi Holocaust and Nuclear Threat* (New York: Basic Books, 1990), pp. 70–73.
4. According to Grossman, Suslov actually confessed to not having read the novel, which he knew only through excerpts quoted in reviews (see Popoff, *Vasily Grossman*, p. 275).
5. Paul R. Josephson, “Atomic-Powered Communism: Nuclear Culture in the Post-war USSR,” *Slavic Review*, 55, 2 (Summer, 1996): 322; Paul R. Josephson, “Rockets, Reactors, and Soviet Culture,” in *Science and the Soviet Social Order*, ed. Lauren A. Graham (Cambridge: Harvard UP, 1990), pp. 168–191.
6. See John Garrard and Carol Garrard, *The Bones of Berdichev. The Life and Fate of Vasily Grossman* (New York: The Free Press, 1996), pp. 272–273. The meeting did not take place, since after the confiscation of the manuscript of *Life and Fate* by the KGB, Grossman deemed it too risky. In their biography of Grossman, John and Carol Garrard present a diagram from Grossman’s unpublished notebooks that testifies to his interest in the technical aspects of nuclear technology and the deadly impact of radiation (Garrard and Garrard, *The Bones of Berdichev*, pp. 332–333).
7. Both *Abel (August 6th)* and *The Sistine Madonna* were first published in 1989. In the Soviet Union, *Life and Fate* first appeared in 1988. In 1980, it had been published in Lausanne, based on a microfilm version that was smuggled to the West (cf. Garrard

- and Garrard, *The Bones of Berdichev*, pp. 258–262, and Alice Stone Nakhimovsky, *Russian-Jewish Literature and Identity: Jabotinsky, Babel, Grossman, Galich, Roziner, Markish* (Baltimore; London: John Hopkins UP, 1992), pp. 114–118).
8. Rosalind J. Marsh, *Soviet Fiction Since Stalin: Science, Politics and Literature* (London; Sidney: Croom Helm, 1986), p. 195. Research on the Soviet literary treatment of nuclear science and nuclear weapons in particular is astonishingly scant, given the importance of “nuclear culture” (Josephson, *Atomic-Powered Communism*) in the Soviet Union. Thus far, there is no comprehensive study on the topic. One can, however, assume that an analysis of exemplary texts will render a reliable picture of the situation, since, as Rosalind Marsh stated in her monograph on *Soviet Fiction Since Stalin*, due to the fact that “the subject [...] was intimately connected with military and foreign policy, and a special military censorship vetted all literary references to nuclear research, Soviet writers on this theme adhere[d] closely to the party line” (Marsh, *Soviet Fiction*, p. 195).
 9. Cf. Marsh, *Soviet Fiction*, p. 196.
 10. For the condemnation of pacifism by Soviet cultural authorities, see Marsh, *Soviet Fiction*, p. 197f. Nuclear technology as Soviet panacea for all kinds of economic woes is discussed in Josephson, 1996. With respect to the depiction of nuclear war scenarios, Vladimir Gakov and Paul Brians point out that while the Soviet audience was familiar with Western nuclear Armageddon fiction and films, “it was felt by many authorities that the ‘social optimism’ traditionally associated with Soviet writers should make them shun such nightmare visions of the future. Depicting a nuclear war as possible or probable was viewed as a sort of defeatism” (V. Gakov, and P. Brians, “Nuclear–War Themes in Soviet Science Fiction: An Annotated Bibliography,” *Science Fiction Studies*, 16, 1 (Mar. 1989): p. 68).
 11. Gakov and Brians, “Nuclear–War Themes,” p. 68f.
 12. For Vasilii Grossman and the Shoah, see Bettina Kaibach, “Abel, Abel, Where Is Your Brother Cain? Vasilii Grossman on Auschwitz and Hiroshima,” in *Images of Rupture in Civilization between East and West: The Iconography of Auschwitz and Hiroshima in Eastern European Arts and Media*, eds. Urs Heftrich, Robert Jacobs, Bettina Kaibach, and Karoline Thaidigsmann (Heidelberg: Universitätsverlag Winter, 2016), pp. 187–216; Bettina Kaibach, “Zweierlei Schweigen: Zur Holocaustliteratur im Westen und der Sowjetunion (Plath, Grossman, Evtušenko, Kuznecov, Rybakov),” in *Die Slaven und Europa*, eds. Gerhard Ressel and Henrieke Stahl (Frankfurt a.M.: Peter Lang, 2008), pp. 161–180; Maxim D. Shroyer, “Bearing Witness: The War, the Shoah and the Legacy of Vasily Grossman,” *Jewish Quarterly*, 217 (Spring 2011): pp. 114–119; and Garrard and Garrard, *The Bones of Berdichev*, for his anti-ideological stance see Kaibach, “Abel.”
 13. Stanislav Savitsky, *The Official and the Unofficial in Soviet Culture 1950–80*, 2005, p. 1 (http://www.helsinki.fi/hum/slav/mosaiikki/en2/ss2_en.htm; retrieved August 17, 2019).
 14. Cf. Marsh, *Soviet Fiction*, pp. 195–196.
 15. On the production of a Soviet atomic bomb, see David Holloway, *Stalin and the Bomb. The Soviet Union and Atomic Energy, 1939–1956* (New Haven: Yale UP, 1994), chps. 11 and 12.
 16. Christoph Garstka, “The Politicization of the Bomb in Post-war Soviet Poetry,” in *Images of Rupture in Civilization between East and West: The Iconography of Auschwitz and Hiroshima in Eastern European Arts and Media*, eds. Urs Heftrich, Robert Jacobs, Bettina Kaibach, and Karoline Thaidigsmann (Heidelberg: Universitätsverlag Winter, 2016), p. 222.
 17. Garstka, “The Politicization,” p. 224.
 18. Cf. Garstka, “The Politicization,” pp. 223–224.
 19. Arkadii Kuleshov, “Slovo k ob edinennym natsiiam,” *Novyi mir*, 4 (1948): p. 81.

20. Roman Kim (1899–1967) was an orientalist by training and spent several years of his life in Japan. While the novel is overtly propagandistic and clearly written in the spirit of Stalinism (Stalin's death actually figures in the novel), it does bespeak a profound knowledge of Japanese culture and history. Kim is listed among the orientalists repressed during Stalinism (cf. Ia. V. Vasil'kov, and M. Iu Sorokin (eds.), *Liudi i sud'by. Bibliograficheskii slovar' vostokovedov – zhertv politicheskogo terrora v sovetskii period (1917–1991)* (St. Peterburg: Peterburgskoe Vostokovedenie, 2003), p. 123. He was arrested in 1937. After his release in 1946, he wrote popular spy and adventure stories. For an overview of Kim's writings, see Wolfgang Kasack, *Lexikon der russischen Literatur ab 1917* (Stuttgart: Alfred Kröner Verlag, 1976), p. 172.
21. Roman Kim, "Devushka iz Khirosimy," *Oktiabr'*, 8 (1954): p. 81.
22. For the problem of racism with respect to the bombing of Hiroshima, see Florian Coulmas, *Hiroshima. Geschichte und Nachgeschichte* (München: C.H. Beck, 2010), pp. 22–23; and Lifton and Markusen, *The Genocidal Mentality*, p. 22.
23. Cf. Kim, "Devushka iz Khirosimy," 8, pp. 10–13; p. 95.
24. Il'ia Sel'vinskii, "Chitaia Fausta," in *Sobranie sochinenii v shesti tomakh. Tom 3-ii: Dramy i tragedii* (Moskva: Khudozhestvennaia literatura, 1973), p. 620 and 603.
25. Sel'vinskii, "Chitaia Fausta," pp. 614–615.
26. Dmitrii Prigov, *Azbuka 1* (<http://www.prigov.ru/bukva/azbuka01.php>Prigov; retrieved October 10, 2019).
27. "Недавней войны кровавая рана / Не даст нам беду проспать. / И в недрах земли не хватит урана, / Чтоб двинуть историю вспять. / Я вижу над их бесславным закатом / Свободных народов суд. / Ни доллар, ни ложь, ни разбуженный атом / От кары их не спасут." ("The bloody wound of the recent war / Keeps us vigilant for disaster. / And all the uranium in the depths of this world / Does not suffice to turn history backwards. / I foresee above their ignoble demise / A court of the free nations. / Neither dollar, nor lie, nor the awakened atom / Will save them from punishment.") For a detailed discussion of this poem, see Garstka, "The Politicization," pp. 223–224.
28. Evgenii Dolmatovskii, "Slovo o zavtrashnem dne (Iz knigi)," *Novyi mir*, 7 (1949): p. 167.
29. Garstka, "The Politicization," p. 224f.
30. Garstka, "The Politicization," p. 222.
31. "Там жил геологов отряд / В морозе и в жаре. / [...] / И командир их молодой, / Как долг ему велит, / Закладывал снаряд взрывной - / Не тол, не динамит, / Есть посильнее вещество / Теперь в твоем краю. / Не буду называть его... / Баюшки-баю. / [...] / Пусть к заграничным берегам / Докатится волна. / Предупреждением врагам / Там прозвучит она. / [...]" (Dolmatovskii, "Slovo," pp. 170–171).
32. Sel'vinskii, "Chitaia Fausta," p. 615, 675.
33. The author emphasizes that by the sheer cruelty of their capitalist system, the perpetrators of Hiroshima victimize the survivors of their crime yet another time: the delegates from Hiroshima, who during the bombing suffered severe injuries, can barely afford their fare to Poland. At the Warsaw festival, however, they get to experience a taste of the future peace implored by the author: for a few days, Blacks, Asians, and Whites from all over the world live harmoniously under one roof, unimpeded by racism, exploitation, and war (Evgenii Vorob'ev, "Delegat iz Khirosimy," in *Literaturnaia gazeta*, No. 93 (August 6, 1955): p. 4).
34. Roman Kim, "Devushka iz Khirosimy," in *Oktiabr'*, 9 (1954): p. 97.
35. Kim, "Devushka iz Khirosimy," 9, p. 86.
36. See Lifton and Markusen, *The Genocidal Mentality*, p. 42.
37. In Kim's novel, the phoenix metaphor serves to presage Sumiko's metamorphosis from radiation victim to Red heroine (Kim, "Devushka iz Khirosimy," 8, p. 75).

38. Mikhail Matusovskii, *Izbrannye proizvedeniia v dvukh tomakh. Tom 1-yi: Stikhotvoreniia, poëmy, pesni* (Moskva: Khudozhestvennaia literatura, 1982), p. 189.
39. Matusovskii, *Izbrannye proizvedeniia*, p. 329.
40. In a similar vein, in Mark Donskoi's 1962 film *Hello, Children (Zdravstvuite deti)*, the death of a Japanese girl from radiation sickness is integrated into the vision of a brighter future safeguarded by the Soviet Union (see Renata von Maydell, "Hiroshima and Artek," in *Images of Rupture in Civilization between East and West: The Iconography of Auschwitz and Hiroshima in Eastern European Arts and Media*, eds. Urs Heftrich, Robert Jacobs, Bettina Kaibach, and Karoline Thaidigsmann (Heidelberg: Universitätsverlag Winter, 2016), pp. 229–238).
41. In the poem *Глыба купола взлетает в небо косо*: "Перед всем, что здесь убито и разбито, / Стиснув зубы, мы в молчании стоим. / Значит, все-таки у мира есть защита, / Чтоб спасти его от новых Хиросим. / С той порой, как ты пылаешь негасимо, / Человечество не знает забытья. / Хиросима [...] / Не слабеет радиация твоя" (Matusovskii, *Izbrannye proizvedeniia*, p. 333).
42. Both in Matusovskii's poetry on Hiroshima and in Donskoi's film *Hello, Children (Zdravstvuite deti)*, 1962), the paper cranes that made Sadako Sasaki world-famous figure in connection with a dying *hibakusha* girl. For Donskoi's film, see von Maydell, "Hiroshima and Artek."
43. For a detailed history of the "Hiroshima Maidens," see Robert Jacobs, "Domesticating Hiroshima in America in the Early Cold War," in *Images of Rupture in Civilization between East and West: The Iconography of Auschwitz and Hiroshima in Eastern European Arts and Media*, eds. Urs Heftrich, Robert Jacobs, Bettina Kaibach, and Karoline Thaidigsmann (Heidelberg: Universitätsverlag Winter, 2016), pp. 83–97.
44. Kaibach, "Abel," p. 195.
45. Kim, "Devushka iz Khirosimy," 8, p. 32.
46. "В небе над Хиросимой началась цепная реакция, которая теперь никогда не кончится и будет вызывать все новые и новые взрывы. Пикадоны теперь будут повторяться так же, как повторяются землетрясения и тайфуны. Будущее человечества—это огромное радиоактивное облако. И в этом облаке исчезнет наша проклятая планета." (Kim, "Devushka iz Khirosimy," 8, p. 32). As a consequence of these ideas, the student proclaims the futility of all human endeavor.
47. Kim, "Devushka iz Khirosimy," 8, p. 32. Kim could be referring to Albert Camus' famous *Combat* editorial *Between Hell and Reason*, written August 8, 1945, two days after the dropping of the nuclear bomb on Hiroshima. The Japanese student's views seem to echo both Camus' abhorrence at the celebration of technical progress prevalent in the first media responses to Hiroshima ("technological civilization has just reached its final degree of savagery") and his apocalyptic forebodings ("Humanity is probably being given its last chance." "Faced with the terrifying perspectives which are opening up to humanity, we can perceive even better that peace is the only battle worth waging. It is no longer a prayer, but an order [...], the order to choose finally between hell and reason," Albert Camus, "Between Hell and Reason," in *Hiroshima's Shadow*, eds. Kai Bird and Lawrence Lifschultz (Stony Creek, CT: The Pamphleteer's Press, 1945), pp. 260–261. Other than Kim's student, Camus does not succumb to doom but appeals to humanity to perceive Hiroshima as a moral wake-up call. According to Vladimir Gakov, the denunciation of literary depiction of nuclear war as defeatist and "Western" was a common one in the Soviet Union (Gakov and Brians, "Nuclear-War Themes," p. 68).
48. Kim, "Devushka iz Khirosimy," 8, p. 32.
49. As late as 1982, Evgenii Dolmatovskii, in his essay on *The Writer and Responsibility*, in evoking the danger of wholesale nuclear war, felt compelled to add the phrase: "But we are not cowards and are no pessimists" (Evgenii Dolmatovskii, "Concern and Responsibility," *Soviet Literature*, 2, 407 (1982): pp. 144.)

50. Vasilii Grossman, "Avel' (Shestoe avgusta)," in *Neskol'ko pechal'nykh dnei. Povesti i rasskazy* (Moskva: Sovremennik, 1989), p. 210; 221.
51. „Политики, философы, военные, журналисты, публицисты в первые же часы после взрыва доказали, что мощный удар урановой бомбы, воздав фашизму за преступления против человечества и парализовав в большой мере сопротивление Японии, ускорит приход мира, которого жаждут все матери ради жизни своих детей. Эти доказательства сразу поняли и в японском генеральном штабе и в императорском токийском дворце. Всего этого не успел понять маленький четырехлетний японец. Он проснулся на рассвете и протянул толстые руки к бабушке. (...) Мальчик знал, что это он доставляет бабушке столько радости – ей приятно, проснувшись, увидеть внучка. (...) Так ни этот мальчик, ни его бабушка, ни сотни других детей, их мам и бабушек не поняли, почему именно им причитается за Пирл–Харбор и за Освенцим.“ (Grossman, "Avel'," p. 221f). This is, of course, an argument that has been invoked against strategic bombing in general.
52. “Сознание людей, освоившее в эпоху фашизма миллионные цифры убитых в лагерях уничтожения, было потрясено быстротой, с которой убивала урановая бомба! В одну секунду, первую секунду после взрыва, число убитых и умирающих достигло семидесяти тысяч человек! Все почувствовали: средства уничтожения поднялись на такую высоту, что не такой уж фантастической стала казаться перспектива уничтожения человечества ради процветания и величия государств, счастья народов и мира между ними.” (Grossman, "Avel'," p. 220).
53. Cf. Lifton and Markusen, *Nuclear-War Themes*, p. 13: “‘Dissociation,’ or ‘splitting,’ is the separation of a portion of the mind from the whole, so that each portion may act in some degree separately from the other.” “‘Doubling’ carries the dissociative process still further with the formation of a functional second self, related to but more or less autonomous from the prior self.”
54. “Те, кто бывал у него дома и совершал с ним боевые полеты, не могли объединить в своем представлении человека в клеенчатом фартуке, с зеленой маленькой лейкой в руках, многословно объяснявшего достоинства окраски и формы выращенных им тюльпанов, с великим летчиком, молчаливым и упорным, лишенным нервности и эмоций” (Grossman, "Avel'," p. 205).
55. Grossman, "Avel'," p. 211.
56. “Баренс повернулся к товарищам, сидевшим за столом, и сказал: – Меня всю жизнь раздражали старинные, заросшие сады, тупой и жадный лопух, крапива, лесная неразбериха тропиков. К чему прут из земли тысячи хищных, ординарных, на одно рыло растений? Я всегда верил, что садовники истребят эти заросли и в мире восторжествуют лилии, платаны, дубы, буки, пшеница. – Понятно, – проговорил, зловеще и дурашливо посмеиваясь, краснолицый, как индеец, Митчерлих, – все ясно. Мы с командиром против зарослей. Шея его была багрова, – казалось, вот-вот вспыхнет от этой огненной багровости сухая седина. Он багровел так, когда пил долго и много. Он поднес стакан Баренсу и сказал: – За успех садовников. Баренс выпил и, поставив пустой стакан на перила террасы, проговорил: – Хватит хвалить садовников. Второй пилот объяснил: – Сегодня Баренс не хочет думать о ботанике и вегетарианстве. – Блек, дорогой друг, это все ерунда. Не стоит говорить.” (Grossman, "Avel'," p. 221).
57. “Тут выпили за садовников, – сказал Баренс. – Мне всегда казалось, что это самое честное, бескровное дело. А теперь я подумал: выпьем лучше за монастыри, а?” (Grossman, "Avel'," p. 222). Interestingly, Grossman, by letting his protagonist implicitly compare the bombing to weeding a garden, has him establish the link between doubling, killing, and healing that, according

- to Darrell J. Fasching, underlies the explanation mechanisms used by both Nazi perpetrators and the men responsible for the destruction of Hiroshima (Darrell J. Fasching, "Reflections on the Holocaust and Hiroshima," in *The Genocidal Temptation: Auschwitz, Hiroshima, Rwanda, and Beyond*, ed. Robert S. Frey (Lanham, Md.: UP of America, 2004), pp. 9–16).
58. "Этот миг всегда был приятен Коннору – миг успокоения, когда трудное напряжение разряжалось. В такие мгновения ему казалось, что бомба отрывалась не от брюха самолета, а от его собственных внутренностей." (Grossman, "Avel'," p. 218).
 59. Shortly before the flight, Connor experiences a moment of paradisiacal unity with all of creation, reminiscent of the harmonious life depicted in Dostoevskii's *Dream of a Ridiculous Man* (to which the passage clearly alludes through the mention of the star Sirius).
 60. Grossman, "Avel'," p. 222.
 61. "Каин обычный паренек, немногим хуже Авеля, и город был полон людей вроде нас. Разница в том, что мы есть, а они были." (Grossman, "Avel'," p. 222).
 62. Grossman, "Avel'," p. 223.
 63. For the term "rupture in civilization" with respect to Grossman's writings, see Kaibach, "Abel."
 64. Ronald Bryden, "The Myth of Major Eatherly," *The Spectator*, February 16, 1962, p. 5.
 65. Günther Anders, *Die atomare Drohung. Radikale Überlegungen. Zweite, durch ein Vorwort erweiterte Auflage von „Endzeit und Zeitenende“* (München: C.H. Beck, 1981), p. 101, translation mine.
 66. Günther Anders, *Burning Conscience. The Case of the Hiroshima pilot, Claude Eatherly, Told in his Letters to Günther Anders, with a Postscript for American Readers by Anders. Preface by Bertrand Russell, foreword by Robert Jungk* (New York: Monthly Review Press, 1962), p. 1.
 67. Grossman, "Avel'," p. 211.
 68. Anders, *Die atomare Drohung*, p. 104.
 69. Anders, *Burning Conscience*, p. xiv.
 70. Vasilii Grossman, "Sikstinskaia Madonna," in *Neskol'ko pechal'nykh dnei. Povesti i rasskazy*, ed. Vasilii Grossman (Moskva: Sovremennik, 1989), p. 397.
 71. See Grossman, "Sikstinskaia Madonna," pp. 396–397.
 72. Grossman, "Sikstinskaia Madonna," p. 399.
 73. Grossman, "Sikstinskaia Madonna," p. 399.
 74. "Узнал ли он ее, он встречал ее в годы своей Восточно-Сибирской, Новоудинской, Туруханской и Курейской ссылки, он встречал ее на этапах, на пересылке... Думал ли он о ней в пору своего величия?" (Grossman, "Sikstinskaia Madonna," p. 401). Here, Grossman seems to imply that unlike Hitler, in his early years, Stalin was initially susceptible to the human spirit, embodied by the Madonna, but after his rise to power lost touch with this spirit.
 75. Grossman mentions both Ukraine during the artificial famine and the Gulag as places where the Madonna dwelled with those suffering from the Stalinist terror (Grossman, "Sikstinskaia Madonna," p. 400).
 76. Translation by Robert and Elisabeth Chandler (Vasilii Grossman, *The Road. Short Fiction and Articles* (Quercus, London: Maclehorse Press, 2010), p. 192). "А послевоенная тишина нарушается время от времени раскатами взрывов, и радиоактивный туман стелется в небе. Вот вздрогнула земля, на которой все мы живем, – на смену оружию атомного распада идет термоядерное оружие. Скоро мы проводим Сикстинскую Мадонну. С нами прошла она нашу жизнь. Судите нас – всех людей вместе с Мадонной и ее сыном. Мы скоро уйдем

- из жизни, уж головы наши белы. А она, молодая мать, неся своего сына на руках, пойдет навстречу своей судьбе и с новым поколением людей увидит в небе могучий, слепящий свет, – первый взрыв сверхмощной водородной бомбы, оповещающей о начале новой, глобальной войны. Что можем сказать мы перед судом прошедшего и грядущего, люди эпохи фашизма? Нет нам оправдания. Мы скажем, не было времени тяжелой нашего, но мы не дали погибнуть человеческому в человеке” (Grossman, “Sikstinskaia Madonna,” p. 402).
77. Robert Chandler assumes that Grossman’s essay with its numerous references to the neutron bomb was written in November or December 1955, after the first Soviet thermonuclear test (see Grossman, *The Road*, p. 80).
78. Cf. Josephson, “Atomic-Powered Communism,” pp. 302–304.
79. “Мы знаем о термоядерных реакциях, при которых материя обращается в могучее количество энергии, но мы сегодня не можем еще представить себе иного, обратного процесса – материализации энергии, а здесь духовная сила, материнство, кристаллизуется, обращено в кроткую Мадонну.” (Grossman, “Sikstinskaia Madonna,” p. 395).
80. “Но может быть, если умрут люди, иные существа, которые останутся вместо них на земле – волки, крысы и медведи, ласточки – будут приходить и прилетать и смотреть на Мадонну...” (Grossman, “Sikstinskaia Madonna,” p. 394).
81. In *The Sistine Madonna*, Grossman does imply that while National Socialism is intrinsically opposed to the human spirit, the Soviet regime betrayed this spirit only after Stalin gained absolute dictatorship (cf. footnote 70).
82. Vasilii Grossman, *Zhizn’ i sud’ba* (Moskva: Vagrius; Agraf, 1998), p. 304. Translation by Robert Chandler (Vasily Grossman, *Life and Fate* (New York: New York Review of Books, 2006), p. 410). Simon Markish considers human kindness “one of the two foundations of Grossman’s new world view,” the second one being freedom (Simon Markish, “A Russian Writer’s Jewish Fate,” *Commentary*, 81, 4 (1986): p. 45).
83. Cf. footnote 2.
84. In *Life and Fate*, Grossman accuses Stalin of grave mistakes in his dealings with Nazi Germany. He mentions the uprisings in East Germany and Hungary in 1953 and 1956, respectively, and alludes to the collaboration in the Holocaust of the local population in Ukraine, to note but some of the explosive topics discussed in the novel.
85. Grossman, *Zhizn’ i sud’ba*, p. 62.
86. Grossman, *Zhizn’ i sud’ba*, p. 350.
87. Grossman, *Zhizn’ i sud’ba*, p. 412.
88. Grossman, *Zhizn’ i sud’ba*, p. 348.
89. “Das ‘prometheische Gefälle’” (Anders, *Die atomare Drohung*, p. 96).
90. Grossman, *Zhizn’ i sud’ba*, p. 574.
91. Grossman, *Zhizn’ i sud’ba*, p. 517.
92. Grossman, *Zhizn’ i sud’ba*, p. 518.
93. Grossman, *Zhizn’ i sud’ba*, p. 483.
94. The psychological mechanisms by which Soviet citizens tried to justify their compliance with the Stalinist regime are at the center of Grossman’s novel *Everything Flows* (*Vse techet*).
95. Cf. Urs Heftrich, “Hiroshima in Czech Press and Poetry,” in *Images of Rupture in Civilization between East and West: The Iconography of Auschwitz and Hiroshima in Eastern European Arts and Media*, eds. Urs Heftrich, Robert Jacobs, Bettina Kaibach, and Karoline Thaidigsmann (Heidelberg: Universitätsverlag Winter, 2016), p. 341f.

96. “Пассажир [...] смотрел в иллюминатор [...]. Он видел огромный океан тьмы впервые, и это зрелище тревожило его. Но чувство волнения, с которым он смотрел в иллюминатор, было вызвано не тем, что он впервые в жизни наблюдал тьму над океаном. Чувство вызывалось тем, что картина эта была ему уже знакомой, он знал ее уже. Он вспомнил, как впервые услышал в чтении матери начальные строки Библии – бог, простерев руку, летел в нераздельном хаосе небес, земли и воды. Таким и был безвидный хаос, возникший в его детских снах, – он клубился вот так же, как он клубится сейчас, он казался тяжелым и легким одновременно, в нем таилась и тьма, и жизнь, и вечный лед смерти, и легкость небес, и черная тяжесть руд, земель и вод. Пассажир вытянул руку и посмотрел на свои [...] пальцы, [...] ощутил маленькую мозоль на пальце, образовавшуюся от многих десятилетий пользования автоматической ручкой. Но мгла над бездной оставалась мглой, и он опустил руку.” (Grossman, “Avel’,” p. 216).
97. The light produced by the detonation is brighter than the brightest sun; the fire-ball resembles “a star born for the second time.” In another biblical allusion, the mushroom cloud is compared to a “pillar of fire” (Grossman, “Avel’,” p. 219). The analogy between the nuclear blast and the act of creation was a common one among advocates of the bomb (see Lifton and Markusen, *The Genocidal Mentality*, pp. 82–83).
98. В этот миг автоматически закрылись все смотровые окна, отключились приборы. [...] Оглушенный пассажир упал на пол, зажмурился, ему представилось, что небо, земля, вода вновь вернулись в хаос... Так и не победив зла, отцом и сыном которого он является, человек закрыл книгу Бытия...” (Grossman, *Avel’*, p. 219). The passenger’s insight does not last long. After a moment, it gives way to a utopian vision of an ideal world of happiness brought about by nuclear fission, reminiscent of the nuclear messianism propelled by bomb advocate and member of the Manhattan Project, Edward Teller. Here, Grossman breaks with a tradition in Russian literature as described by Yuri Leving (Yuri Leving, “Na podstupakh k teorii “bol’shogo vzryva” v literature.” Unpublished article in possession of the author, 2014) that links the semantics of explosion with the act of creation.
99. Cf. Garstka, “The Politicization.”
100. *Баллада о хиросимской любви*, Matusovskii, *Izbrannye proizvedeniia*, p. 274.
101. Matusovskii, *Izbrannye proizvedeniia*, p. 265.

7 The Legal Heritage of the Atom

Dealing with Victims of Radioactive Contamination in the Post-Soviet Space

Tanja Pentter

Looking at the different compensation policies, laws, and practices in post-Soviet Russia, Ukraine, Belarus, and Kazakhstan, I develop comparative perspectives on the ways in which these new states dealt with victims of radioactive contamination and how the societies constructed victims' identities. I argue that post-Soviet compensation programs can serve as a "window" into the transformation societies. It seems to be specific for the developments in the former Soviet space that here environmental victims stand on an equal footing with the victims of the Stalinist and National Socialist dictatorships. The process of coming to terms with the experience of dictatorship after the end of the Soviet Union therefore has a strong ecological component, which requires that approaches to transitional and environmental justice be thought of as interconnected. More recently, this process has also taken on an international dimension, manifested in a growing number of appeals to the ECHR by Russian and Ukrainian environmental victims. The once unnoticed environmental victims of the Soviet past have learned to assert their rights vis-à-vis national and international institutions and organizations.

The heritage of the atom in the former Soviet space includes not only radioactively contaminated landscapes but also specific legal legacies, new historical resources (e.g. thousands of private letters with claims for compensation), and a new place for environmental victims in the national cultures of remembrance. The end of the Soviet Union was accompanied by the extensive uncovering and documentation of the crimes of the past hand in hand with an erosion of old Soviet patriotic memory and the development of a new culture of remembrance. Next to the victims of Stalinism and National Socialist crimes in World War II, the victims of nuclear accidents and radioactive contamination also played a central role in the nation- and state-building processes in some of the successor states of the Soviet Union. Historical knowledge about places of Stalinist and National Socialist mass crimes as well as environmental disasters, which before 1989 were often known only by rumor and within the borders of local communities, has since grown. In addition, various victim groups received (often for the first time) state and social recognition in the form of rehabilitation, compensation, and social protection laws. This process gave rise to a variety of social negotiation

processes about who could be considered victims in the post-Soviet social orders and which victims were at the top of the new victim hierarchies. The forms of legal and public recognition were quite similar for all three groups of victims. Thus, I will argue that in the post-Soviet context, it makes sense to combine approaches of transitional justice and environmental justice.

Looking at the different compensation policies, laws, and practices in post-Soviet Russia, Ukraine, Belarus, and Kazakhstan, I will develop several comparative perspectives on the ways in which these new states dealt with victims of radioactive contamination and how the societies constructed victims' identities. To what extent did these compensation and social protection laws promote a new understanding of citizenship, including a range of civil rights of the citizens toward the state? How were the laws implemented in practice? Did they improve the situation of those affected? What role did environmental victims play in the cultures of memory of the post-Soviet states? Did these laws, moreover, contribute to the "visibility" of the zones of radioactive contamination and in general to the awareness of radiation dangers among the population? I will argue that the ways in which the successor states of the Soviet Union dealt with the victims of the Soviet era also reveal different pathways of political and social development that these states took. In other words, post-Soviet compensation programs can also serve as a "window" into transformation societies. In all successor states of the Soviet Union, processes of recognizing and compensating victims of the past overlaid with general political, economic, and social processes of change and the emergence of a new social order and post-Soviet cultures of remembrance.

Concepts of Victims, Transitional Justice, and Environmental Justice

Allow me to start with a few general reflections on the concepts of victim, transitional justice, and environmental justice: victim concepts and discourses have a socially constructed and historically variable character. The term "victim" is ambiguous and contains different semantics that are actualized in different ways in different historical contexts. Victim narratives provide a powerful tool for justifying moral, social, and political claims in the present from past suffering.¹

The increase in victim narratives since the 1990s also reflects a general trend in Western countries, characterized by social upgrading and a changed attention economy (*Aufmerksamkeitsökonomie*) toward passive victims.² The sociologist Michel Wieviorka therefore speaks of an "age of victims,"³ while Jean Michel Chaumont (philosopher and sociologist) sees increasing competition among victims for recognition.⁴ In her study, Svenja Goltermann pointed out the importance of new knowledge in medicine and law for the perception of victims. In her opinion, concepts of psychological trauma have contributed to the popularization of the speech of victims in the late twentieth century.⁵

The term *transitional justice* refers, on the one hand, to a political arena that seeks to deal with human rights violations and war crimes committed by former repressive regimes. On the other hand, it also indicates an expanding field of research that has developed since the mid-1990s and investigates precisely these practices. The collapse of the Soviet Union – in addition to further transition processes in Latin America and South Africa – has given decisive impulses for the development of transitional justice as a field of action and research. However, the origins of the concept can be traced back, according to some experts, far earlier, in the period after 1945, symbolized by the Nuremberg and Tokyo war crimes trials. Nuremberg remains the central model for all subsequent debates to this day.⁶ According to some historians, it was precisely at this time that the emergence of a clearly contoured concept of human rights in the political arena was to be located, even though older lines of tradition in the history of ideas certainly date back well into the eighteenth century.⁷

With regard to Eastern Europe, the general question here is of course whether these genealogies apply at all to the countries behind the “iron curtain.” According to many political scientists, coming to terms with the dictatorial past is a key element in building a stable democracy.⁸ In this context, rehabilitation and reparation programs are of particular importance for the victims. “Reparation” is to be understood as the interplay of discourses and practices that change the meaning and evaluation of historical injustice and create certain claims among the victims. According to the Swiss historian Regula Ludi, the significance of the category of “victim” in remembering the Holocaust has only become possible because “being a victim” changed from a stigma to a respectable status through the politics and practice of reparation until the early 1960s.⁹

The perspectives of transitional justice research provide an initial framework to bring together questions of the historical treatment of victims and perpetrators for the Soviet context. At the same time, however, the post-Soviet development also shows the limitations of the concept. Transitional justice represents to some degree a Western concept, the transferability of which to other regions of the world should and must be questioned.¹⁰

Environmental justice emerged as a political arena in the USA in the early 1980s, focusing on the fair distribution of environmental benefits and burdens. At the same time, it describes a rapidly developing field of research that deals with issues at the interface of environmental, social, and health policy.¹¹ Christopher Williams defines environmental victims as “those of past, present, or future generations who are injured as a consequence of change to the chemical, physical, microbiological, or psychosocial environment, brought about by deliberate or reckless, individual or collective, human act or act of omission.”¹² Adriana Petryna, in her pioneering study on state compensation for Chernobyl victims in post-Soviet Ukraine, coined the term “biological citizenship,” which describes the ways Chernobyl victims in Ukraine enforced their compensation claims. Petryna has also shown that the recognition of

Chernobyl victims in Ukraine has become an important part of nation- and state-building processes.¹³ Nuclear contamination was unequally distributed in the Soviet Union. Only after the end of the Soviet Union did these disparate stressful and health-endangering situations, such as the Chernobyl catastrophe, the atomic bomb testing in Semipalatinsk, Kazakhstan, or the nuclear waste accident in Chelyabinsk, Russia, become enforceable principles of environmental justice and were covered by specific legislation on victims' rights to compensation and social protection. To achieve that goal, since the Perestroika period, regional, often internationally networked environmental movements played an important role.¹⁴

Petitions of Russian Citizens Demanding Compensation

Thousands of private letters, some with page-long descriptions of a life suffering, were sent to post-Soviet regional and local authorities in connection with various compensation claims. The compensation and social protection laws have generated specific historical sources that, among other things, also provide exciting insights into the subjective experience of post-Soviet transformation processes.

After the first regulation for victims of the radioactively contaminated landscapes in Chelyabinsk in the Urals was passed in Russia in 1993 under the former Russian President Boris Yeltsin,¹⁵ the authorities there received many letters from affected people. The nuclear waste accident occurred in 1957 in the closed city of Chelyabinsk-40, in which plutonium was produced for the Soviet nuclear weapons program. Even before the accident, since the late 1940s, radioactive waste from this production had been regularly discharged into the Techa River.¹⁶ Russian and Norwegian researchers estimate the total amount of radioactive material released to be scarcely less than of the Chernobyl disaster.¹⁷ Hundreds of thousands of people in the contaminated regions as well as military personnel used as liquidators were exposed to increased doses of radiation and left unaware of the associated dangers. According to the logic of the Cold War and the secrecy practices of the closed nuclear cities, the catastrophe was concealed and only officially confirmed in 1989 under Gorbachev's Perestroika politics, in the virtual aftermath of the Chernobyl catastrophe. In the late 1980s, a strong regional environmental movement had developed in Chelyabinsk, and for the first time, a union-wide reporting on the disaster took place. The end of the Soviet Union was thus also the consequence of an ecological crisis, as environmental history-oriented research has highlighted.¹⁸

In the following, some of these interesting letter documents and their potential for historical research will be examined in more detail.¹⁹ Many of those affected had been deployed as military men or civilian workers in the cleanup operations during and after the 1957 nuclear waste accident. Some, however, had witnessed and suffered from the radioactive contamination of the Techa River, into which the reactor effluent had been discharged, since the late 1940s. They had been used there for cleaning work.²⁰

Ivan Pavlovich T. served as a soldier for the troops of the Ministry of the Interior (MVD) from 1951 to 1954. In an angry letter to the Chelyabinsk authorities in 1994, he demanded recognition as an aggrieved participant in the cleaning work on the Techa River and the associated supply privileges. In his letter, he described the working conditions at that time:

The place where we worked is where contaminated water was first discharged into the hot lake. We built a dam to shield the hot water from the lake. [...] The work was carried out directly from floating platforms in the hot water of Lake Karachi, as it is called today. [...] In 1951 the military unit was stationed near the lake and the dams. [...] During this time, we lived and worked on the lake. [...] There the ducks were running around without feathers, naked and blind, and we did not know why. Now I have found out, but at that time nobody told us anything about it being harmful. Now they still do not acknowledge that it was harmful, and I am an invalid of the second group. Back then we were serving and working and nobody warned us that it was dangerous here. We knew nothing. In those days, security technology was not considered. We worked for 8 hours and even bathed in the warm water. After that we didn't feel like getting married, but still we thought that was all stupid stuff. And now I have no documents at all. Now I have to go to the hospital in Sverdlovsk because of the diseases and I can't be treated because I don't have any documents.²¹

The problem of proof of residence and service in the radioactively contaminated territories expressed in the letter was shared by many of those affected, who then wrote letters to the Chelyabinsk authorities. Those who were unable to provide official proof of their service did not receive any compensation or supply privileges at all.

Of particular interest is the letter of Avgusta Alevtina L.. She was not only one of the few female aggrieved persons who turned to the Chelyabinsk authorities but also a former prisoner. In the late 1940s in Chelyabinsk-40, prisoners had been used for forced labor. Avgusta Alevtina writes that she served a prison sentence from July 1947 to March 1948 and was used for forced labor at Chelyabinsk-40. At the end of her prison term, she was not released home but had to continue working in an auxiliary plant of Chelyabinsk-40 in the heavily contaminated area, where she was deployed together with soldiers and prisoners. In her letter, she writes about the working conditions:

In 1949 I worked with the soldiers and the prisoners. First, they put the soldiers around the lake and there was also the camp for the prisoners. [...] The soldiers dug trenches, then they fenced everything with barbed wire. I supplied them with tools. I fetched water. I worked with the prisoners - they put the whole place in order. In the morning I brought them sometimes by car, sometimes by horse, tools, fence posts and a canister

of water and then again for lunch I brought water, and, in the evening, I collected everything from them and took it away. [...] Yes, and I had to dig 30–50–centimeter rivulets by the lake. [...] In general, we did all kind of works. [...] I worked near the lake and on the eleventh dam I worked in the swamp.²²

Avgusta Alevtina possessed a certificate of her work assignment as “liquidator” of the radioactive contamination at the river Techa. She made clear and self-confident demands to the Chelyabinsk authorities, underpinned by medical evidence:

I need free medical care and the apartment should be paid for by at least half. I lost all my teeth in 1954. My thyroid gland is sick, a nodular goiter of second degree, my eyes are aching, my legs and hands are numb. I have not earned the second, but the first degree [of disability – T.P.]. I ask you to check this and send me a certificate of the first category, because I was there, in this place, from 1947 to 1963.²³

Some of the letter writers had witnessed the 1957 nuclear waste accident themselves, such as Nikolai Vasil’evich P., who was 25 years old at the time. He wrote in his letter:

While I was carrying out railway maneuvers, I heard a powerful explosion in the Ozero rayon. Afterwards a glow of fire shone in the sky. Later it was told that an accident had happened with the release of radioactivity. We later cleaned the railway tracks on the object together with the fire department. After the accident they started to check with signal sensors at the Ozero station to see if the railroad cars were clean: Green means clean, red means dirty. There were days when the devices lit up red without any wagons being there, just because of the wind. [...] There have been other accidents, but we didn’t think it was that serious then.²⁴

Nikolai Ivanovich K., who as a member of the military, had also experienced the 1957 explosion directly on-site, which he reported in his letter about the first safety measures at the scene of the accident: “In the evening we were denied dinner. They said that all the food in the refectory was radioactively contaminated. The next day they cut our hair and told us to take everything we needed, towel, soap, and toothpaste. They took us to the disinfection. In the sauna we were washed, checked with a machine and only then we got food.”²⁵ But only one month later, he was reassigned to work on the object of the accident and spent over a year working there. In his letter to the authorities, Nikolai Ivanovich also wrote about his serious health problems and the fact that he now urgently needed help.

Civilian specialists, such as Aleksander Fedorovich S. who worked in the geodesy department of the engineering office in Chelyabinsk-40 from

1957 to 1960, were also deployed in the radioactively contaminated area. Aleksander Fedorovich participated in the mapping of the boundaries of the contaminated zone and took topographical photographs along the Techa River, which were needed for the construction of dams. In his 1993 letter to the director of the Combine, he aptly summarized the spirit of the times and the mood of the workforce by saying: “In those not-so-distant times of secrecy, we were simply sent to these places. There were no dosimeters, and no one checked our clothing, there was no limit to the amount of time we could work. Yes, and somehow nobody thought about it either. It was necessary, so we did it.”²⁶

Several people mention in their letters the forced evacuation of the civilian population after the accident in 1957, for example, former military officer Yuri Evgenevich L. reported in his letter to the mayor of Chelyabinsk on the evacuation of two Bashkir villages. He mentioned that the people could initially only be provisionally accommodated in emergency military shelters and had to leave behind most of their personal belongings. The entire livestock of the villages was destroyed by the soldiers:

On the shore of the lake, trenches were dug with bulldozers and then everything living, except the people, was driven to this place. Then machine guns were fired and then everything was covered with earth. [...] Nobody thought about themselves at that time, because this ‘plague’ did not smell and was not visible. Only a dosimeter could determine the degree of contamination, but we paid little attention to this. Only at the entrance to the barracks stood a soldier with a dosimeter, and if the shoes shone, we had to clean them ourselves several times.²⁷

In 1991, 58-year-old Yuri Evgenevich was recognized as an invalid of the second group due to serious health problems. Thus, he received free medication. He hoped that the new compensation law would lead to a small increase in his pension and other social benefits. In order to be able to apply for these, however, he urgently needed a corresponding confirmation from the Chelyabinsk authorities.

These letters to the authorities also provide interesting insights into the question of the information available at the time and the level of knowledge of the Soviet apparatus about the dangers of radioactive radiation. In some of these sources, it becomes quite clear that the regional political and economic administration was aware of the dangers for the workers but only passed on information and warnings to a limited extent. A civilian worker who was involved in building the dam on the lake with the cooling water from the reactor in Chelyabinsk-40 remembered: “Time and time again a commission travelled to the site and said that the place is contaminated, that we should not pick mushrooms and berries, catch fish, not drink the water. They checked the radioactivity and left again in silence, telling us nothing, but they must have told someone from the higher leadership.”²⁸

Many of the civilian workers were very young, inexperienced men who were gaining their first work experience. Vladimir Isoilovich G. had been sent to work in Mayak in 1958 after completing his professional training, together with a group of ten other 18- to 19-year olds, and worked there for more than 15 months:

The object where I worked was on the river Techa. We dug a sewer beside the ‘dirty’ lake. Our supervisor told us that the lake was ‘dirty’ and that we should not go near it. [...] The machine operators were soldiers. Then they were ordered to demobilize, and they could be replaced and go home. They taught us quickly and we became machine operators and continued to work on the canal with four of us. The foreman came only once a month. [...] Once in spring other soldiers came and asked us if we had been working here for a long time. We answered that we had been here since autumn. Then they asked how much x-rays we get per week. How would we know that? The management had kept quiet about it and they hadn’t given us any equipment to measure it. The soldiers were very surprised. When they left, they told us to ask for dosimeters or refuse to work in this region. As volunteers, we should not be forced to work here. [...] When we demanded the dosimeters, we were no longer used at this object. [...] In my opinion, this can be regarded as a crime of the superiors who sent us there at that age. [...] I have no children of my own and Chelyabinsk-40 is to blame for this, because in my family there were no other such cases.²⁹

The man wrote angrily to the Chelyabinsk authorities to find out whether he was entitled to the social privileges, which he had read about in the newspaper. He pointed out that many of his previous letters to various authorities had gone unanswered.

In addition to detailed descriptions of the historical everyday life, working and living conditions in the radioactively contaminated areas, the letters also provide valuable insights into the individual transformation experiences of the former Soviet citizens after the end of the Soviet Union.³⁰

Actions of Russian and Ukrainian Citizens before the ECHR for Chernobyl Compensation

Since the 1990s, Russian and Ukrainian victims have also increasingly turned to international organizations to claim their rights, including the European Court of Human Rights.³¹ In the understanding of some victims’ associations, the right to compensation has even been elevated to a general human right, which is why the Court of Human Rights seemed to them to be a suitable addressee. With its judgments, the European Court of Human Rights sometimes (involuntarily) also becomes an actor in the field of historical policy, because its jurisdiction occasionally includes judgments on history.³²

Since the beginning of the 2000s, more than 180 complaints have been filed with the European Court of Human Rights by Chernobyl victims from Russia against the Russian state, who complained that they have not received their promised compensation payments. These were liquidators who were used to clean up the reactor and the contaminated areas. Since the Chernobyl disaster,³³ victims of nuclear accidents have received public perception in the late Soviet Union. They, too, can in some way be regarded as victims of the Soviet system, because it deliberately left them ignorant of the risks and dangers of radioactive contamination of their environment, or deliberately exposed them to these dangers. The Chernobyl catastrophe in 1986 not only caused an “anthropological shock”³⁴ among the international public – as Ulrich Beck put it. Even within the Soviet Union, the accident gave rise to criticism of the ruling system. “It was not just a nuclear power plant that exploded, but the whole complex of irresponsibility, lack of discipline and bureaucracy,” wrote the Belarusian writer Ales’ Adamovich in a 1986 letter to Mikhail Gorbachev.³⁵

The case of the plaintiff Malinovskii, who filed a lawsuit against the Russian state at ECHR in July 2005, stands as an example for many similar cases.³⁶ Malinovskii (born in 1962) lives in Staryi Oskol in the Belgorod Region of Central Russia, close to the Ukrainian border. In 1986, as a young man of 24 years, he was engaged in emergency operations at the site of the Chernobyl nuclear plant disaster. Later, as a result of the deterioration in his health arising from that event, the applicant became entitled to certain State benefits, linked to the category of disability assigned to him. In 1999, Malinovskii applied for free accommodation from the State. His housing conditions were recognized as substandard and he was placed on a waiting list. Two years later, in 2001, the applicant brought proceedings against the Belgorod regional administration, contesting its failure to make accommodation available to him. The Starooskolskii Town Court of the Belgorod Region ruled in Malinovskii’s favor, referring to the Law “On social protection of citizens exposed to radiation as a result of the Chernobyl nuclear power station explosion.” The Town Court ordered the Belgorod regional administration to provide the applicant with a flat in accordance with the applicable standard conditions. Until March 2004, the judgment was still not enforced and Malinovskii was still waiting for his new apartment. Only after Malinovskii, who on March 5, 2004 (with a group of five people), went on hunger strike to protest against the poor level of welfare protection provided for the Chernobyl victims, did the mayor of Staryi Oskol launch a public call for donations in support of the protestors and collected the amount necessary to provide all of them with satisfactory housing.

The ECHR declared that Malinovskii’s application was admissible and there had been a clear violation of the Convention. The judges decided that the Russian state had to pay the applicant within three months the amount of EUR 3,000 in respect of non-pecuniary damage, to be converted into the national currency. Several other former Chernobyl liquidators successfully

sued the Russian state in order to achieve an inflation adjustment of their compensation payments and social benefits.³⁷

Moreover, an interesting more recent development demonstrates that Russia is now also being sued before the ECHR with regard to further accidents involving health damages by radioactive pollution: in April 2008, 29 Russian citizens filed a complaint against the Russian state referring to health damages due to pollution by a radiochemical plant of the Siberian chemical industrial complex in Tomsk.³⁸

The comparison with Ukraine³⁹ shows that there were also numerous lawsuits by Ukrainian victims of the Chernobyl disaster against the Ukrainian state after social benefits were not received, including a class action involving the claims of 12,148 people.⁴⁰

One of the first cases against Ukraine was filed with the ECHR by Svetlana Borisovna Naumenko in 1998.⁴¹ She had been deployed as a disaster relief worker in 1986 after the explosion of the reactor and had suffered health damage from the radiation. This status was first officially recognized for her in 1991, which enabled her to claim compensation payments. A year later, however, this status was withdrawn again by the Ukrainian Ministry of Health on the grounds that she had not permanently stayed in the exclusion zone within a 30-kilometer radius of the damaged reactor. After a successful lawsuit before the regional court in Odessa, Svetlana Naumenko was again granted the status of a victim of the Chernobyl disaster in 1994. The following year, however, this decision was again annulled. The applicant thus again lost her right to financial compensation and again took legal action against this decision. After a seemingly endless odyssey through various judicial instances, the applicant was finally granted the status of a disaster worker with full entitlement to a state pension in 2003. However, it took until 2004 before the outstanding pension amounts were paid to her. Due to the unreasonable processing time of the courts, Svetlana Naumenko successfully filed a lawsuit before the ECHR and was awarded a compensation payment of 20,000 euros by the Ukrainian state.⁴²

The lawsuits before the ECHR by Svetlana Naumenko and other plaintiffs reveal the problems of the Ukrainian state in meeting the financial claims of all those affected, including both disaster relief workers sent to the exclusion zone after the accident and residents of the radioactively contaminated area. The ECHR, which has been confronted with a rapidly growing number of claims from those affected in recent years, had recommended to the Ukrainian government that the compensation laws be revised accordingly, but the government has so far refused to do so in view of the high symbolic political significance of the laws for the Ukrainian nation-building project.⁴³ The Chernobyl victims enjoy high esteem in the state and society of Ukraine and are (in case of the liquidators) sometimes revered as national heroes. Due to the intensifying Ukrainian-Russian conflicts since 2014, the question now seems to be even more politically charged, as it is also about the assertion of interpretational supremacy with regard to the Chernobyl catastrophe.

What does it mean that environmental victims are increasingly trying to enforce their rights internationally against the Russian and Ukrainian state? Here, a process that also took place in other spheres in the post-Soviet states becomes visible: the intrusion of international actors, value and order concepts, and legal procedural practices, which also led to certain internationalization tendencies with regard to ideas of civil rights, legitimate authority practice, or historical justice. The once helpless victims of the Soviet past now presented themselves to international organizations as self-confident citizens who knew and claimed their rights vis-à-vis their respective states.

Some Soviet citizens had already had earlier experiences in contact with actors from Western countries since the late 1980s in connection with international Chernobyl aid.⁴⁴ The promising opportunities opened up by foreign actors were increasingly recognized, even in a country like Belarus, which is still ruled by an authoritarian regime. And so, one letter from former Nazi victims to the Belarusian President Lukashenka in 2002 reads the self-confident threat that was put forward: “If the President does not read our letter this time either, we will turn to the international organizations!”⁴⁵

Legal Regulations for Victims in the Aftermath of Chernobyl and the Fall of the Soviet Union

After the collapse of the Soviet Union, laws were passed in Ukraine, Belarus, Russia, and Kazakhstan on compensation and social protection of victims of nuclear accidents and radioactive contamination. These laws concern the reactor catastrophe in Chernobyl, the nuclear waste accidents in Chelyabinsk, and the nuclear test site in Semipalatinsk, Kazakhstan. In the successor states of the Soviet Union, there are some similarities between the design of the legal regulations and their practical implementation, but there are also clear differences, which shall be analyzed here in a comparative approach.

The reactor accident in Chernobyl and the bad information policies and delay of countermeasures by the Soviet authorities had mobilized large sections of the population, especially in Ukraine. Chernobyl awakened an ecological awareness that became an important element of the political opposition. Already in the final phase of the Soviet Union, the question of reparation for the victims of the Chernobyl disaster was on Ukraine’s and Belarus’ political agenda. Scientists of the national academies of sciences in Ukraine and Belarus developed radiation protection concepts (in connection with the design of their own republican Chernobyl programs), which differed from those of the Soviet Ministry of Health.⁴⁶ The national Chernobyl programs in Ukraine and Belarus met with criticism in Moscow mainly because of the high costs for the union budget. In addition, the Soviet republics also competed among themselves for funds from Moscow for their exposed populations.⁴⁷ In February 1991, i.e. before the dissolution of the Soviet Union, social protection laws were passed in Ukraine and Belarus based on independent national radiation protection concepts and signed by the Chairmen

of the Supreme Soviets in both Soviet Republics.⁴⁸ Even in the final phase of the Soviet Union, various national actors had clear room to maneuver in regulating threshold values and resettlements. In so far, the situation was different from the first phase of disaster management after the 1986 accident, when the Soviet Union initially reacted with well-known strategies of bureaucratization and secrecy and controlled all decisions from Moscow. As Melanie Arndt has argued, it was the situation of disorder, excessive demands and improvisation on the part of Soviet authorities, as well as a general loss of legitimacy on the part of the party and the state, which provided more freedom of action for the regional actors in Minsk and Kyiv. The double crisis of post-Chernobyl and post-Socialism confronted all actors with unexpected new challenges, while also creating new corners of freedom.⁴⁹

The Ukrainian and Belarusian laws, which responded in both countries to the demands of the affected populations and national movements, bear substantial similarities. Both started with the similar statement that the Chernobyl catastrophe struck the fate of millions of people and created new ecological, social, and economic conditions in the regions with radioactive contamination. Both laws declared the countries to “zones of national ecological emergency”⁵⁰ and acknowledged the necessity to mobilize considerable financial, material, and scientific resources to cope with the ecological and social consequences of the disaster. Both the Ukrainian and the Belarusian laws determined basic provisions regarding the realization of constitutional rights of the citizens, who suffered from the Chernobyl catastrophe with regard to the protection of their life and health and the granting of amenities and compensations (according to their category of suffering). This included the right of all citizens to receive complete, credible, and timely information about all questions connected to the Chernobyl catastrophe.⁵¹ In both laws, the state explicitly took responsibility for the compensation of the harm caused to the citizens, including health damages, loss of workability, and loss of a family’s breadwinner by death.

The laws in Ukraine and Belarus defined two main groups of victims: firstly, so-called liquidators, citizens who directly participated in the accident and the liquidation of its consequences (among them members of the military and firemen); and secondly, residents of the contaminated zones, including evacuees. The comprehensive lists of compensations included free medical treatment, annual treatments in sanatoria, food assistance, assumption of housing costs, unemployment benefit at the level of the previous wage, free building loans, free use of public transport, and preferential treatment when allocating kindergarten places or access to university programs. The highest compensation payments were made to former liquidators and radiation patients, depending on their health problems. Evacuees and resettled citizens were able to receive new housing and compensation for the property left behind. According to the law, they should also be supported in their professional reorientation.⁵² Belarus and Ukraine set different priorities in their Chernobyl programs: while until the mid-1990s Belarus initially invested

primarily in resettlement and housing construction, social protection measures had priority in Ukraine. The Belarusian laws for Chernobyl victims provided social benefits for about 2.1 million people (one-fifth of the total population). Ukrainian laws included about 3.1 million people (6% of the Ukrainian population).⁵³

Adriana Petryna and Astrid Sahn, in their studies, nevertheless concluded that in Belarus as a whole comparatively less funds were spent on supporting Chernobyl victims than in Ukraine. Since 1996, expenditure in the Belarusian state budget for the elimination of the consequences of the Chernobyl disaster had been reduced to a minimum. This can also be seen in connection with the construction of the first nuclear power plant in Belarus. The Belarusian social law has been amended more than 16 times up until today, and social benefits for Chernobyl victims have been gradually reduced. Among other things, the number of residential areas recognized as contaminated in Belarus has been continuously reduced to date.⁵⁴ As a result, people from these villages are no longer able to benefit from the social support for Chernobyl victims. Moreover, the liquidators gradually lost their special status among the injured and benefits granted earlier, such as assumption of 50% of the rental costs, interest-free building loans, as other benefits were already removed in the 2009 amendment of the law. The status of Chernobyl claimants has been treated since then in the same way as that of “normal” disabled people.⁵⁵

Nonetheless, in Ukraine, there were also practical problems and budget bottlenecks in the implementation of the laws, as the declarations of independence in August 1991 exacerbated the problem of program financing. For example, the inhabitants of the city of Kyiv had been ignored mainly for cost reasons, although the radioactive contamination in some parts of the city was considerable and corresponded to the resettlement criteria.⁵⁶ As mentioned above, the Ukrainian state’s payment problems have more recently given rise to a wave of claims filed by thousands of affected persons with the ECHR.

Adriana Petryna has coined the term “biological citizenship” for the way in which Chernobyl victims in Ukraine claimed compensation based on their exposed bodies. According to Petryna, in post-Soviet Ukraine, where democratization was linked to a harsh market transition, the injured biology of a population has become the basis for social membership and staking claims to citizenship. Government-operated radiation research clinics and non-governmental organizations mediated an informal economy of illness and claims to a “biological citizenship.” This implied a form of social welfare based on medical, scientific, and legal criteria that recognized (on a limited scale) injury and thus compensated for it. Petryna shows how communities of “at-risk” populations came into being, how norms of citizenship changed, and how these processes were related to institutions of medicine and law in Ukraine. In this situation, reparations became an important source of income for many of the victims, and their injured bodies now formed the basis for civil rights and public recognition. This led to an informal economy of disease in which

the sick tried to stay sick in order not to lose their vital privileges. What influence did the reparations programs have on the development of civil society? On the one hand, the Chernobyl laws engendered new and democratic forms of civic organizing and opportunities for non-governmental action in Ukraine. On the other hand, according to Petryna, they became one of the state's most notorious mechanisms of corruption.⁵⁷

Aid for Chernobyl victims also had a transnational dimension: the governments of the then Soviet republics Belarus and Ukraine were the first to turn to the international community in 1990 with requests for help and assistance. Aid from abroad was of central importance, especially for Belarus. Using the example of the Chernobyl children, about one million Belarusian, Ukrainian, and Russian children and adolescents who had been sent to other regions of the Soviet Union and abroad for weeks and months, Melanie Arndt draws in her study the transnational history of a nuclear catastrophe.⁵⁸ Around the Chernobyl children, a transnational network of NGOs emerged, which took over tasks of the state social systems in the post-Soviet states. As a result, innumerable initiatives (initially often with a Christian background) were launched not only in the West but also in the East itself, in the field of Chernobyl aid. Arndt uses the example of the Chernobyl children and the global networks of concern emerging around them to draw a new picture of the decentralization processes in the outgoing Soviet Union. However, the window of opportunity for the development of the NGO scene in Belarus remained very small, because since Lukashenka took power in 1994, the possibilities for NGOs to operate in Belarus (in connection with the general curtailment of freedom of opinion and freedom of the press) have been clearly reduced to the point of a ban on sending Chernobyl children abroad. Thus, the wave of social mobilization for humanitarian engagement and the general mood of optimism in the East and West remained limited to a small window of opportunity in which "everything seemed possible in the East and West beyond the borders of the dissolving Cold War bloc confrontation."⁵⁹

In Ukraine, even stronger than in Belarus, the recognition of Chernobyl victims became an important part of the nation-building process: in the Ukrainian culture of remembrance, Chernobyl and its consequences for man and nature were combined with the experience of extermination in the great famine of 1932/1933, better known as the *Holodomor*.⁶⁰ Representatives of the Ukrainian national movement equally regarded not only the *Holodomor* but also the Soviet Chernobyl policy as a "genocide" against their people. The thesis of an inherent connection between *Holodomor* and Chernobyl as decidedly anti-Ukrainian measures by Moscow goes back to the Kyiv opposition writer Ivan Drach, who first expressed this at a congress of the Ukrainian Writers' Union in 1986.⁶¹ But while under President Viktor Yushchenko, the *Holodomor* was in 2006 acknowledged by law as genocide against the Ukrainian people, nothing similar took place so far with regard to the Chernobyl disaster.⁶² However, Chernobyl has become an integral part of

Ukrainian culture of remembrance: in 1992, a national Chernobyl museum opened in the capital Kyiv and monuments were erected in several cities of Ukraine.

In Russia, a comprehensive law on the “social protection of citizens, who were exposed to radiation as a result of the Chernobyl catastrophe” was passed a few months later in May 1991 by Boris Yeltsin, reacting to the Ukrainian and Belarusian laws. The number of Russian citizens affected by the Chernobyl catastrophe was considerably smaller. Moreover, the Russian law used different semantics, “exposure to radiation” instead of “suffering from radiation” or the rather blurred designation of “influence zone of unfavorable factors” (*zona vliianiia neblagopriiatnykh faktorov*), but it also declared a right of all Russian citizens to receive compensation for their damage (health and property) as well as measures of social support.⁶³

The Ukrainian, Belarusian, and Russian laws classified four to five different zones of radioactive risk and contamination, using similar threshold values and connecting these zones to state evacuation and resettlement policies: compulsory resettlement was foreseen if the annual dose exceeded 5 millisievert (mSv). If the annual dose exceeded 1 mSv, there was a general right to resettle for the inhabitants.⁶⁴ Only the Russian law also provided for a zone with “privileged socio-economic status,” where the dose was below 1 mSv.

At the same time, Russia initially found it difficult to recognize the claims of victims of nuclear accidents that took place on Russian territory long before Chernobyl, such as the nuclear waste accident of 1957 in the closed city of Chelyabinsk-40.⁶⁵ It was thanks to the efforts of Chelyabinsk environmental activists that a law was passed in Russia in 1993 under President Yeltsin that extended the scope of the Chernobyl law to the victims of Chelyabinsk-40.⁶⁶

One of the peculiarities of the situation in Russia was that victim groups from three different contexts of radioactive contamination had to be considered. Therefore, in post-Soviet Russia, the recognition of the rights of victims of radioactive accidents took place in several stages: starting with the Chernobyl laws (1991), followed by the Chelyabinsk laws (1993, 1998), and concluding with the Semipalatinsk laws (1995, 2002).⁶⁷

The practical implementations of the laws, however, still encounter problems today, partly because the conditions of the three cases of radioactive contamination differ so greatly. Thus, for example, the Chelyabinsk law, which was strongly oriented toward the Chernobyl law, did not take into account the specificities of the social and environmental situation in the Chelyabinsk region, which meant that some of the victims were not taken into account. The Chernobyl law defined the radioactively contaminated areas according to the degree of their contamination with caesium-137, but in the Mayak accident, the contamination was mainly caused by strontium-90. In addition, the health risk in Chelyabinsk was the long duration of exposure of the population to radiation in the contaminated regions. This meant that the total dose had to be calculated over the whole period since the late 1940s.⁶⁸

Problematic is, for example, that local inhabitants of the contaminated territories only profited from the law (per definition) if they lived in settlements, which had partly been evacuated in the aftermath of the nuclear accident during the 1950s, or in settlements where the actual radiation dose amounted to more than 1 mZv. As we know today, by far not all contaminated settlements were evacuated during the 1950s. So those people, who were not included into Soviet evacuation policies – among them inhabitants of several Bashkir and Tatar villages – also had problems to enforce their actual claims for compensation and social protection.⁶⁹ Moreover, the law excluded all those people who had relocated to the contaminated settlements after the enacting of the law in the 1990s.

The Russian lawyer Adis Shafikov has called for the Russian state to fundamentally change its policy toward victims of radioactive accidents and better recognize its responsibility toward the victims. This should include, on the one hand, compensation for the inflicted damage and suffering and, on the other hand, the provision of social protection for the affected population. In this context, the demand for a uniform law on the social protection of citizens who have suffered damage as a result of radioactive accidents in the Russian Federation was raised, which equally covers the accidents at Chernobyl, Chelyabinsk, and Semipalatinsk. Moreover, such a law is intended to cover not only those injured directly but also the subsequent generations of children and grandchildren.⁷⁰

Shafikov considers that only in the first phase after the end of the Soviet Union from 1991 to 1995 did the population receive broad information on environmental problems and health risks, while since 1994, a policy of cover-up and secrecy has again dominated.⁷¹ In no small number of cases, it is difficult for the injured parties to assert their right to compensation for damage to their health and property, as those affected are under the burden of proof. The letters of affected people presented at the beginning have shown this. Persons who are not sufficiently taken into account by the law include civilian volunteers who were employed as liquidators of the accident in 1957 and today, decades later, have problems in providing evidence of their deployment. Some of those affected could only enforce their status as liquidators of the accident by court order. However, the practice of the courts in these cases varies from region to region. People who resettled voluntarily and on their own initiative and did not participate in the state evacuation measures also encountered problems of proof.⁷² Moreover, as scientists know, the extent of damage to health caused by radioactivity and the link between radioactive radiation and illness can often not be clearly determined, as other environmental factors might have had a negative effect as well.

Approximately 21,000 people live in the Chelyabinsk Oblast, to whom the statutory compensation regulations apply. Of these, 15,000 are liquidators of the 1957 accident and evacuees. About 4,000 people still live in settlements where the average annual dose of radiation is 1 mSv or more. Russian lawyers consider it problematic that the law does not take sufficient account of

the children of those affected, who have also suffered lifelong health damage. Their claims are limited up to the age of 18. In contrast, the claims of subsequent generations of injured people are not limited to the Chernobyl Act.⁷³ In Russia, several court cases have taken place in which the question was examined of whether radioactivity can change the genetic makeup of a person. Whole families were examined by geneticists of the Russian Academy of Sciences and the scientists were able to clearly identify the genetic changes that are associated with a high risk of malformation in future generations of children. In the case of a severely damaged child, a Chelyabinsk court even awarded the parents 5 million rubles in compensation at the expense of the company “Mayak.”⁷⁴ There are general demands on the Russian state to extend the circle of children to be compensated to children of the third and subsequent generations. In addition, nationwide data on the number of victims of radioactive radiation, illness and death statistics, shall be collected and made public.⁷⁵

Unlike in Ukraine, there are hardly any monuments to the liquidators of the Chelyabinsk accident in Russia today. In the city center of Chelyabinsk, it is not the nuclear accident of 1957 or the radioactive contamination of Techa River that is commemorated, but the head of the Soviet nuclear bomb program, Igor Kurchatov, admired by the population as a national hero. In Russia, the victims of radioactive radiation are not seen as victims of an inhuman Soviet system, but as individuals who have fallen into the “zone of influence of unfavorable factors,” according to the Russian text of the law.⁷⁶ This can partly be explained by the still widespread view that individual victims had to bear the consequences of the development of the nuclear shield that effectively protected all Soviet citizens. Russia, however, is by no means an isolated case. Also, in the USA, newborns, who were born within the sphere of influence of the American nuclear test site in Nevada and suffered from severe handicaps, were for a long time called “sacrifice babies.”⁷⁷ And even victims of the US nuclear tests on the Marshall Islands have only been able to obtain compensation payments from the American state since the 1980s with the help of class action suits.⁷⁸

Kazakhstan, with regard to its nuclear test ground in Semipalatinsk, chose a different way of legal classifications and also used different threshold values. In Kazakhstan, radiation exposure is increased over an area of 350,000 square kilometers (one-tenth of the country’s total area) with a population of over one million. At the nuclear test site in the steppe region, less than 200 kilometers from the city of Semipalatinsk (now Semey), the Soviet Union detonated 456 nuclear bombs between 1949 and 1989 (extensive atmospheric and underground nuclear testing). In addition, Kazakhstan has other sources of increased radiation exposure, such as the smaller test sites in Azgir, Lira, and Galit, where non-military nuclear tests were carried out, or the approximately 400,000 tons of radioactively contaminated overburden from uranium mining, which has accumulated in more than 100 places during the extraction of uranium ore.⁷⁹ The “fast breeder” in Aktau (formerly Shevchenko),⁸⁰ which

has now been shut down, and the radiation exposure in connection with oil production should also be mentioned in connection with the increased radiation exposure.⁸¹

In Kazakhstan, already in the late Soviet era under Gorbachev, environmental activists unleashed a wave of opposition, such as the Almaty demonstrations that were kept down by the force of police. The issue of nuclear testing was publicly raised in 1989 at demonstrations for independence in Almaty. Later, political protests were organized by the Nevada-Semipalatinsk Movement, which was together with the Chelyabinsk antinuclear protests among the first antinuclear movements created on the territory of the former USSR. Eventually, the Semipalatinsk nuclear test site was closed in 1991.

In independent Kazakhstan in December 1992, a “Law on the Social Protection of Citizens Exposed due to Nuclear Tests at the Semipalatinsk Nuclear Test Site” had been adopted, which declared the social protection and compensation of citizens, who suffered from nuclear testing near Semipalatinsk.⁸² The Kazakh law identified three zones for increased to extraordinary radioactive risk, where the dose ranged from 70 to over 1,000 mSv (accumulated during the whole period of nuclear tests since 1949). However, for economic reasons, it was not implemented and put on hold for several years.

The wording of the law starts with the statement that the testing of nuclear weapons, which were carried out within 40 years in Semipalatinsk, caused irreplaceable damage to the health of people and the surrounding environment, which became visible in an increase of disease and death rates. Like in the Ukrainian and Belarusian laws, the affected regions were declared to “zones of ecological emergency.” Moreover, the law also recognized the effects of radiation in the following generations and declared the governments’ obligation to compensate the citizens’ damages of health and property. The Kazakh law bore several similarities with the Ukrainian, Belarusian, and Russian laws in defining different exposure groups and categories of claimants, but the Kazakh approach was the most comprehensive. It defined the different zones of radiation risk and threshold values and listed the administrative regions and settlements, which belonged to the different risk zones. Moreover, from the beginning, the law included all people who lived, worked, or carried out military service on these territories during the period of the nuclear testing – it was not limited to those who had developed significant medical conditions associated with radiation exposure. The government has officially recognized 1,323,000 people as having been negatively affected by the nuclear tests. Of these, 1,057,000 have received “radiation passports” (*poligonnoe udostoverenie*) officially confirming their status.⁸³ In addition, following the Russian example, some benefits were admitted to residents of the so-called territory of special privileged socio-economic status – defined by law as an area adjacent to the minimum radiation risk area with a low radiation dose. The law excluded people who moved to contaminated areas after 1991. Compensation and benefits included small direct payments

(depending on the exposure category), additional paid holidays, retirement at a younger age, higher pensions and salary top-ups for state employees, extended maternity leave for up to 184 days, and free medical treatment for children. Since 1995, an Interdepartmental Expert Council has been in operation and has made judgments on the question of the relationship between the individual's exposure to radiation and disease (or death). A positive expert decision served citizens as legal grounds for applying for additional social benefits. But in practice, due to the economic situation in Kazakhstan in the 1990s, the government was partly unable to fulfill its obligations, and many had to wait years before they received the compensation they were entitled to. Moreover, claimants have criticized the poor size of the compensation payments.⁸⁴ In particular, the most deprived inhabitants of the affected rural regions had difficulties in asserting their claims to social benefits.⁸⁵ It was not until the Kazakh state's capital gains from the oil industry at the beginning of the twenty-first century that compensation programs reached the people in the affected regions. The construction of oil pipelines to Russia and China and oil exports abroad secured the financing and implementation of compensation laws in Kazakhstan. At the same time, a new nuclear program based on large-scale uranium mining began in Kazakhstan, so that the Republic of Kazakhstan soon became the world leader in uranium exports. With clear economic considerations to save government resources, the Kazakh state moved to limit its compensation and social benefits to those who had actually been diagnosed with diseases that were attributable to radiation according to agreed lists. It was therefore no longer sufficient to have lived in radioactively contaminated regions. A new dividing line was introduced between an exposed versus an affected individual.⁸⁶ With short delay, Kazakh law also radiated into Russia: in August 1995, the Russian Federation also passed a law on social security for Russian citizens who had suffered damage as a result of the nuclear tests in Semipalatinsk.⁸⁷ The law provided social guarantees for citizens who lived in settlements within and outside the Russian Federation (included in the special lists of settlements approved by the government) and were as a result of the above-ground nuclear tests at the Semipalatinsk test site (between 1949 and 1963) exposed to radiation. Also included were children under 18 years of the first and second generation of these citizens suffering from diseases caused by radiation exposure to one of their parents.⁸⁸

The Russian law on the victims of Semipalatinsk illustrates the double challenge for the Russian state: on the one hand, it had to deal with the cross-border character of the radioactive contamination, affecting also some Russian border regions close to Semipalatinsk. On the other hand, it had to cope with the heritage of strong personal ties and exchange across republic borders in the former Soviet Union.

A decade after the law had passed in Kazakhstan, victims of the nuclear testing became part of the official cultural memory, represented by the monument "Stronger than Death," which was opened in August 2001 in Semipalatinsk (Semey). Just as in Ukraine and Belarus, victim narratives played a certain

role in post-Soviet nation-building processes in Kazakhstan after the end of the Soviet Union. However, Kazakhstan's politics of history and culture of remembrance also differed markedly from those in Ukraine: while in post-Soviet Ukraine, the commemoration of the victims of the *Holodomor*, the great famine of 1932–1933 under Stalin, took on a central significance, the considerable number of hunger victims in Kazakhstan (more than a third of the total population) was for a long time only marginally acknowledged in Kazakhstan's culture of remembrance, because peace within Kazakhstan's multiethnic society should be preserved and relations with its powerful neighbor Russia should not be affected.⁸⁹ It can thus be concluded that in the Republic of Kazakhstan, primarily, the victims of the Semipalatinsk nuclear test site played an important role in the post-Soviet culture of remembrance.

Victims Competing for Political Acknowledgment and Welfare Resources

The end of the Soviet Union was accompanied by a new attention for the numerous victims of the past. In addition to the environmental victims, there were other groups of victims whose rights and privileges of care now found their way into the legislation of the successor states of the Soviet Union. Among them were victims of political repression, especially the numerous victims of the Stalin era. On October 18, 1991, President Yeltsin signed into force a law in Russia on the rehabilitation of victims of political repression, which provided for all those affected to be given back their civil rights and for material losses to be compensated as far as state resources allowed.⁹⁰ This concerned, as the text of the law stated, “millions of people who were victims of the despotism of a totalitarian state during the period of Soviet power and were subjected to repression because of their political and religious beliefs or because of their social, national, and other characteristics.”⁹¹

Similar laws had been adopted a few months earlier in Ukraine⁹² and Belarus,⁹³ while such a law was not adopted in Kazakhstan⁹⁴ until 1993. The implementation of these laws varied widely in various post-Soviet states, depending on political priorities and budgetary situations. Unlike the environmental victims, however, many victims of political repression had already undergone initial phases of rehabilitation during the Soviet period following Stalin's death, during the so-called thaw period under Khrushchev, and later in the outgoing Soviet Union under Mikhail Gorbachev.

Victims of National Socialist crimes in World War II now also became the focus of public attention, which was related to German reparation programs. At the beginning of the 1990s, state reconciliation foundations had been set up in Russia, Ukraine, and Belarus, which, with the help of German funds, were to organize payment programs for victims of Nazi crimes.

While the individual Nazi victims were paid comparatively small sums of money under the disbursement program in the 1990s, the amounts paid out under the compensation program for former forced laborers in the early

2000s were more significant. At that time, approximately 256,000 former forced laborers and Nazi victims received compensation payments in Russia, 471,000 in Ukraine, and 129,000 in Belarus. The total amount paid out was 1.638 million euros.⁹⁵

While in Belarus, the compensation of former Nazi victims, especially Nazi forced laborers, became a showcase project of the Lukashenka government and was also of great importance for the Ukrainian governments, it had only marginal relevance in Russia under the Yeltsin government and, since 2000, under President Vladimir Putin's rule.⁹⁶ Under the first German payment program 1993–1999, over 40 million euro had been lost in Russia due to mismanagement of the Russian foundation “Understanding and Reconciliation” (*vzaimoponimanie i primirenje*) during the 1998 financial crisis, so that almost 100,000 Nazi victims were unable to receive their payment at all or only partially.⁹⁷

Some of the post-Soviet states also passed their own legislation in the 1990s for the social protection of Nazi victims. While in Ukraine, a general law was introduced for all victims of Nazi crimes, the legal regulations in Russia and Belarus only referred to individual groups.⁹⁸ The political significance of different groups of Nazi victims varied greatly in the post-Soviet states, which was reflected not only in the legal regulations but also in the states' history policies.⁹⁹

In addition to pension allowances, the benefits for Nazi victims were (quite similar as in the case of the environmental victims) mainly reductions on electricity, gas, water, and telephone costs, free local transport, free medication, and stays in sanatoria. For many seniors, who were often particularly needy, this aid was vital for survival.

The German compensation programs in Russia, Ukraine, and Belarus thus overlapped with domestic legislations that were based on different principles, partly considering different groups of victims and requiring different types of evidence. The granting of compensation from Germany did not automatically entail legal recognition as Nazi victims (with corresponding privileges) in the home country and vice versa. The German Foundation Act thus came into conflict with national legislation in various areas, much to the disappointment and incomprehension of the people concerned. At the same time, German compensation programs for Nazi victims as well as international aid programs for Chernobyl victims subsidized the state social systems, which was particularly evident in the case of Belarus. Belarusian authorities had even temporarily switched over to offsetting foreign payments and aid against regular state benefits.¹⁰⁰

Under conditions of the harsh market transition, the victims' claims for compensation and social supply privileges became a tool for them to participate in the (however limited) state-protected post-Soviet social welfare system. *Kompensatsija* was not just payment for past damages but also an instrument for survival under the brutal market transition (compensating for state deficits or dysfunctional public health-care systems).¹⁰¹ This connection

is visible in the letters mentioned above from victims of the radioactive contamination in Chelyabinsk, when they asked for support and evidence to be able to obtain urgently needed medical services. Thus, in November 1994, the former military member and invalid of the second group, Yuri Evgenevich L., appealed urgently to the mayor of Chelyabinsk: "My health is getting worse every day, the doctors are advising me to stay in the hospital, but there is no place available. I sincerely hope for your understanding and support."¹⁰²

The generation of pensioners often suffered particularly from the economic and social upheavals following the end of the Soviet Union.¹⁰³ In December 1999, for example, an old woman from the city of Bryansk in Russia and former forced laborer wrote to Otto Graf Lambsdorff, the Special Representative of the German Government for the compensation of Nazi forced laborers: "I am 81 years old and live on the miserable Russian pension. I live under the most difficult conditions. Our Russian pension is only enough for half a month for basic foodstuffs."¹⁰⁴

Pensions and wages had not risen at the same rate during the transformation years. In 1999, the average pension in Russia was only 70% of the subsistence minimum, and in the following years, it leveled off at about the subsistence minimum. This did not change until 2009, when pensions were raised significantly as part of the Russian government's anti-crisis program. In Russia, as in Ukraine and Belarus, there were major deficits, particularly in nursing care for the elderly and in the health system. These areas particularly affect the elderly. According to the Russian Constitution, medical services should in principle be free of charge for citizens, but in practice, they must increasingly be paid for by the citizens themselves. In addition, medical care differs greatly between Russian regions and there is an urban-rural divide, so that poor people in villages or small towns often cannot receive the necessary treatments.¹⁰⁵ The social legislation divided pensioners into different pension categories with graduated rights and benefits, thus creating social and economic disparities. At the top of the pensioners' care pyramid in Russia are still war veterans, whose health care is regulated by law. This also reflects the continuous central importance of the "Great Patriotic War" in Russian history policy and culture of remembrance.¹⁰⁶

Various victim groups competed for scarce resources of the post-Soviet social welfare systems during the difficult transformation period after the end of the Soviet Union. Sometimes this also led to the phenomena of "competition between victims" as described by the philosopher and sociologist Jean-Michel Chaumont.¹⁰⁷ In the successor states of the Soviet Union, in particular, the relationship between victims of Stalinism and National Socialism or between Jewish and non-Jewish victims was sometimes very tense. After a visit to Minsk in November 2000, a representative of a German association for victims of Nazi persecution noted in his travel report: "This resigned basic mood – mixed with envy of the Jewish victims of persecution – results in widespread anti-Semitism, even among those victims who themselves suffered in the concentration camps."¹⁰⁸

Nevertheless, it should not be overlooked that the legal acts for many victims constituted a means to receive a certain recognition inside the homeland society. For some victims of Nazi crimes (e.g. former forced laborers), who had been stigmatized for decades as “homeland traitors” according to the Soviet narrative of World War II, this aspect of public acknowledgment of their suffering was even more important than the material benefits. Those who received compensation payments often gained recognition on two levels: within society, as the injustices they had suffered were finally publicly acknowledged; and within their family circles, as they were now able to contribute significantly to the family budget.¹⁰⁹

Conclusion

Comparing the developments in Ukraine, Belarus, Russia, and Kazakhstan, we can conclude that the national legislations took place in a larger post-Soviet space, influencing each other in various ways and coinciding with state- and nation-building as well as with processes of social and economic transformation. Differences between the countries become visible: while the acknowledgment of victims of radioactive contamination played a central role in the nation-building in Ukraine, Belarus, and Kazakhstan since the 1990s, this was not to the same extent the case in the Russian Federation. While Ukrainian, Belarusian, and Kazakh laws (to different degrees) attempted to settle accounts with the deleterious Soviet past in a retributive process, the developments in Russia took a different path. Dissimilar to the Chernobyl victims in Ukraine or Belarus and Semipalatinsk victims in Kazakhstan, the Russian victims of the Chernobyl and Chelyabinsk disasters were not an integral part of the Post-Soviet Russian nation-building process. Moreover, they were not perceived as victims of an inhuman Soviet system, but rather as individuals who happened to be in the “influence zone of unfavorable factors.” This might be due to still prevailing views that these inhabitants were bearing the consequences of the Soviet nuclear shield, thus protecting Soviet citizens as a whole. Today, the Russian state’s dominant history policy under Putin, focusing entirely on Russia’s heroic past (including renewed admiration of Stalin) leaves little scope for considering victims of this past. Post-Soviet historiography and remembrance cultures have developed differently in the successor states of the Soviet Union, and today there is a lack of a common narrative on the history of the Soviet era. This is precisely why competing images of history are repeatedly used by all actors as a “weapon” against the respective enemy and legitimize their own political actions.¹¹⁰

Compensation and social protection laws for victims of radioactive contamination as well as for other groups of victims (e.g. victims of Stalinism or Nazi crimes) overlapped with nation-building and general political, economic, and social transformation processes in the post-Soviet states. For parts of the population, they represented a means of alleviating their economic plight and at the same time addressing past injustices.

It seems to be specific for the developments in the former Soviet space that here environmental victims stand on an equal footing with the victims of the Stalinist and National Socialist dictatorships and play an equally important role in the nation-building processes. The Chernobyl victims were even the first group of victims for whom legal regulations were created in Ukraine, Belarus, and Russia and might have had a certain model character for the legislature. The process of coming to terms with and overcoming the experience of dictatorship after the end of the Soviet Union therefore has a strong ecological component here, which requires that approaches to transitional and environmental justice be thought of as interconnected.

The heritage of the atom in former Soviet space is manifold. It has produced a specific legal legacy that has shaped the new social orders after the end of the Soviet Union. More recently, this process has also taken on an international dimension, manifested in a growing number of appeals to the ECHR by Russian and Ukrainian environmental victims. The once unnoticed environmental victims of the Soviet past have learned to assert their rights vis-à-vis national and international institutions and organizations.

In the new social orders of the post-Soviet states, different groups of victims competed for supply privileges and public recognition, among them victims of Stalinism, victims of Nazi crimes, victims of nuclear disasters, and others. They were all part of a larger process of victimization in the post-Soviet states, which means that former Soviet citizens who experienced suffering and injustices under Soviet rule, for the first time, perceived themselves as victims. This becomes very tangible in the new cultures of remembrance for victims that emerged in the successor states after the collapse of the Soviet Union, in which environmental victims often occupy a prominent place.

Moreover, the compensation and social protection acts also contributed to making the radioactive danger visible. Risks of radioactive contamination are normally invisible and not sensible for human beings. To measure them, scientific expertise and special technical devices are necessary. Most of the citizens are not able to obtain their own picture of the degree of contamination and the involved everyday risks. It remains the responsibility of the state to know about and inform the citizens about these risks. I thus argue that the compensation laws and practices formed an important element of the public visibility of radioactive contamination by presenting certain standards and threshold values and linking them to a specific compensation practice, thereby confirming the link between diseases and radiation exposure. As a result, the knowledge of local communities about state compensation practices might have been very much connected to the knowledge about radiation risks. And in reverse, if measures of social protection and compensation did not take place, this might have contributed to a “double invisibility” of radiation risk.¹¹¹

One of the important legacies of the atom for historians is not least the fact that compensation and social protection laws have produced a specific historical tradition that is now available for research to evaluate. These sources include thousands of application documents and letters from environmental

victims to the post-Soviet authorities, which are remarkable self-testimonies. Next to supporting documents, they often contain detailed biographical accounts and, in some cases, even personal photographs. These documents provide historians with exciting insights not only into how nuclear accidents were handled in the Soviet era and how people lived and worked in radioactively contaminated environments but also into the subjective perceptions of environmental victims of post-Soviet transformation processes.

Notes

1. Constantin Goschler, "Der Umgang mit den Opfern des Nationalsozialismus in Deutschland nach 1945," in: Günther Heydemann and Clemens Vollnhals (eds.), *Nach den Diktaturen. Der Umgang mit den Opfern in Europa* (Göttingen: Vandenhoeck & Ruprecht, 2016), 27–45.
2. Svenja Goltermann, *Opfer: die Wahrnehmung von Krieg und Gewalt in der Moderne* (Frankfurt a.M.: S. Fischer-Verlag, 2017); Peter Hallama, "Geschichtswissenschaften, Memory Studies und der Passive Turn. Zur Frage der Opferperspektive in der erinnerungskulturellen Forschung," in: Erik Franzen and Martin Schulze Wessel (eds.), *Opfernarrative. Konkurrenzen und Deutungskämpfe in Deutschland und im östlichen Europa nach dem Zweiten Weltkrieg* (München: Veröffentlichungen des Collegium Carolinum 126, 2012), 9–27, here 14; Critics warn, however, that the strong focus on historical victims risks fading out contemporary phenomena of violence and exclusion, i.e. the victims of today.
3. Michel Wieviorka, *Neuf leçons de sociologie* (Paris: Pluriel, 2008), 162.
4. Jean-Michel Chaumont, *Die Konkurrenz der Opfer. Genozid, Identität und Anerkennung* (Lüneburg: zu Klampen Verlag, 2001).
5. Goltermann, *Opfer*.
6. Ruti G. Teitel, *Transitional Justice* (Oxford: Oxford University Press, 2002), 69–94.
7. Jan Eckel, *Die Ambivalenz des Guten: Menschenrechte in der internationalen Politik seit den 1940ern* (Göttingen: Vandenhoeck & Ruprecht, 2015).
8. Guillermo O. Donnell and Philippe C. Schmitter, *Transitions from Authoritarian Rule: Tentative Conclusions about Uncertain Democracies* (Baltimore, MD: Johns Hopkins University Press, 1991), 30; Vladimir Tsimaneanu, *Fantasies of Salvation. Democracy, Nationalism and Myth in Post-Communist Europe* (Princeton, NJ: Princeton University Press, 1998), 116. According to John Borneman, the significance of retributive justice goes far beyond the fate of individual victims and perpetrators and is part of a "global ritual purification of the center of political regimes that seek democratic legitimacy." C.f. John Borneman, *Settling Accounts. Violence, Justice and Accountability in Postsocialist Europe* (Princeton, NJ: Princeton University Press, 1997), VIII.
9. Regula Ludi, *Reparations for Nazi Victims in Postwar Europe* (Cambridge: Cambridge University Press, 2012).
10. Anne K. Krüger, *Wahrheitskommissionen. Die globale Verbreitung eines kulturellen Modells* (Frankfurt a.M./New York: Campus, 2014), 256; Anne K. Krüger, "Transitional Justice," Version: 1.0, in: *Docupedia-Zeitgeschichte*, 25.1.2013. URL: http://docupedia.de/zg/Transitional_Justice?oldid=125451.
11. Gordon Walker, *Environmental Justice: Concepts, Evidence and Politics* (London and New York, NY: Routledge, 2011); Michael Kloepfer, *Umweltgerechtigkeit. Environmental Justice in der deutschen Rechtsordnung* (Berlin: Duncker & Humblot, 2006); David Schlosberg, *Defining environmental justice. Theories, movements, and nature* (Oxford: Oxford University Press, 2007); Gwen Ottinger and Benjamin Cohen (eds.), *Technoscience and Environmental Justice. Expert Cultures in a Grassroots Movement* (Cambridge, MA: MIT Press, 2011); Spencer Banzhaf (ed.), *The Political Economy of*

- Environmental Justice* (Stanford, CA: Stanford Economics and Finance, 2012); Barbara Rose Johnston (ed.), *Life and Death Matters. Human Rights, Environment, and Social Justice*, (Walnut Creek, CA: Left Coast Press, 2011); Christopher Williams, "An Environmental Victimology," in: *Social Justice*, 23 (1996) 4, 16–40; On the Soviet Union and its successor states: Julian Agyeman and Yelena Ogneva-Himmelberger (eds.), *Environmental Justice and Sustainability in the Former Soviet Union* (Cambridge, MA: MIT Press, 2009); Paula Garb, "Russia's Radiation Victims of Cold War. Weapons Production Surviving in a Culture of Secrecy and Denial," in: Barbara Rose Johnston (ed.), *Half-Lives, Half-Truth. Confronting the Radioactive Legacies of the Cold War* (Santa Fe, NM: University of New Mexico Press, 2007), 249–275.
12. Williams, "An Environmental Victimology," 21.
 13. Adriana Petryna, *Life Exposed. Biological Citizens after Chernobyl* (Princeton, NJ: Princeton University Press, 2003); Adriana Petryna, "Biological Citizenship: The Science and Politics of Chernobyl-Exposed Populations," in: *Osiris*, 2nd Series, Vol. 19, Landscapes of Exposure: Knowledge and Illness in Modern Environments (2004), 250–265; Adriana Petryna, "Nuclear Payouts: Knowledge and Compensation in the Chernobyl Aftermath," in: *Anthropology Now*, 2009, 1(2), 30–40.
 14. On environmental history see Douglas R. Weiner, *A Little Corner of Freedom: Russian Nature Protection from Stalin to Gorbachev* (Berkeley, CA: University of California Press, 1999); Paul Josephson et al., *An Environmental History of Russia* (Cambridge: University Press, 2013); Laurent Coumel and Marc Elie (eds.), *A Belated and Tragic Ecological Revolution: Nature, Disasters, and Green Activists in the Soviet Union and the Post-Soviet States, 1960s–2010s*, Special Issue, *Soviet and Post-Soviet Review*, 40, 2 (2013); Nicholas Breyfogle, *Eurasian Environments: Nature and Ecology in Imperial Russia and Soviet History* (Pittsburgh, PA: University Press, 2018); Melanie Arndt and Laurent Coumel (eds.), *The Green End of the Red Empire*, Special Issue, *Ab Imperio* 20, 1 (2019); Melanie Arndt (ed.), *Politik und Gesellschaft nach Tschernobyl: (Ost-) Europäische Perspektiven* (Berlin: Ch. Links Verlag, 2016).
 15. Law of the Russian Federation Nr. 4995-I, 20.05.1993 "On social protection of citizens exposed to radiation as a result of the 1957 accident at the Mayak production association and the dumping of radioactive waste in the Techa river" ("O sotsial'noi zashchite grazhdan, podvergshikhsja vozdeistviu radiatsii vledstvie avarii v 1957 godu na proizvodstvennom ob'edinenii „Mayak“i sbrosov radioaktivnykh otkhodov v reku Techa"). This law was replaced by a modified version in 1998: Law of the Russian Federation Nr. 175-FZ, 26.11.1998 "On social protection of citizens of the Russian Federation exposed to radiation as a result of the accident at the Mayak production association in 1957 and the dumping of radioactive waste in the Techa river" ("O sotsial'noi zashchite grazhdan Rossiiskoi Federatsii podvergshikhsja vozdeistviu radiatsii vledstvie avarii v 1957 godu na proizvodstvennom ob'edinenii „Mayak“i sbrosov radioaktivnykh otkhodov v reku Techa").
 16. See Kate Brown, *Plutopia. Nuclear Families, Atomic Cities and the Great Soviet and American Plutonium Disasters*, (Oxford: Oxford University Press, 2013); Sonja D. Schmid, *Producing Power: The Pre-Chernobyl History of the Soviet Nuclear Industry* (Cambridge, MA: MIT Press, 2015); Laura Sembritzki, "Maiak 1957 and its Aftermath: Radiation Knowledge and Ignorance in the Soviet Union," in: *Jahrbücher für Geschichte Osteuropas*, 66, 1 (2018), 45–64; Laura Sembritzki, *Nukleares Naturschutzgebiet im Süd-Ural: Atommüllkatastrophen und Strahlenschutz in der Sowjetunion* (Diss. Heidelberg University, 2019).
 17. See the contributions by Laura Sembritzki and Olga Nikonova in this volume.
 18. Klaus Gestwa, "Ökologischer Notstand und sozialer Protest. Ein umwelthistorischer Blick auf die Reformunfähigkeit und den Zerfall der Sowjetunion," in: *Archiv für Sozialgeschichte* 43 (2003), 349–383; Julia Obertreis, "Von der Naturbeherrschung zum Ökozid? Aktuelle Fragen einer Umweltzeitgeschichte Ost- und Ostmitteleuropas," in: *Zeithistorische Forschungen* 9 (2012), 115–122.

19. Collection of private letters in: Regional State Archive Chelyabinsk (Ob'edinennyi gosudarstvennyi archiv Cheliabinskoi oblasti, OGACHO), F. R-1212, D. 1-23. I thank Laura Sembritzki for providing me with a copy of the letters. The names of the letter writers have been anonymized.
20. Both facts of radioactive contamination, the accident of 1957 and the continuous pollution of the river Techa with radioactive waste water, were explicitly considered in the Russian law.
21. Collection of private letters in: OGACHO, F. R-1212, D. 1-23.
22. Collection of private letters in: OGACHO, F. R-1212, D. 1-23.
23. Collection of private letters in: OGACHO, F. R-1212, D. 1-23.
24. Collection of private letters in: OGACHO, F. R-1212, D. 1-23.
25. Collection of private letters in: OGACHO, F. R-1212, D. 1-23.
26. Collection of private letters in: OGACHO, F. R-1212, D. 1-23.
27. Collection of private letters in: OGACHO, F. R-1212, D. 1-23.
28. Collection of private letters in: OGACHO, F. R-1212, D. 1-23.
29. Collection of private letters in: OGACHO, F. R-1212, D. 1-23.
30. Transformation research, which flourished after 1991, was initially dominated by political studies that examined the system change from socialism to capitalism, particularly at the level of economic transformation, political institutions, and the actors in the transformation process. Much less is known, however, about how the transformation processes were perceived and processed by individuals and social groups themselves. Methodological approaches of ethnologists can be made fruitful, criticizing the political approach to transition, focused primarily on the question of how far-reaching social transformation processes affected the social network of relationships and the living environments of citizens in post-socialist states. In doing so, they countered the notion of a clear break between two successive social systems with a perspective on the complex and sometimes contradictory continuities at the social, political, and economic levels that were expressed in different social practices and cultural representations. See, among others, Christopher Hann (ed.), *Postsozialismus. Transformationsprozesse in Europa und Asien Aus Ethnologischer Perspektive* (New York, NY: Frankfurt am Main: Campus Verlag, 2002); Michał Buchowski, *Rethinking Transformation. An Anthropological Perspective on Post-Socialism* (Poznan: Humaniora, 2001); Katherine Verdery, *What Was Socialism and What Comes Next?* (Princeton, NJ and New York, NY: Princeton University Press, 1996).
31. On the growing number of complaints by Russian citizens to the European Court of Human Rights see: Lauri Mälksoo and Wolfgang Benedek (eds.), *Russia and the European Court of Human Rights. The Strasbourg Effect* (Cambridge: Cambridge University Press, 2018).
32. See Angelika Nußberger and Caroline von Gall, eds., *Bewusstes Erinnern und bewusstes Vergessen. Der juristische Umgang mit der Vergangenheit in den Ländern Mittel- und Osteuropas* (Tübingen: Mohr Siebeck, 2011).
33. The Chernobyl disaster on April 26, 1986 has been the object of much scholarly attention: Olga Kuchinskaya, *The Politics of Invisibility: Public Knowledge about Radiation Health Effects after Chernobyl* (Cambridge, MA: MIT Press, 2014); Edward Geist, "Political Fallout: The Failure of Emergency Management at Chernobyl," in: *Slavic Review*, 74, 1 (2015): 104–126; Aliaksandr Dalhouski, *Tschernobyl in Belarus: Ökologische Krise und sozialer Kompromiss, 1986–1996* (Wiesbaden: Harrasowitz, 2015); Melanie Arndt (ed.), *Politik und Gesellschaft nach Tschernobyl: (Ost-) Europäische Perspektiven* (Berlin: Ch. Links Verlag, 2016); Melanie Arndt, *Tschernobylkinder: Die transnationale Geschichte einer nuklearen Katastrophe* (Göttingen: Vandenhoeck & Ruprecht, 2020); Adam Higginbotham, *Midnight in Chernobyl: The Untold Story of the World's Greatest Nuclear Disaster* (New York, NY: Simon & Schuster, 2019); Serhii Plokhly, *Chernobyl: History of a Tragedy* (London: Penguin, 2019);

- Kate Brown, *Manual for Survival: A Chernobyl Guide to the Future* (New York, NY: W. W. Norton & Company, 2019); Susanne Bauer, Karena Kalmbach and Tatiana Kasperski, "From Pripjat to Paris, from Grassroots Memories to Globalized Knowledge Production: The Politics of Chernobyl Fallout," in: Laurel MacDowell (ed.), *Nuclear Portraits: Communities, the Environment, and Public Policy* (Toronto: University Press, 2017), 149–189.
34. Ulrich Beck, "Der anthropologische Schock. Tschernobyl und die Konturen der Risikogesellschaft," in: *Merkur* 8/1986.
 35. Ales' Adamovic, "Nicht nur ein AKW. Ein Brief an Michail S. Gorbacev," in: *Osteuropa*, 56, 4 (2006), 19–22.
 36. CASE OF MALINOVSKIY v. RUSSIA, Application no. 41302/02, July 2005.
 37. CASE OF DAVLETKHANOV and other "Chernobyl pensioners" v. RUSSIA, Applications nos. 7182/03, 10115/04, 21752/04, and 22963/04, 23 September 2010; CASE OF ALEKSEY ZAKHAROV v. RUSSIA, Application no. 51380/07, March 2009.
 38. CASE OF ROLGEZER AND OTHERS v. RUSSIA, Application no. 9941/03, April 2008. The applicants complained, in particular, about the excessive length of the civil proceedings. The ECHR decided in favor of the applicants and declared that the Russian state had to pay all 29 applicants within three months the amount of EUR 2,000 in respect of their non-pecuniary damage.
 39. The comparison with Belarus and Kazakhstan must be left out at this point, as they are not members of the Council of Europe or the ECHR.
 40. CASE OF BURMYCH AND OTHERS v. UKRAINE, Applications nos. 46852/13 et al., October 2017. It is not entirely clear how many of the plaintiffs were victims of the Chernobyl disaster. However, some judges of the Court assumed that this was the case for the majority. The Grand Chamber judgment of the ECHR in this case concerns the continuous failure of Ukraine to adopt general remedial measures to deal with applications to the ECHR on the subject of non-enforcement or delayed enforcement of domestic judicial decisions. Following its "pilot" judgment YURIY NIKOLAYEVICH IVANOV v. UKRAINE adopted in 2009, the ECHR dismissed all 12,143 cases, handing them to the Department of Execution at the Council of Europe for enforcement. In their dissenting votes, seven judges complained: "It is particularly troubling that among the present applicants, and most likely among those applications which were not seen by a judge, there are many victims of the Chernobyl disaster and other vulnerable persons. We refrain from describing the kind of additional suffering the perpetuation of their misery will cause" (p. 74).
 41. CASE of SVETLANA NAUMENKO v. UKRAINE, Application no. 41984/98 March 2005.
 42. CASE of SVETLANA NAUMENKO v. UKRAINE, Application no. 41984/98 March 2005, p. 22.
 43. Sylvia Kotting-Uhl, "Bericht Einzeldienstreise in die Ukraine 10. bis 13. April 2018," <<https://kotting-uhl.de/site/bericht-einzeldienstreise-in-die-ukraine-10-bis-13-april-2018/>> (20.05.2021). The financing of the compensation payments would comprise about 22% of the total Ukrainian budget.
 44. Arndt, *Tschernobylkinder*; Dalhouski, *Tschernobyl in Belarus*.
 45. Collection of private letters in the archive of the Foundation "Understanding and Reconciliation" in Minsk, Belarus.
 46. In particular, they criticized the threshold value set in Moscow, according to which a life dose of radiation (calculated over 70 years of life) of 35 rem (=350 mSv) does not cause any damage to health. The scientists demanded a significantly lower limit of maximum 7 rem (=70 mSv) than the life dose and argued that even low radiation could lead to health damage. An annual radiation dose of 0.1 mSv should already justify the resettlement of the residents. The Supreme Soviet of Ukraine had passed

- this significantly lower limit of 7 rem by law. See Astrid Sahn, *Transformation im Schatten von Tschernobyl. Umwelt- und Energiepolitik im gesellschaftlichen Wandel von Belarus und der Ukraine* (Münster: Lit Verlag, 1999), 224, 226, 408–413.
47. For the period 1990–1992, 5.8 billion rubles were earmarked for Chernobyl measures in Belarus, 4.5 billion rubles for Russia, and only 3.6 billion rubles for Ukraine. This gave rise to the impression of discrimination in Ukraine. See Arndt, *Tschernobylkinder*, 187.
 48. Law of the Republic Belarus Nr. 634-XII (22.02.1991) “On social protection of citizens affected by the catastrophe at the nuclear power plant in Chernobyl” (“*O sotsial’noi zashchite grazhdan, postradavshikh ot katastrofy na Chernobyl’skoi AES*”). This law until today has been revised more than 16 times. Law of the Ukrainian Republic Nr. 796-XII (28.02.1991) “On the status and social protection of citizens, who suffered the consequences of the Chernobyl catastrophe” (“*Pro status i sotsial’ni zakhist hromadian, iaki postrazhdali vnaslidok Chornobil’skoi katastrofy*”).
 49. Arndt, *Tschernobylkinder*, 185.
 50. Law of the Republic Belarus Nr. 634-XII (22.02.1991) “On social protection of citizens affected by the catastrophe at the nuclear power plant in Chernobyl”; Law of the Ukrainian Republic Nr. 796-XII (28.02.1991) “On the status and social protection of citizens, who suffered the consequences of the Chernobyl catastrophe.”
 51. In 2001, this right of information was even extended in the Belarusian law to a general right of citizens for full and true information about all radioactive contaminations of territories and food products. In Ukraine in 2000 a law was passed on the “Protection of Population and Territories from Man-Caused and Natural Emergencies,” which also included a general right of all citizens to receive information about man-caused and natural emergencies, which occurred or could occur and required safety measures.
 52. Law of the Republic Belarus Nr. 634-XII (22.02.1991) “On social protection of citizens affected by the catastrophe at the nuclear power plant in Chernobyl”; Law of the Ukrainian Republic Nr. 796-XII (28.02.1991) “On the status and social protection of citizens, who suffered the consequences of the Chernobyl catastrophe.”
 53. Sahn, *Transformation im Schatten von Tschernobyl*, 234–250.
 54. Resolution of the Council of Ministers of the Republic Belarus Nr. 1623 (23.12.2004) “About confirmation of the lists of settlement points and objects located in the zones of radioactive pollution” (“*Ob utverzhdenii perechenia naselennykh punktov i obektov, nachodiashchikhsia v zonakh radioaktivnogo zagriazneniia*”).
 55. Svetlana Belous, L’gotniki. Sotsial’naia zashchita chernobyl’tsev: “Poteriy zdorov’o, mogu ia proiti bez ocheredi?,” 27.04.2015, in: <https://news.tut.by/society/445572.html> (accessed September 29, 2017).
 56. Sahn, *Transformation im Schatten von Tschernobyl*, 234–250.
 57. Petryna, *Life Exposed*; Petryna, “Biological Citizenship,” 250–265.
 58. Arndt, *Tschernobylkinder*.
 59. Arndt, *Tschernobylkinder*, 348.
 60. See Anne Applebaum, *Red Famine. Stalin’s War on Ukraine* (New York, NY and London: Penguin Random House, 2017); “Soviet Famines. Roundtable on Soviet Famines,” in: *Contemporary European History*, 27, H. 3 (2018), 432–481; “Vernichtung durch Hunger. Der Holodomor in der Ukraine und der UdSSR,” in: *Osteuropa* 54 (2004).
 61. See: Kerstin Jobst, *Geschichte der Ukraine* (Stuttgart: Reclam, 2010), 225; Astrid Sahn, “Atomenergie nach Tschernobyl und Fukushima. Reaktionen in Ost- und Westeuropa,” in: *Osteuropa* 63/7 (2013), 101–121.
 62. On the Ukrainian historical policy with regard to the Holodomor, see: Gregorii Kasianov, “The Holodomor and the Building of a Nation,” in: *Russian Social Science Review* 52 (2011) 3, 71–93; Heorhiy Kasianov, “Holodomor and the Politics of Memory in Ukraine after Independence,” in: Christian Noack, Lindsay Janssen,

- Vincent Comerford (eds.), *Holodomor and Gorta Mór. Histories, Memories and Representations of Famine in Ukraine and Ireland* (London and New York, NY: Anthem Press, 2012), 167–188; Wilfried Jilge, “Holodomor und Nation. Der Hunger im ukrainischen Geschichtsbild,” in: *Osteuropa*, 54 (2004), 12, 147–163; Under Viktor Yushchenko, monuments for the famine victims were established at many places in Ukraine; in the Ukrainian capital of Kyiv, even a memorial complex and a national museum were built. Anna Kaminsky (ed.), *Erinnerungsorte an den Holodomor 1932/33 in der Ukraine* (Leipzig: Leipziger Univ. Verlag, 2008).
63. Law of the Russian Federation Nr. 1244-I (15.05.1991) “On social protection of citizens exposed to radiation as a result of the catastrophe at the nuclear power plant in Chernobyl” (“*O sotsial’noi zashchite grazhdan, podverghshikhsia vozdeistviu radiatsii vsledstvie katastrofy na Chernobyl’skoi AES*”).
 64. For comparison: According to the German Radiation Protection Act, the limit for the effective dose for the protection of individuals in the population is currently 1 mSv. See “Radiation Protection Act of 27 June 2017 (BGBl. I S. 1966), last amended by Article 11 of the Act of 12 December 2019 (BGBl. L p. 2510),” § 80 (1).
 65. See Kate Brown, *Plutopia. Nuclear Families, Atomic Cities and the Great Soviet and American Plutonium Disasters* (Oxford: Oxford University Press, 2013); Sonja D. Schmid, *Producing Power: The Pre-Chernobyl History of the Soviet Nuclear Industry* (Cambridge, MA: MIT Press, 2015); Laura Sembritzki, “Maiak 1957 and Its Aftermath: Radiation Knowledge and Ignorance in the Soviet Union,” in: *Jahrbücher für Geschichte Osteuropas*, 66, 1 (2018), 45–64; Laura Sembritzki, *Nukleares Naturschutzgebiet im Süd-Ural: Atommüllkatastrophen und Strahlenschutz in der Sowjetunion* (Diss. Heidelberg University, 2019).
 66. Law of the Russian Federation Nr. 4995-I, 20.05.1993 “On social protection of citizens exposed to radiation as a result of the 1957 accident at the Mayak production association and the dumping of radioactive waste in the Techa river.” This law was replaced by a modified version in 1998 (see endnote 15).
 67. See Garb, “Russia’s Radiation Victims of Cold War,” 249–275.
 68. Vgl. A.M. Shafikov, *Sotsial’naja zashchita grazhdan, podverghshikhsia vozdeistviu radiatsii vsledstvie avarii na proizvodstvennom ob’edinenii „Mayak“i sbrossov radioaktivnykh otkhodov v reku Techa* (Chelyabinsk: Poligraf-Master, 2013), 27.
 69. Fauzija Bajmarova, *Der nukleare Archipel oder der atomare Genozid an den Tartaren*, Weiler 2006; Natalja Mironova, Maria Tysiachniouk and Jonathan Reisman, “The Most Contaminated Place on Earth: Community Response to Long-Term Radiological Disaster in Russias Southern Urals,” in: Michael R. Edelstein, Maria Tysiachniouk and Lyudmila V. Smirnova (eds.), *Cultures of Contamination: Legacies of Pollution in Russia and the U.S.* (Emerald Group Publishing, 2007), 165–184; Laura Sembritzki, *Nukleares Naturschutzgebiet im Süd-Ural*.
 70. Vgl. Shafikov, *Sotsial’naja zashchita grazhdan*; A.M. Shafikov/M.S. Sagandykov: Gosudarstvo kak publichnyi sub’ekt pravootnoshenii s uchastiem grazhdan, postradavshikh ot tekhnogennykh katastrof, in: *Bulletin of the South Ural State University, Series “Law,”* 14, 1 (2014), 64–67.
 71. Shafikov, *Sotsial’naja zashchita grazhdan*, 24–27.
 72. Shafikov, *Sotsial’naja zashchita grazhdan*, 103–114.
 73. Shafikov, *Sotsial’naja zashchita grazhdan*, 83.
 74. Shafikov, *Sotsial’naja zashchita grazhdan*, 93.
 75. Shafikov, *Sotsial’naja zashchita grazhdan*, 120.
 76. Law of the Russian Federation Nr. 1244-I (15.05.1991) “On social protection of citizens exposed to radiation as a result of the catastrophe at the nuclear power plant in Chernobyl”; Law of the Russian Federation “On social protection of citizens exposed to radiation as a result of the 1957 accident at the Mayak production association and the dumping of radioactive waste in the Techa river” (1993, 1998).
 77. Williams, “An Environmental Victimology,” 21.

78. In June 1983, the United States and the Marshall Islands entered into a formal agreement in which the United States recognized the contributions and sacrifices made by the Marshallese as a result of the Nuclear Testing Program. The Marshall Islands Nuclear Claims Tribunal was established in 1988 to grant compensation for personal injury deemed to have been caused by the testing. In their 2008 report, the Tribunal reported partial payment on personal injury awards to 2127 individuals totaling 96.658.250 US\$ with 23.131.552 still owed. See Holly M. Barker, "Radiation Communities: Fighting for Justice for the Marshall Islands," in: Johnston (ed.), *Life and Death Matters*, 357–380, here 371.
79. Kazakhstan has large uranium ore deposits. Before the collapse of the Soviet Union, one-third of the Soviet uranium and 85% of the fuel for the Soviet nuclear power plants were produced here.
80. See the contribution by Stefan Guth in this volume.
81. Artem Ermilov, "Atomtests, Uranförderung und Ölindustrie, Strahlenbelastung und Strahlenschutz in Kasachstan," in: *Osteuropa*, 4–5 (2008), 165–176; Gundula Bahro, *Durch Die Atomindustrie Verseuchte Gebiete in Kasachstan*, Stuttgart 1998; Gundula Bahro, "Tödliche Erbschaften – Das Atomare Potential in Kasachstan," in: *APUZ*, 52–53 (1992), B 39–46.
82. Law of the Republic Kazakhstan Nr. 1787-XII (18.12.1992) "On the social protection of citizens affected by the nuclear tests at the nuclear test site in Semipalatinsk" ("*O sotsial'noi zashchite grazhdan, postradavshchikh vsledstvie iadernykh ispytanii na Semipalatinskom ispytatel'nom iadernom poligone*").
83. Roman Vakulchuk, Kristian Gjerde, Tatiana Belikhina, and Kazbek Apsalikov: "Semipalatinsk Nuclear Testing: The Humanitarian Consequences," in: *Norwegian Institute of International Affairs, NUPI Report*, Nr. 1 (2014); Susanne Bauer, Boris Gusev, Tatiana Belikhina, Timur Moldagaliev, Kazbek Apsalikov, "The Legacies of Soviet Nuclear Testing in Kazakhstan: Fallout, Public Health and Societal Issues," in: Deborah Oughton and Sven Ove Hansson (eds.), *Social and Ethical Aspects of Radiation Risk Management* (Elsevier Science, 2013), 239–258.
84. Vakulchuk, Gjerde, Belikhina, and Apsalikov, "Semipalatinsk nuclear testing"; Cynthia Werner and Kathleen Purvis-Roberts, "Unraveling the secrets of the past: Contested versions of nuclear testing in the Soviet Republic of Kazakhstan," in: Johnston, *Half-Lives, Half-Truth*, 277–298. For an ethnological study on the communities living at the Semipalatinsk nuclear test site, see: Magdalena Stawkowski, "'I Am a Radioactive Mutant': Emergent Biological Subjectivities at Kazakhstan's Semipalatinsk Nuclear Test Site," in: *American Ethnologist*, 43, 1 (2016), 144–157; Magdalena Stawkowski, "Everyday Radioactive Goods? Economic Development at Semipalatinsk, Kazakhstan," in: *Journal of Asian Studies*, 76, 2 (2017), 423–436.
85. Susanne Bauer, "Radiation Science after the Cold War: The Politics of Measurement, Risk, and Compensation in Kazakhstan," in: Olga Zvonareva, Evgeniya Popova, and Klasien Horstman (eds.), *Health, Technologies and Politics in Post-Soviet Settings: Navigating Uncertainties* (New York, NY: Palgrave Macmillan, 2018), 225–249.
86. Bauer, "Radiation Science After the Cold War."
87. Law of the Russian Federation Nr. 149-FZ (19.08.1995) "On social protection of citizens exposed to radiation as a result of nuclear tests at the Semipalatinsk test site" ("*O sotsial'noi zashchite grazhdan, podvergnshchisia radiatsionnomu vozdeistviuu vsledstvie iadernykh ispytanii na Semipalatinskom poligone*"). In 2002, the law originally passed under Yeltsin was modified under Putin's administration: Law of the Russian Federation Nr. 2-FZ (10.01.2002) "On social guarantees for citizens exposed to radiation as a result of nuclear tests at the Semipalatinsk test site" ("*O sotsial'nykh garantiakh grazhdanam, podvergnshchisia radiatsionnomu vozdeistviuu vsledstvie iadernykh ispytanii na Semipalatinskom poligone*").

88. In the first law of 1995, adopted under Yeltsin, persons were considered entitled to benefits if they received a total (accumulated) effective dose of more than 50 mSv. Under Putin, this dose was then increased to 250 mSv in the new law of 2002.
89. Robert Kindler, "Opfer ohne Täter. Kasachische und ukrainische Erinnerung an den Hunger 1932/33," in: *Osteuropa*, 62 (2012) 3, 105–120. For studies of the famine in Kazakhstan, see: Robert Kindler, *Stalins Nomaden. Herrschaft und Hunger in Kasachstan*, Hamburg 2014; Sarah Cameron, *The Hungry Steppe: Famine, Violence, and the Making of Soviet Kazakhstan* (Ithaca, NY: Cornell University Press, 2018); Niccolò Pianciola, *Stalinismo di frontiera. Colonizzazione agricola, sterminio dei nomadi e costruzione statale in Asia centrale (1905-1936)* (Viella: Media et Orientalis Europa), 2009.
90. Russian Law Nr. 1761-I (18.10.1991) "On rehabilitation of victims of political repressions" ("O reabilitatsii zhertv politicheskikh repressii").
91. Russian Law Nr. 1761-I (18.10.1991) "On rehabilitation of victims of political repressions."
92. Ukrainian Law Nr. 962-XII (17.04.1991) "On rehabilitation of victims of repressions of the communist totalitarian regime 1917–1991" ("Pro reabilitatsiiu zhertv represiiu komunistychnoho totalitarnoho rezhymu 1917–1991 rokiv").
93. Decree of the Supreme Soviet of the Belarusian SSR "Ob utverzhdeniiu polozheniia o poriadke vosstanovleniia prav grazhdan, postradavshikh ot repressii v 20-50-kh godakh, Nr. 479-XII, 21.12.1990"; Decree "O poriadke vosstanovleniia prav grazhdan, postradavshikh ot repressii v 20-50-kh godakh" Nr. 847-XII, 06.06.1991.
94. Zakon Respubliki Kasachstan "O reabilitatsii zhertv massovykh politicheskikh repressii," Nr. 2143-XII, 14.04.1993.
95. Tanja Penter, "Zwischen Misstrauen, Marginalität und Missverständnissen. Zwangsarbeiterentschädigung in Russland, Litauen und Lettland," in: Constantin Goschler (ed.), *Die Entschädigung von NS-Zwangsarbeit am Anfang des 21. Jahrhunderts*, Bd. 4: Helden, Opfer, Ostarbeiter. Das Auszahlungsprogramm in der ehemaligen Sowjetunion, Göttingen 2012, 194–280; Tanja Penter, "Die belarussische Stiftung 'Verständigung und Aussöhnung' – Zwangsarbeiterentschädigung im Schatten der Lukašenka-Herrschaft," in: Constantin Goschler (ed.), *Die Entschädigung von NS-Zwangsarbeit am Anfang des 21. Jahrhunderts*, Bd. 4: Helden, Opfer, Ostarbeiter. Das Auszahlungsprogramm in der ehemaligen Sowjetunion, Göttingen 2012, 104–193; Tanja Penter, "Compensation for Nazi Forced Labour in Post-Soviet Russia and Belarus," in: Constantin Goschler (ed.), *Compensation in Practice* (New York, NY and Oxford, 2017), 211–238; Julia Landau, "Es ist unzulässig, dass die Worte der Entschuldigung nur an den Grabsteinen erklingen." Zwangsarbeiterentschädigung in der Ukraine und der Republik Moldau, in: Constantin Goschler (ed.), *Die Entschädigung von NS-Zwangsarbeit am Anfang des 21. Jahrhunderts*, Bd. 4: Helden, Opfer, Ostarbeiter. Das Auszahlungsprogramm in der ehemaligen Sowjetunion, Göttingen 2012, 7–103.
96. Penter, "Compensation for Nazi forced labor," 211–238.
97. Penter, "Zwischen Misstrauen, Marginalität und Missverständnissen."
98. Landau, "Es ist unzulässig, dass die Worte der Entschuldigung nur an den Grabsteinen erklingen," 7–103; Sabine Erdmann-Kutnevic, "Minimal versorgt, partiell geachtet. NS-Opfer in den ostslawischen Staaten," in: *Osteuropa* (2010) 5, 63–75; Penter, "Zwischen Misstrauen, Marginalität und Missverständnissen." Soviet Nazi victims achieved legal recognition of certain privileges of care for the first time in the outgoing Soviet Union. However, the privileges only applied to "child prisoners" of concentration camps, ghettos, and other places of detention during World War II. Adult Nazi forced laborers were excluded from these benefits because in the Soviet understanding, they were not considered victims but as collaborators of the Nazis. Russia and Belarus had initially largely adopted this discriminating regulation in their post-Soviet legislation.
99. Penter, "Die Belarussische Stiftung 'Verständigung und Aussöhnung'; Penter, "Zwischen Misstrauen, Marginalität und Missverständnissen."

100. Penter, “Die belarussische Stiftung Verständigung und Aussöhnung,” 104–193.
101. Petryna has shown this in detail using the example of the Chernobyl victims in Ukraine. Ukraine Petryna, *Life Exposed*.
102. Collection of private letters in: OGACHO, F. R-1212, D. 1–23.
103. Aleksej Levinson, “Flöten wie Sokrates. “Neue Alte” und die alte Realität in Russland,” in: *Osteuropa*, 60 (2010) 5, 159–173.
104. Archive of the Foundation “Remembrance, Responsibility, Future” (*archive EVZ*) in Berlin, Working Group Foundation Initiative, Letters by Citizens, AS-SI-Bbr, 12.4.
105. Lilija Ovčarova, “Nachholende Evolution. Die soziale Absicherung alter Menschen in Russland,” in: *Osteuropa*, 60 (2010) 5, 205–221.
106. See for World War II in the Russian culture of remembrance (among others): Julie Fedor, Markku Kangaspuro, Jussi Lassila, Tatiana Zhurzhenko (eds.), *War and Memory in Russia, Ukraine and Belarus: Palgrave Macmillan Memory Studies* (London: Palgrave Macmillan, 2017); Nikolay Kopolov, *Memory Laws, Memory Wars. The Politics of the Past in Europe and Russia* (Cambridge: Cambridge University Press, 2018).
107. Jean-Michel Chaumont, *Die Konkurrenz der Opfer*.
108. Report by Lothar Evers on his journey to Belarus, 17–20.11.2000, in: *Archive EVZ*, 501.10.
109. Penter, “Compensation for Nazi forced labour.”
110. Guido Hausmann and Tanja Penter, “Der Gebrauch der Geschichte. Ukraine 2014: Ideologie vs. Historiographie,” in: *Osteuropa*, 64, H. 9-10 (2014), 35–50.
111. Kuchinskaya, *The Politics of Invisibility*.



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Part III

**Traces of Exposure and
the Politics of Memory**



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8 Witnesses to Radioactive Contamination

Eva Castringius

Prologue

On the morning of the ninth, a man who suspected nothing had been leaning on this wall. And then the flash came. And at that moment, the wall was a glowing surface, and the man had turned to ash.

Unburned, by contrast, was the part of the wall that the man had covered in the last fraction of his last second. This piece was recorded by the flash photograph. As a negative. He had preserved this piece. He had preserved himself in this negative. For it is the only trace that has remained of his days on earth. And the only one that will remain of his days on earth.

What, then, will remain of us?¹

In this quotation from *Der Mann auf der Brücke: Tagebuch aus Hiroshima und Nagasaki* (The Man on the Bridge: Diary from Hiroshima and Nagasaki), the philosopher and writer Günther Anders is referring to a photograph that he found in the Atomic Bomb Museum in Nagasaki. The photograph shows the results of dropping the plutonium bomb “Fat Man” over Nagasaki on August 9, 1945, at 11:02 a.m.: A shadow is marked on a wall, showing the burned remnants of a human body. The dead are inscribed like shadows in their surroundings, thus depicting an enduring and determined state that in Günther Anders’s book becomes the epitome of the omnipresent threat of atomic extermination.² In the quotation above, the author establishes an analogy between the consequences of the explosion and the photograph. He compares the creation of a human silhouette with the technique of the photograph. The figure is projected onto the ground by a light source. In this case, the “negative” is produced by the atomic flash that left behind dramatic traces in Nagasaki.³

Photographic Traces

In *Camera Lucida*, the photograph of his deceased mother represents an important motivation for Roland Barthes to rethink photography: “The photograph is literally an emanation of the referent. From a real body, which

was there, proceed radiations which ultimately touch me, who am here; the duration of the transmission is insignificant; the photograph of the missing being [...] will touch me like the delayed rays of a star.”⁴ In his observations, he traces the appearance of his mother back to an “emanation” revealed in the photograph. Barthes employs the metaphor of the light ray that reproduces the “missing being” of his mother. The image of his mother in his memory is updated and represents a bridge from the past to the present.⁵

Much like Roland Barthes, in their reflections on the theory of the photograph, various authors have described the photographic image as the result of the *imprint* of the object and thus immediately connect the trace to the photographic process.⁶ They advocate the view that the material relationship of object and support clarifies the essence of photography. The production of traces is regarded as the true photographic process.

Clearly, the photographic traces described leave something enduring behind, which becomes the indicator or index. The media theorist Marry Anne Doane sums it up accordingly: “The footprint, the weathercock, the photographic image—all testify to the fact that the referent was present and left its legible trace directly in the representation.”⁷

Especially in the context of radioactive radiation, this trace paradigm takes on new weight. The author and artist Susan Schuppli underscores the film material’s *testimony* by means of the radioactive ray contracting the film negative. She uses the term “material witness” and says of it: “the violence out of which the image emerges is directly encoded in the image as the very means by which it comes into the world.”⁸ Elsewhere, in connection with the history of the nuclear era, she writes: “the radiological contact print is immanent to and continuous with the event.”⁹ For Schuppli, the images of the first test of an atomic bomb in the New Mexico desert on July 16, 1945, already contain later international tests of atomic bombs as well as nuclear accidents such as Three Mile Island, Chernobyl, and Fukushima.

Testimonies to the Material

These so-called indexical¹⁰ properties of photography as a medium of the imprint or trace are well suited to the manifestation of the electromagnetic tradition in general and radioactive radiation in particular. Early discourses on photography already show the close connection between the photographic image and its materiality. In the case of William Henry Fox Talbot, in his *Pencil of Nature* of 1844, it is the sun that is depicted on the photographic plate. In the case of the physicist Henri Becquerel in 1897, it is uranium salts inscribing their radioactivity.¹¹

Unlike the light ray, radioactive radiation is invisible to the naked eye. It is manifested in the photographic negative as overexposure,¹² and depending on the photographic technique, it depicts itself. The chemical emulsion of the film of the negative reacts to the radioactive radiation, making its presence visible. In documentary photography, which depicts social, cultural, and

historical events, radioactive radiation has a disruptive effect in that it overwrites the representational information to the point of unrecognizability.

When referential and indexical pictorial elements are depicted simultaneously, a hybrid image results from a “mixed form of radiation.” The light that reaches the film through the lens, which is responsible for reproducing the motif, is joined by the radioactive radiation that has found its way into the camera’s casing. The radioactive radiation depicts itself and is not intended by the photographer. Only in the action of observation does it become the indicator of contamination and interpretable as a potential danger. The section “Radiation of August 6, 1945” cites the photographer Yoshito Matsushige, whose nuclear reality in Hiroshima¹³ is complemented in the section “Radiation of April 26, 1986” by the photographs of Igor Kostin,¹⁴ in which the radioactive threat of the Chernobyl accident becomes visible.

Radioactive radiation is revealed more directly in the camera-less photographic technique of autoradiography. In this method, the photographer brings the radioactive object in direct contact with the radiation-sensitive emulsion of the photographic negative, which depicts itself on the film without light. This was originally a practice from scientific photography to document radioactive materials and is also used as a standard method for showing macromolecules that have been radioactively marked. In the sections “Radiation of July 16, 1945” and “Radiation of March 11, 2011,” two photographers are mentioned who have adopted this process in order to document radioactivity: the photojournalist Fritz Goro and the artist Shimpei Takeda. Whereas the intention of the former is to illustrate the radioactive effects of the first plutonium bomb in *Life* magazine, the artistic practice of the latter is a search for clues about the Fukushima accident.

In all four examples, the energy unleashed leaves behind its traces. At the time they are taken, the photographs become silent witnesses of contamination. The images of nuclear tests and sites of catastrophes such as Hiroshima, Chernobyl, New Mexico (Trinity test), and Fukushima should be understood together with the photographers in question as *double testimonies*.

Radiation of August 6, 1945 (Yoshito Matsushige)

The photographs of Yoshito Matsushige (1913–2005) were taken a few hours after the atomic bomb exploded in Hiroshima. The photographer was located around three kilometers from the hypocenter and took just five pictures.¹⁵ Matsushige was working as a reporter for the daily newspaper *Chugoku Shinbun* in the Hiroshima region and also took photographs for the regional information service of the general staff of the ground forces. His work was extremely regulated; for example, he was not permitted to capture or show corpses or the severely injured.

Immediately after the explosion, he headed toward the military offices and had with him his 6 × 6 cm Mamiya camera with a total of 24 exposures (two rolls of black-and-white film, 100 ASA). On his way there, he tried to photograph the



Figure 8.1 Yoshito Matsushige, Hiroshima, August 6, 1945, first of five photographs taken by Matsushige on the day the A-bomb destroyed Hiroshima.

Source: Atomic Photographers Guild. Courtesy of Robert Del Tredici.

destruction of the surroundings, although he had not been officially tasked with doing so. Shortly after 11 a.m., he took his first photograph at Miyuki-bashi Bridge ([Figure 8.1](#)). It was taken about 2 km from the hypocenter.

He was almost paralyzed by the horrors and was barely able to press the shutter release: “Injured people were everywhere. Both sidewalks of the bridge were crowded with dead and suffering victims. When I saw them, I realized I had to take a picture, and I tried to push the shutter, but I couldn’t. It was so terrible. These people were pathetic. I had to wait. Most of the people were students, children.”¹⁶

In the photograph ([Figure 8.1](#)), the Senda-cho police station is seen, in front of which soldiers are providing medical aid, administering oil for burns that has itself become hot. The injured are mostly female students from the Hiroshima Girls’ Commercial High School and the Hiroshima Prefecture Daiichi Middle School, who had been mobilized to create a firebreak in the case of a bombing attack.

Matsushige's photograph is faithful to the original, not cropped. The black edge indicates that it was a full-format image. Defects of the image are clearly visible,¹⁷ showing that the material of the negative must have been badly affected by external conditions. In the view of the art historian Michael Lucken, these images¹⁸ do not fundamentally differ from ordinary propaganda photography, which is essentially distinguished by having to uphold the state-decreed, heroic doctrine of the gaze. Thus, Lucken writes: "One can therefore say that the photographs he took do not show the catastrophe, but rather that they depict in a new order of things the trace of the rules that were previously relevant for him."¹⁹

Indeed, the full extent of the catastrophe is not conveyed by the motif, since the people in the images have already been helped, which was intended to suggest that the Japanese military had brought the situation "under control." Nevertheless, the actual uncontrollability of the situation – in this surprising first atomic bomb attack – is evident, since it is conveyed quite fundamentally by the flawed elements of the picture: the streaks, dots, splashes, areas out of focus, and cloud-like overexposures.

In an interview by the artist and photographer Robert del Tredici,²⁰ Matsushige describes his situation as follows: "I went into the field holding my wife's hand, but I couldn't see her face because of the blast and the uranium dust. Everywhere there was dust; it made a grayish darkness over everything."²¹ Matsushige's description of the radioactive fallout to which he and his wife were exposed and his time spent near the hypocenter makes it distressingly clear how much he was physically exposed to the toxic radiation. Though he ultimately says little about the health consequences he suffered, he offers clear comments on the damaged state of the negatives, which were restored in the 1970s.

The author Greg Mitchell points out that Matsushige developed his photographs in the toxic environment shortly after taking them: "When he was done he returned to his home and developed the pictures in the most primitive way, since every dark room in the city, including his own, had been destroyed."²² This opens up speculation about whether the primitive situation under which they were developed was the cause of the visible defects.²³

It is, in any case, clear that the invisible danger is implemented, in a sense, in the message of the photographs by the various indexical overwritings in the images. The events during which they were taken and the circumstances under which they were developed are encoded in the material, which both endures within and testifies to the catastrophe.

Radiation of April 26, 1986 (Igor Kostin)

The photographer Igor Kostin worked for the Soviet news agency Novosti (Agenstvo Pechati Novosti, APN). Shortly after the catastrophe in Chernobyl on April 26, 1986, Kostin documented the damaged nuclear power plant, of which the fourth reactor was completely destroyed in the explosion. He had been called that night by a friend who was a helicopter pilot and



Figure 8.2 Igor Kostin, Aerial photograph of the Chernobyl power plant, April 26, 1986.

Source: Picture-Alliance/dpa.

who offered to fly him there to photograph the results of the explosion at the nuclear power plant. As he approached the plant, he noticed the hectic activity of military vehicles and, briefly thereafter, the gaping hole in Reactor 4 caused by the explosion, which had ripped away the reinforced-concrete slab that weighed 3,000 mt. At the base of the ruins, he recognized the melting, reddish core of the reactor. From the helicopter, which was protected by a lead floor, he photographed the ruins of the reactor. Despite the warning about the high radiation, he opened the window, later describing his experience with the radioactive radiation on the day of the explosion as follows:

I stopped myself from coughing and pointed my lens towards the ground. I made my first shots, about twenty of them. Suddenly, my camera locked. [...] In Kiev, while developing it, the film was covered with an opaque surface. Almost all the photographs are entirely black, as if the camera had been opened in full light and exposed. I did not understand it then, but it was due to the radioactivity. [...] Only the first photographs seemed less damaged. Undoubtedly, they had been protected by the roll casing. Struggling with the film, I ended up obtaining an acceptable photograph that I sent to Moscow, to the Novosti agency main office. It was not published.²⁴

This aerial photograph of the Chernobyl power plant from April 26, 1986, has been described as Kostin's only usable photograph from the day of the accident, and its graininess can be attributed to the extremely high level of radiation at the site (Figure 8.2).²⁵ The Soviet regime kept the catastrophe secret for the first days. On May 5, Kostin received official permission from his agency to take photographs, but these photographs were not published initially. Instead, officials downplayed, passed over in silence, and intentionally misrepresented the danger the catastrophe posed.²⁶

Another photograph shows seven workers doing removal work on the roof of Reactor 3 (Figure 8.3). Kostin, who had difficulties gaining access to Reactor 4, got onto the roof of Block 3 under the authority of



Figure 8.3 Igor Kostin, liquidators cleaning up on the roof of Reactor 3.

Source: Atomic Photographers Guild.

Alexander Yurchenko, the head of the dosimetrists, a group of 18 workers who were examining the ruins and recording their radioactivity. They called themselves the “Roof Cats” and knew every corner of the ruin. Kostin was thus moved from the roof of Reactor 3, which had to be cleaned of the highly radioactive rubble, to Block 4, a much less dangerous place from which he could document the cleanup work. He photographed the so-called liquidators who had roughly forty seconds to throw one or two loads of radioactive trash into the open hole of Block 4. The maximum whole-body dose has been set at 25 roentgens by the military radiation protection standard.²⁷ The workers on the roof of Reactor 3 were exposed to much higher levels of radiation, namely, as many as 10,000 roentgens per hour.²⁸

Kostin, too, was a victim of high radioactivity as he took pictures on the roof. The white areas of overexposure on the lower edge of the photograph in [Figure 8.3](#) are commented on as follows in *Chernobyl: Confessions of a Reporter*: “The cameras of Igor Kostin were not spared. The radiation attacked the film, forming white stripes along the length of the images. These shots cost him two Nikons.”²⁹ Apparently, the radiation reached the film through the casing of the camera, since it is considerably more difficult for radiation to pass through the glass of the lens. The catastrophe depicts itself, as it were, in this stripe-like overexposure. The men dressed in protective clothing move through the fog that flickers flame-like on the lower edge and stands out against the sad and gloomy backdrop of the ruin. The graininess of the high contrast shot merges with the bright shimmering of the black-and-white scenery. Clearly, the radioactive radiation has *inscribed itself* into the film. It is added to the documentary photograph in a way that contributes to the picture and becomes part of its message. This results in a narration that becomes intelligible through the situation that created it. This pictorial hybrid consists of two sorts of radiation, both of which are depicted on the photosensitive film.

In an interview by the filmmaker Alexander Kluge, Kostin mentioned that he had increased the contrast of the photograph to make the traces of the radioactivity stand out more intensely.³⁰ By doing so, Kostin reinforced the impression of danger and, accordingly, the message to the viewer. Kostin’s increasing of the contrast – a process that standards for photojournalism interpret as an acceptable correction of the image – is used as a way of amplifying the message. He made his construction of reality more intense by using a format of reporting that emphasizes the photographer’s subjective look at the catastrophe. Kostin felt obliged to use his photographs to warn against other catastrophes of this kind.³¹ To that end, he exposed himself to great health risks and suffered from radiation sickness. With his camera, he followed the cleanup work and the construction of the “sarcophagus,” having documented over the years the psychological and physical damage to the workers and the local population.³²

Pictorial Interference and Unintentional Recording of Radiation

The art and photography historian Peter Geimer coined the term “Bildstörung” (pictorial interference), which he discussed in detail in his text “Was ist kein Bild? Zur Störung der Verweisung” (What is not a Picture? On the Interference of Reference).³³ Geimer has drawn attention to, among other things, Josef Maria Eder’s *Ausführliches Handbuch der Photographie* (Detailed Handbook on Photography),³⁴ which discusses unintentional pictorial effects that originate in chemically or physically flawed processes of exposure and photo developing. In his work, Geimer concludes that “the conspicuousness and urgency of the unusable by no mean represent a deficient mode. For precisely when the material beings to interfere, precisely when it interrupts, contaminates, or paralyzes the transmission, it demonstrates the conditions of the possibility of photography.”³⁵ Geimer sees a particular potential in interferences with the process of photographic depiction. He emphasizes the haphazard quality of pictorial interferences that cannot be produced consciously: “once one has become familiar with certain interferences, one can take them into account in the future. Simulated in experiments, observed, named, and compared, they lost their status of the unexpected and became calculable quantities.”³⁶

The seemingly flawed effects on Matsushige’s film negatives correspond to the pictorial interferences described by Geimer and thus have a random quality. The same is true of Kostin’s photographs, though he intensified the visual effect of the radioactive trace (see [Figure 8.3](#)) by increasing the contrasts and thus intensifying the message of the image.

In the case of both photographers, the effects of interference are, on the one hand, unintentional and are associated with a loss of visual information; on the other hand, they point to new information about the authentic situation of the taking of the pictures. The works of both Matsushige and Kostin indirectly show the difficult circumstances under which the photographs were taken. Kostin even speaks of the film being covered in a black, impenetrable layer even after the photographs were taken.

The random quality still found in Matsushige and Kostin becomes a calculable quantity for two other photographers. Seen in that way, the concept of pictorial interference is undermined by the photographers to be discussed next: Fritz Goro and Shimpei Takeda. They take a different approach and provoke these effects largely intentionally by exposing the film with the radioactive object. In these so-called autoradiographs, the object depicts itself on the photosensitive layer with its own radiation without the use of light.

Radiation of July 16, 1945 (Fritz Goro)

Life magazine of September 24, 1945 displays images by the photographer Fritz Goro (1901–1986). Fritz Goro was a German-Jewish émigré who fled to New York with his family in 1933 and continued his career as an art and

science photographer by working for *Life* and other magazines. The article was titled “New Mexico’s Atomic Bomb Crater” and reported on the Trinity test site some two months after the explosion of the first atomic bomb³⁷ near Alamogordo in New Mexico.³⁸ The Trinity crater, which Goro photographed from the air, was described as a “dark scar”³⁹ in the Jornada del Muerto Desert with the panorama of the Sierra Oscura. He supplemented this sublime perspective with spectacular closeups of the soil, which had melted into a glass-like material. Goro used this so-called trinitite for his autoradiography (Figure 8.4). He covered the negative with melted crater

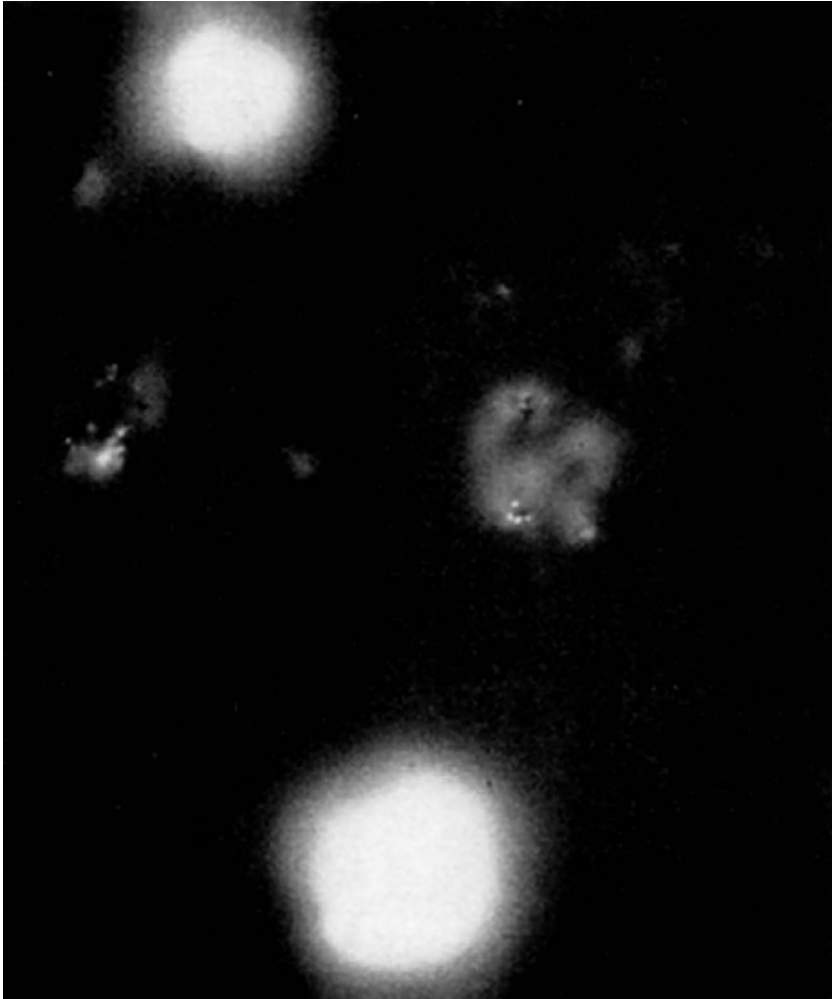


Figure 8.4 Fritz Goro, Trinitite autoradiography.

Source: *Life* 19, no. 13 (September 24, 1945): 27, Fritz Goro/LIFE Picture Collection/Shutterstock.

sand. Overnight, dark dots appeared on the negative that prove that the crater was radioactive.

Goro's photographs testify to his participation in an exclusive press reception at the Trinity test site, guided by General Leslie R. Groves and Dr. J. Robert Oppenheimer. The article states that the reporters were supposed to investigate a "weird question."⁴⁰ The reference was to a statement "of the Japanese" that the cities of Hiroshima and Nagasaki were in part highly radioactively contaminated. Rescue workers in Hiroshima and Nagasaki were said to have died from radioactive radiation, even though they had not been in either city at the time of the explosions.

Contrary to his knowledge at the time about the effects of radiation,⁴¹ Groves asserts that "the Japanese" were wrong and cites as a comparison the Trinity atomic test. The soil at Trinity is described as "not fatally radioactive," even though the bomb was detonated only about 30 m above the ground. With the radioactivity estimated at the crater, it was calculated that six hundred hours spent at the site would have meant certain death. Groves emphasizes that the altitude of the explosion of the bomb is responsible for radioactive contamination. In Hiroshima and Nagasaki, as Groves argued, the bombs were detonated at an altitude of 500 and 600 m, respectively. Hence, he claimed, the radioactivity was carried away by hot air and did not reach the ground. Groves describes the contamination as harmless because of the low altitude of the detonation at the Trinity test site (roughly 30 m above the ground) and likewise in Nagasaki and Hiroshima. His specious argument makes it clear that he wanted to emphasize the successful detonation of the "Gadget" and not the long-term risks of radioactivity. He denies the danger so that he and the US government need not admit their guilt.

Not coincidentally, no illustrations were published to indicate the devastating effects of the bombs in Japan. Instead, the article was supplemented by an eyewitness report: "Nagasaki was the Climax of the New Mexico Test."⁴² Its author was William L. Laurence, who had watched the dropping of the atomic bomb over Nagasaki from an escort plane. Laurence was a journalist for the *New York Times* and also worked as a science journalist for the *Physical Review*. In April 1945, he was appointed by General Groves as the official historian of the Manhattan Project and was the only journalist allowed to take part in the Trinity test. "Atomic Bill," as his colleagues at the *New York Times* called him, already indicated in the headline of his article that the plutonium bomb had been tested in the New Mexico desert in order to drop it over Japan.

Goro's aerial photograph of the Trinity site was given the following caption: "The first atomic bomb's crater is a great green blossom in the desert near Alamogordo. The lighter splash around the dark center, which was made when the explosion's heat melted the desert sand, is a layer of glass 2,400 feet across."⁴³ The trinitite, which as green glass shined like a "blossom" in the desert, was fascinating because it had been formed "by a blast of heat greater than the temperature at the surface of the sun."⁴⁴ The local situation can be

seen in the other photographs by Goro. The area had to be accessed by an airtight, lead-sealed tank; protective clothing and radiometers were employed. The infrastructure of the former test site was seriously damaged by the explosion or burned by the extremely high heat.

Radioactive radiation became a lasting feature of the affected surroundings. Goro made it visible using autoradiography (Figure 8.4). He placed pieces of trinitite on negative material overnight, without admitting any light, so that the radioactive radiation of the melted glass exposed the photographic material. An abstract-looking visual world resulted. Two large points of light look auratic in the infinite darkness of this supposed macrocosm and are brought back by means of the surface pattern recognizable in closeups of several pieces of trinitite. The intense radiation of the material partially overexposed the negative. As a comparison, another photograph shows the trinitite under light (Figure 8.5). Thanks to this reference image,⁴⁵ the observer receives an impression of the object in Goro's photograph.

Goro's autoradiograph not only shows the radioactivity on site but also demonstrates the enduring intensity of the radiation.



Figure 8.5 Fritz Goro, Trinitite, 1945.

Source: Goro Studio, New York. Courtesy of Thomas J. F. Goreau.

Although the danger of radioactivity had been little studied, the risks were known but nevertheless deemed acceptable. Goro's grandchildren note in their book *On the Nature of Things*: "Amazingly, the top brass of the Manhattan Project—and Goro—had been exposed to radiation at levels that would now be impermissible because of the risk of cancer. Atom bombs had been dropped on densely populated Hiroshima and Nagasaki without any real knowledge of the biological effects of radioactivity."⁴⁶ At the latest, after the bombs were dropped on Hiroshima and Nagasaki, American scientists began to systematically study the effects of radiation on living creatures.

It is unlikely that Goro was aware of the full extent of the political explosiveness of his autoradiographs of trinitite. He continued to employ the technology of autoradiography, for example, when he photographed the El Dorado Mine in the Northwest Territories of Canada for *Life* in 1946,⁴⁷ which had been the source of the uranium for the Manhattan Project. Taking up the thread of his images of the Trinity site, Goro has employed the same photographic process for the pitch blende (Figure 8.6).⁴⁸ He placed the stone on the film, whereupon it depicted itself by means of radiation.

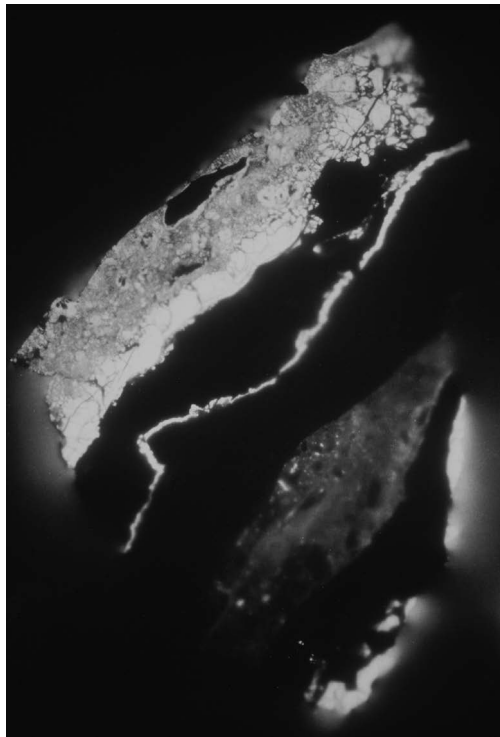


Figure 8.6 Fritz Goro, Uranium ore veins (autoradiography), 1946.

Source: Goro Studio, New York. Courtesy of Thomas J. F. Goreau.

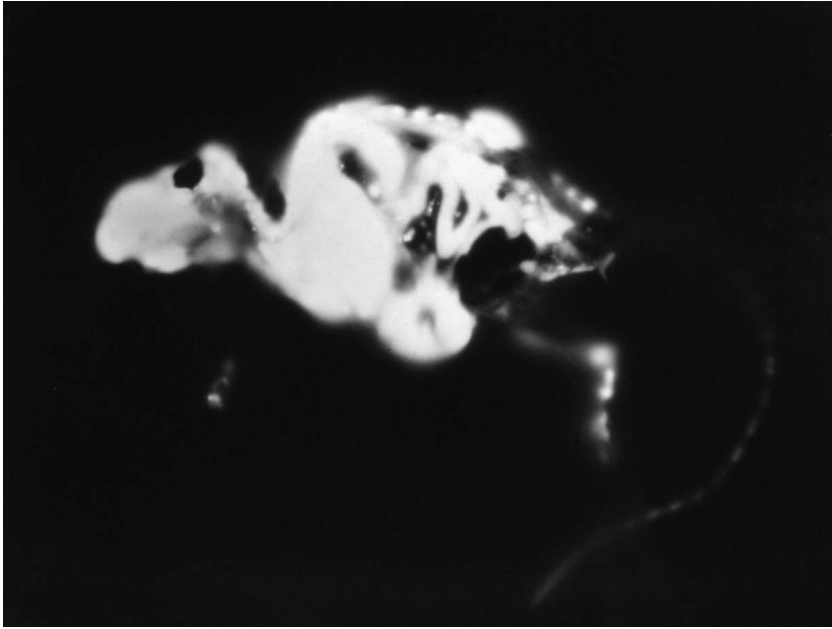


Figure 8.7 Fritz Goro, Rat (autoradiography), 1946.

Source: Goro Studio, New York. Courtesy of Thomas J. F. Goreau.

Goro was also officially commissioned to document the Operation Crossroads series of atomic bomb tests in 1946, the two Pacific tests Able (atmospheric test) and Baker (underwater test) located at the lagoon of Bikini Atoll. Goro photographed the preparations, and test and its effects. He also photographed test animals kept on the target ships.⁴⁹ For example, for one photograph, he placed a dissected, radioactively contaminated rat on the photo negative (Figure 8.7). The rat's organs were so badly contaminated that it exposed the photosensitive material beneath it.

In the illustrated report *Operation Crossroads: Official Pictorial Record* (1946), the autoradiograph *Surgeon Fish* (Figure 8.8) is included, together with other photographs by Goro. It was taken as part of the studies of the biological effects of radioactive radiation on marine flora and fauna in which Goro had participated.⁵⁰

The fish, the stomach of which is filled with calcium algae enriched with strontium 90, is described in the report as an example of the “elemental life form,”⁵¹ which absorbs the radioactive isotope from food throughout its body over an extended time before it dies of it.⁵²

Susan Schuppli summarizes that the “radiological contact prints”⁵³ of the nuclear test series Operation Crossroads represent a “counter-archive” to the numerous depictions of atomic mushroom clouds: “While the image-rapture

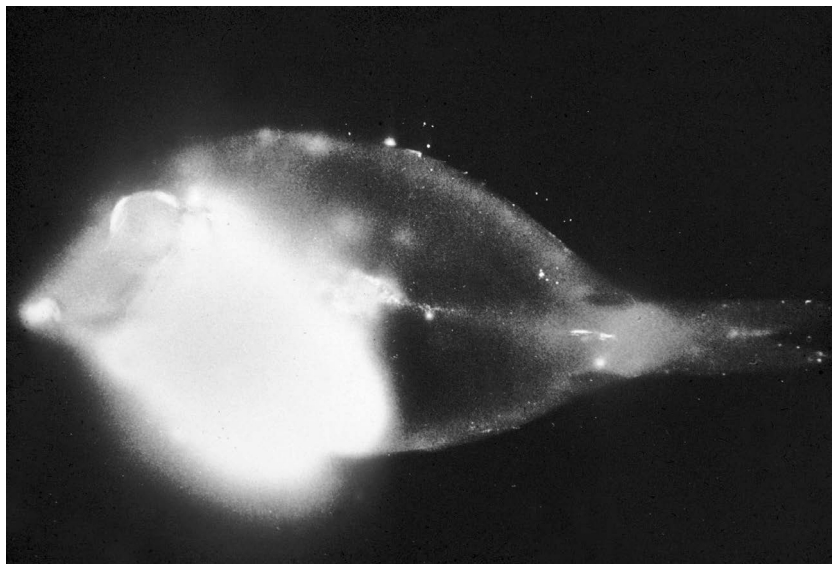


Figure 8.8 Fritz W. Goro, Surgeon fish (autoradiography), 1946.

Source: Goro Studio, New York. Courtesy of Thomas J. F. Goreau.

induced by the lethal combustion of atomic energy has tended to occlude the morality that circumscribes the unleashing of such large-scale bio-chemical testing, the mushroom cloud finds its counter-archive within the radiological contact print.”⁵⁴ The “counter-archive” mentioned by Schuppli is closed off to glorification of the atomic bomb as symbolized by the image of the mushroom cloud and counters it with the risks of biochemical testing on a large scale.

Radiation of March 11, 2011 (Shimpei Takeda)

The artist Shimpei Takeda describes his long-term project *Trace: Cameraless Records of Radioactive Contamination* as a “physically direct record”⁵⁵ of what is for him the worst nuclear disaster in the history of humankind. In doing so, he addresses the specific approach of his work: he does not depict the disaster naturalistically, but rather in a “physically direct” way, using the technique of autoradiography, that is to say, the indexical qualities of photography.

Takeda’s work refers to the radioactivity released by the Fukushima Daiichi atomic power plant on March 11, 2011, which was heavily damaged by the Tōhoku earthquake and the resulting tsunami.⁵⁶

In late 2011, the artist began to measure the radioactivity of the soil and air in 16 different locations within a radius of about 300 km.⁵⁷ He collected soil samples at significant historical and cultural sites, for example, near temples,

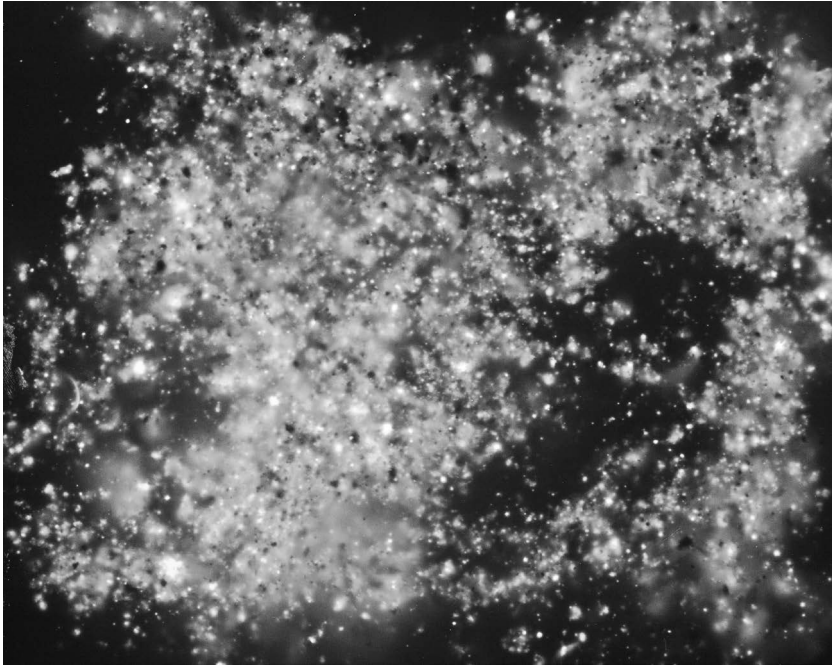


Figure 8.9 Shimpei Takeda, Trace #16, Lake Hayama/Mano Dam (Iitate, Fukushima) from the series Trace, gelatin silver print 20 × 24 in. (50.8 × 61 cm), 2012.

Source: Courtesy of the artist.

shrines, battlegrounds, castle ruins, and his native town. He placed these radioactive soil samples on sheets of eight-by-ten-inch negative film and kept them in a lightproof container for a month. The samples gave off radioactivity, and the photosensitive layer of the negatives reacted to it,⁵⁸ after which he then printed the negatives on large-format photographic paper ([Figure 8.9](#)).

In an interview by Friends of the Pleistocene (FOP),⁵⁹ Takeda emphasizes the artistic-conceptual background of such camera-less photographs, which, much like Goro's autoradiographs, bear witness to catastrophe, saying: "Certainly it goes beyond a photography project. It is more of a scientific documentation of the disaster, which is still ongoing. Using radioactive particles in the soil, exposing them to photo paper or film, that process is more like a science experiment. [...] At the same time, there is a little room for artistic decisions that I can make. Such as the choice of soil as the material I use, the length of the film's exposure, or places that I collect the soil. But I have tried to not over-control the project and let it become more of a representation of how things are on their own."⁶⁰

The fallout of Fukushima, which spread far in the Japanese landscape, exposed the layers of film in his studio. The prints have white dots and streaks

that are depicted on the photo paper in cloud-like density depending on the strength of the radioactivity. The artist controls the “physically direct record”⁶¹ and considers the textures of the soil samples from aesthetic perspectives. To that end, he uses mosses, which are famous for storing radioactive nuclides with particular efficiency.⁶² In Takeda’s work, they leave concise traces behind on the paper. The chemical limits of the photographic material limit the exposure time, and it is up to the artist’s aesthetic assessment to stop the exposure process.

Takeda, who had expanded his collecting activity to five prefectures, preferred to take soil samples in locations marked by their spiritual context.⁶³ He felt a connection to the souls of his ancestors who lived there: “So I added this element, the memory of precious ancestors’ souls by selecting specific locations.”⁶⁴

Using the technique of autoradiography, Takeda seems to approach spiritual phenomena as well. This recalls an early chapter in the history of photography in which the goal was to use photographic processes to make paranormal phenomena, such as fluids, energy currents, and ghosts, visible.⁶⁵ Takeda, however, contradicts the possibility of seeing deceased relatives in the photographs of *Trace* but recognizes it as a component of the production process. His works may also be characterized by their closeness to Japanese Shinto philosophy, where the point is to focus attention on the energy of objects with souls. He remarks on this: “Growing up in Japan automatically means I have a relationship to Shinto to some degree, so animism is always somewhere in my mind.”⁶⁶ In his catalog on the photo series, Takeda speaks of the digging of soil samples in Fukushima feeling like the collection of the ashes of a deceased person.⁶⁷

In Takeda’s artistic concept, which focuses very strongly on the process of image production, the indexical qualities of photography play a crucial role. At the same time, his own contact with the landscape, which for him is composed of personal, historical, cultural, and spiritual aspects, relates to the performative implementation. His search for clues and contact to things has an indexical quality and finds its pendant in the indexical quality of the photographic process. For him, the index truly becomes an artistic method.

Epilogue (Making Visible)

In Günther Anders’s text *Der Mann auf der Brücke*, it is the shadows in Nagasaki that point to the dead of the destructive atomic devastation of Nagasaki. “For witnesses [...] will not be found. Only other silhouettes on other walls.”⁶⁸

In the photographic examples discussed above, the contamination caused by the events of Hiroshima, Chernobyl, New Mexico (Trinity test), and Fukushima are made visible in the first place by photography. The radioactive radiation inscribes itself as a trace on the photographic negative and fades out or erases the representational information. Hybrid forms of representation (Kostin and Matsushige) move within the area of tension between

imaging and image-interfering depiction. In the camera-less autoradiograph, the radioactive radiation forms on the negative in a situation produced by the photograph but with only limited control. In the scientific and the artistic contexts (Goro and Takeda), different criteria of assessments are employed in the autoradiographs, which are found again in the interpretation of the depiction according to the professional background and individual questions posed.

The photographs of all four photographers obtain a particular urgency by referring indexically to the resulting damage of the nuclear explosion in each case and testify to it on the material level. In Roland Barthes, the photographed object shines like “the delayed rays of a star”⁶⁹ from the photograph and connects to his persona as “a sort of umbilical cord.”⁷⁰ With these metaphors, he establishes a material connection between him as viewer and the photograph, which results in an updating of the past. Applied to the cited photographic examples and their traces of contamination, in each case, the photographed nuclear catastrophes obtain a dangerous contemporaneity.

Translated from German by Steven Lindberg

Notes

1. Günther Anders, *Der Mann auf der Brücke: Tagebuch aus Hiroshima und Nagasaki* (Berlin: Union, 1965), 148.
2. See Günther Anders, *Die Antiquiertheit des Menschen* (Munich: C. H. Beck, 1961), 233ff.
3. See Michael Lucken, “Hiroshima—Nagasaki: Des photographies pour abscisse et ordonnée,” in *Études photographiques*, no. 18 (May 2006): 4–25, esp. 6. The author refers to the connections between atomic bombs and photographs, and to the correspondences between “the shadow of Hiroshima and Nagasaki” and the metaphors of the past and death in the photographic process.
4. Roland Barthes, *Camera Lucida*, trans. Richard Howard (New York, NY: Hill and Wang, 1982), 80–81.
5. In Barthes, the photographic trace is immediately connected to the photographic process: “For the noeme ‘That-has-been’ was possible only on the day when a scientific circumstance (the discovery that silver halogens were sensitive to light) made it possible to recover and print directly the luminous rays emitted by a variously lighted object.” Barthes, *Camera Lucida*, 80.
6. They include Charles Sanders Peirce, André Bazin, Roland Barthes, Susan Sontag, Rosalind Krauss, Philippe Dubois, Marry Anne Doane, and William J.T. Mitchell; see Peter Geimer, “Das Bild als Spur: Mutmassungen über ein untotes Paradigma,” in Gernot Grube, Sybille Krämer, and Werner Kogge, eds., *Spur: Spurenlesen als Orientierungstechnik und Wissenskunst* (Frankfurt am Main: Suhrkamp, 2007), 95–120.
7. Mary Ann Doane, *The Emergence of Cinematic Time: Modernity, Contingency, the Archive* (Cambridge, MA: Harvard University Press, 2002), 70.
8. Susan Schuppli, “Radical Contact Prints,” *Camera Atomica*, ed. John O’Brian, exh. cat. (Toronto, ON: Art Gallery of Ontario, 2015), 277–291, esp. 281.
9. Susan Schuppli, “Radical Contact Prints,” 281.
10. In this text, the index is equated with the physical relationship of the referent/object to its sign/representamen. The concept of the index goes back to Charles S. Peirce’s semiotics. Peirce calls the physical reference of a representamen to its referent “indexical” and emphasizes the causal connection between sign and object.

11. See Carolin Artz, *Indizieren—Visualisieren: Über die fotografische Aufzeichnung von Strahlen* (Berlin: Kadmos, 2011), 110–120.
12. In order to verify it, it helps to reconstruct the history of the making of the photography, since it could also be overexposure by light rays.
13. In Matsushige's photographs of Hiroshima, I assume that the hybrid form of inscription can be traced back to radioactivity and adjusting the visual features to the story of the making of the photographs: Matsushige was taking pictures near ground zero for several hours shortly after the explosion.
14. See [Figure 8.1](#), Yoshito Matsushige, Hiroshima, August 6, 1945, and [Figure 8.2](#), Igor Kostin, Aerial photograph of the Chernobyl power plant, April 26, 1968.
15. Of his five photographs in all, the first two were taken on the Miyuki-bashi Bridge, one of which was a closeup. The third shows the couple's personal surroundings: Ms. Matsushige searching for valuables in her destroyed hair stylist salon. The fourth is the view from the window of the salon toward the collapsed Nishi fire station. The final picture shows the policeman Tokuo Fujita wearing a head bandage and sitting at table where the victims are being handed certificates for bread ration tickets.
16. *Ibid.*, 188.
17. The concept of pictorial interference goes back to Peter Geimer, who interprets it as being between imaging and image-interfering. See Peter Geimer, "Was ist kein Bild? Zur 'Störung und Verweisung,'" in Peter Geimer, ed., *Ordnungen der Sichtbarkeit: Fotografie in Wissenschaft, Kunst und Technologie* (Frankfurt am Main: Suhrkamp, 2002), 313–341, esp. 313–326.
18. When the American occupation ended, (April 28, 1952), these images were published in the August 1952 issue of the journal *Asahi guraifu*. The magazine *Asahi guraifu* initially published Matsushige's photographs in a special edition on August 6, 1952. This edition was titled "First Exposé of A-Bomb Damage." This special edition sold out so quickly that four additional printings were run, replacing the original color cover with a black-and-white one. The total circulation of this special edition was approximately 700,000. *Life* magazine published Matsushige's photographs in the September 29, 1952, issue with the article "When Atom Bomb Struck—Uncensored."
19. Michael Lucken, "Von der Ordnung in der Zerstörung: Die japanischen Fotografien der Bombardierung Hiroshimas und Nagasakis," in *Atombilder: Ikonographie des Atoms in Wissenschaft und Öffentlichkeit des 20. Jahrhunderts*, ed. Deutsches Museum (Göttingen: Wallstein, 2009), 177–185, esp. 179.
20. Robert del Tredici is an artist, photographer, and teacher with a BA in philosophy, an MA in Comparative Literature (University of California, Berkeley), and an interest in the dynamic between image and text. In 1987, Robert del Tredici founded the Atomic Photographers Guild.
21. Quoted in Robert del Tredici, *At Work in the Fields of the Bomb* (New York, NY: Perennial, 1987), 187.
22. See Greg Mitchell: "Inscribing Hiroshima: The photography of Matsushige Yoshito," in *The Asia-Pacific Journal* 35 (2005): 1–3, <http://www.japanfocus.org/~Greg-Mitchell/1562/article.html>.
23. Greg Mitchell adds about the situation of developing the film: "Under a star-filled sky, with the landscape around him littered with collapsed homes and the center of Hiroshima still smoldering in the distance, he washed his film in a radiated creek and hung it out to dry on the burned branch of a tree"; Greg Mitchell, "Inscribing Hiroshima," 1–3.
24. Igor Kostin, *Chernobyl: Confessions of a Reporter*, trans. Ghada Karam (New York, NY: Umbrage, 2006), 9.
25. Igor Kostin, *Chernobyl*, 6.

26. Igor Kostin, *Chernobyl*, 9–10.
27. See Igor Kostin, *Chernobyl*, 71. Kostin cites the unit roentgen (R), which is no longer permitted today, having been replaced by the sievert (Sv) or the gray (Gy). One roentgen corresponds to one millisievert under the condition that is the biological effect of ionizing radiation or other photon radiation, such as gamma radiation. Hence, 25 roentgens would be a dose of 250 millisievert (mSv). By comparison, the Bundesamt für Strahlenschutz established an annual dose of 20 mSv for people professional exposed to radiation. On this, see <https://www.bfs.de/DE/themen/ion/strahlenschutz/grenzwerte/grenzwerte.html#Anker3>.
28. This would correspond to a radiation of 100,000 mSv/h.
29. Kostin, *Chernobyl*, 78–79.
30. See Alexander Kluge, *Die Wächter des Sarkophags: 10 Jahre Tschernobyl* (Hamburg: Rotbuch, 1996), 50.
31. See the interview by Christine Daum with Igor Kostin, in *Osteuropa* 56, no. 4, (2006): 57–62, esp. 62.
32. See Kostin, *Chernobyl*, 9.
33. See Geimer, “Was ist kein Bild?,” 313–341.
34. See Josef Maria Eder, *Ausführliches Handbuch der Photographie*, 3. Teil, vol. 1/2 (Halle: Wilhelm Knapp, 1930).
35. Peter Geimer, “Was ist kein Bild?,” 326.
36. Peter Geimer, “Was ist kein Bild?,” 326.
37. The Gadget, July 16, 1945.
38. See “New Mexico’s Atomic Bomb Crater,” *Life* 19, no. 13 (September 24, 1945): 27–30.
39. “New Mexico’s Atomic Bomb Crater.”
40. “New Mexico’s Atomic Bomb Crater,” 27.
41. Groves knew the report of the first test of the Gadget on May 7, 1945; he knew of the first accident in Los Alamos on August 21, 1945, after which a worker died on September 15, 1945, from the consequences of acute radiation exposure. See Jon Hunner, *Inventing Los Alamos: The Growth of an Atomic Community* (Norman, OK: University of Oklahoma Press, 2004), 84ff.
42. William L. Laurence, “Nagasaki was the Climax of the New Mexico Test,” *Life* 19, no. 13 (September 24, 1945): 27–31, esp. 30. This section of his text is based on his report “Eyewitness Account of Atomic Bomb over Nagasaki,” published by the Defense Department on September 9, 1945. William L. Laurence’s full report can be read at <http://www.atomicarchive.com/Docs/Hiroshima/Nagasaki.shtml>.
43. William L. Laurence, “Nagasaki,” 28.
44. William L. Laurence, “Nagasaki,” 27.
45. This is probably not the original object of the autoradiograph; rather, Goro arranged the pieces of trinitite for viewing.
46. Peter Thomas and Stefan Goreau, *On the Nature of Things: The Scientific Photography of Fritz Goro* (New York, NY: Aperture, 1993), 13.
47. See “Canada Mines Uranium in Arctic,” *Life* 20, no. 2 (January 14, 1946): 21–28.
48. Pitch blende from the Eldorado Mine was used to produce the plutonium for the Gadget (the name of the bomb in the Trinity test).
49. Laboratory animals such as pigs, goats, guinea pigs, rats, and mice were brought to Bikini Atoll aboard target ships and positioned on 22 ships of the target flotilla in order to expose them to the atomic weapon explosion and its radiation and pressure effects. The goal was to test their suitability and their ability to survive a nuclear conflict. They were placed in stations where the crew was also supposed to be in case of attack.
50. Thomas F. Goreau (Fritz Goro’s son) was a recognized marine biologist and coral reef expert. At the age of 46, he died of cancer that had been caused by radiation from his research work on Bikini Atoll. He came into contact with the

- contaminated water while diving for various species to be evaluated for scientific studies. See the article “In Memoriam: Dr. Nora Goreau, April 25, 1921–December 18, 2016 – Mother of Coral Reef Science,” <http://www.globalcoral.org/memoriam-dr-nora-goreau-april-25-1921-december-18-2016/>.
51. See caption “Inside the fish, a ‘hot’ supper,” in *Operation Crossroads: The Official Pictorial Records* (New York, NY: W. H. Wise, 1946), 216.
 52. Quoted in Robert del Tredici, *At Work in the Fields of the Bomb*, 187.
 53. Schuppli uses “radiological contact print” synonymously with “autoradiograph.”
 54. Schuppli, “Radical Contact Prints,” 280.
 55. Takeda describes *Trace* as a “physically direct record of the worst man-made nuclear accident in history.” See “Trace: An Interview with the Artist Shimpei Takeda, Friends of the Pleistocene.” 2012, <https://fopnews.wordpress.com/2012/10/08/trace-an-interview-with-artist-shimpei-takeda/>.
 56. The resulting nuclear catastrophe released more than twice as much radioactive material than Chernobyl and continues to contaminate air, soil, water, and food in the country and the surrounding ocean. Between 100,000 and 150,000 residents have left the immediate surroundings and hundreds of thousands of abandoned animals from agricultural businesses have died.
 57. Takeda has published the relevant values on his website: <http://www.shimpeitakeda.com/trace/locations/>.
 58. Photo emulsions are composed of gelatin with embedded halides, silver chloride, silver bromide, or silver iodide.
 59. Friends of The Pleistocene is an online project by smudge studio in collaboration with Elizabeth Ellsworth and Jamie Kruse. See notes 55 and 60.
 60. “Trace.”
 61. See note 55.
 62. See *Radionuklide im Waldökosystem*, Monographien 59 (Vienna: Bundeskanzleramt—Strahlenschutz; Bundesumweltamt Österreich, 2000).
 63. See Pat O’Malley, “Shimpei Takeda Makes Art Out of Radioactive Dirt,” *Vice*, June 28, 2013, https://www.vice.com/en_us/article/3b5xkj/shimpei-takeda-123.
 64. See O’Malley, “Shimpei Takeda Makes Art Out of Radioactive Dirt.”
 65. See Rolf H. Kraus, *Jenseits von Licht und Schatten: Die Rolle der Photographie bei bestimmten paranormalen Phänomenen—ein historischer Abriss* (Marburg: Jonas, 1992).
 66. Interviewer from the Friends of the Pleistocene: “Japanese aesthetics and philosophies often explore human awareness of the forces of ‘inanimate things.’” See “Trace.”
 67. *Shimpei Takeda: Trace*, exh. cat. (New York, NY: Shika, 2012).
 68. Anders, *Der Mann auf der Brücke*, 148.
 69. Barthes, *Camera Lucida*, 81.
 70. Barthes, *Camera Lucida*, 81.

9 **Fallout Memory Trajectories at Semipalatinsk**

Reassembling the Post-Soviet Past

Susanne Bauer

Located in a river park in Semey, formerly Semipalatinsk, an enormous monument is dedicated to the victims of nuclear testing. Reaching higher than the trees, the memorial titled “Stronger than Death” on the banks of the river Irtysh features a gigantic tombstone in anthracite color, with the silhouette of the mushroom cloud of a nuclear explosion; beneath the atomic mushroom is the sculpture of a woman shielding a child (Figure 9.1). With nuclear tests being part of Semipalatinsk’s formerly secret past and now public memory, residents of Semey city and surrounding settlements come here on weekends or for an afternoon stroll during summer, taking their pictures in front of the monument. Locals take their visitors to the memorial for sight-seeing, along with Semey’s museum of Dostoyevsky and the new suspension bridge across the river Irtysh built by a Japanese company in the 2000s, or the surrounding woods with the scent of pine trees and the historic burial sites in the wide-open steppe south of the city. Often this memorial is referred to as an achievement, given the weight and impact of the nuclear past as well as the overcoming of the economic crisis of the 1990s.

Built in 2001, the memorial “Stronger than Death” is an official, visible testimony to how the new Republic of Kazakhstan officially has positioned itself in relation to its Soviet nuclear past. The government commissioned two Kazakh artists to design it: Shota Valikhanov, a sculptor and architect who also supervised the creation of the independence monument on the Republic Square in Almaty (Alma-Ata during the Soviet time), and Zhandarbek Malibekov, the designer of the Kazakhstani national emblem. The memorial joins the new republic’s state symbols, many of which evoke the Kazakh past as one of Eurasian steppe nomads. Some date back to the 6th–5th century BC, the century of the “Golden Man” (“*zolotoi chelovek*”) found about 50 km east of Almaty in a Soviet archeological expedition in 1969–1970 and are today presented in a dedicated section of the Central Museum of Kazakhstan in Almaty. Foregrounding and linking “Kazakhness” back to the era of the Eastern Scythes is one example of how heritage representations in museums are crafting new accounts of deep Kazakh past.¹

The politics of state building also reached into the ways in which the aftermath and legacies of Soviet nuclear testing was dealt with. Closing down



Figure 9.1 Memorial “Stronger Than Death,” Semey, Kazakhstan.

Source: Photograph by Susanne Bauer (2011).

nuclear testing at the Semipalatinsk test site was an important moment for post-Soviet state building which President Nazarbayev seized in a strategic effort and proudly presented as host of the OSCE meeting in Astana in December 2010.² To leave behind the Cold War logic of “mutually asserted destruction,” the new independent Republic of Kazakhstan initiated a “Central Asian Nuclear-Weapon-Free Zone.”³ This was part of crafting a break with the Soviet past and nation building along with infrastructural changes, such as moving the capital from Almaty to then Tselinograd, renamed first Akmola and then Astana (capital in Kazakh) – today’s Nur-Sultan – and the promotion of Kazakh as official language in all domains, while keeping Russian as a language of communication between different national groups within Kazakhstan. The government promoted the Kazakh language while labeling Kazakhstan’s society as multiethnic and multireligious in the statutes of the new republic.

Most post-Soviet countries offered citizenship to all residents after the dissolution of the USSR independent of the entry of category “nationality” (“*natsional’nost*”) in their Soviet passports. Unlike other post-Soviet countries of central Asia, Kazakhstan kept distinguishing between “Kazakh” as a category for language and “*natsional’nost*” – and “Kazakhstani” for citizenship.⁴

The Russian-focused Soviet standard curricula in history and philosophy were replaced by new textbooks; university graduates had to pass exams on Kazakh history and philosophy.⁵ The Republic of Kazakhstan held on to the key categories of Soviet historiography, but exchanged most of its protagonists.⁶ For instance the annual commemoration of the many Central Asian veterans on May 8–9 is an important unifying continuity of the Soviet past, while the history curricula in institutions and programs in science and education were completely reorganized. Major reorientations in research policies affected not only the humanities but also the environmental health sciences – especially in relation to the Soviet nuclear program and its Central Asian sites. Long-term health effects of nuclear test fallout and residual radionuclides became subject to major research programs under the auspices of different ministries of the Republic of Kazakhstan, including the Ministry of Health, the Ministry of Education and their regional branches.⁷ For the neighboring Altai region, bordering the exposed areas to the northeast, the Russian Ministry of Emergency Situations set up a Federal Program “Semipalatinsk Test Site/Altai,” which included the compilation of health data, dose reconstruction, and an exposure registry for the rural population of Altai region settlements, exposed to fallout from nuclear testing.⁸

In her account of Soviet census-taking in the early USSR, historian Francine Hirsch shows how scientific programs, the statistics and routines they generate, play a key role in shaping states, political technologies, and historical narratives. State-funded scientific programs also perform and constitute broader collective cultural memory and technologies of memorialization.⁹ This chapter builds on studies of memorialization and Science and Technology Studies (STS) in order to broaden the concept of memorialization beyond its symbolic dimensions. In examining a specific set of scientific memory practices¹⁰ in radiation risk studies, I trace the specific memorialization work done through biomedical risk assessments during the early post-Soviet years (1991–2010). While this approach builds on and joins recent scholarship in atomic heritage studies,¹¹ it foregrounds technoscience studies of biomedical practices. Theorizing residual radionuclides in the environment and human bodies, it takes inspiration in Hannah Landecker’s notion of the “biology of history,” in terms of “understanding both the materiality of history and the historicity of matter in theories and concepts of life today.”¹²

I examine how, after the end of nuclear testing, risk assessment practices documented the nuclear past and its embodiments, especially with respect to transgenerational effects of fallout exposure. As techniques for tracing and scientific memory work, cytogenetics and population genetics had moved center stage in the atomic era, later on followed by standardized genomics-based techniques that came to constitute credible methods to document radiation effects in blood cells. By highlighting scientific practices as a particular mode of memory work, this chapter focuses on the production of radiation knowledge. I investigate how the post-Soviet reassembling¹³ of

legacies combined with new scientific developments shaped specific versions of risk assessment and nuclearity.¹⁴ I will first address the role of the nuclear weapons program in post-Soviet Kazakhstan, followed by an examination of three scales of memory practices, which biomedical scientists have brought to work in order to document radiation effects. Thus, this chapter traces the ways in which environmental effects materialize at different scales and through biomedical concepts of life – chromosomal, transgenerational, and populational – as they are mobilized in the meticulous labor and memory practices in radiation science.

Post-Soviet Reassembling: Retrieval and Containment of the Cold War Nuclear

As part of the secret atomic program, Soviet authorities had decided to place the USSR's first nuclear weapons test site in the steppe area near Semipalatinsk, in the northeast of Kazakhstan. The area is situated south of the Altai region in today's Russian Federation, and not far from the border to the Xinjiang region of China.¹⁵ In 1947 construction works for a closed nuclear city at the shores of the river Irtysh began, as a key step of the nuclear program at the dawn of the Cold War. At the command of Lavrentii Beria on August 29, 1949, the first Soviet nuclear bomb (22 kt TNT eq.) was detonated at the test site, under vast political pressure, during unfavorable weather conditions.¹⁶ This first nuclear explosion in 1949 led to fallout reaching to settlements northeast of the test site and into parts of the Altai region, up to the city of Biisk, as aerial surveys showed.¹⁷ Following the first Soviet nuclear test, military aircraft conducted measurements of the fallout and the radioactive cloud; in western countries, the detonation was detected on seismographic monitoring instruments. Under secrecy yet witnessed by largely ignored local communities,¹⁸ nuclear weapons testing amounted to an official total of 456 nuclear detonations between 1949 and 1989, according to numbers published by Russian authorities.¹⁹ Official sources counted 116 above ground nuclear explosions at the Semipalatinsk test site. This included the first Soviet hydrogen bomb on August 12, 1953, with a yield of 400 kt TNT eq., the most massive detonation conducted at Semipalatinsk. Atmospheric nuclear testing continued until 1963 and, as a result of the first moratorium of the Limited Nuclear Test Ban Treaty, nuclear testing proceeded with underground nuclear devices from 1965 through to 1989, before the test site was closed in 1991. Due to the sheer impossibility to take the complex formation of the exposure situation into account, Kazakhstani dosimetrists would begin their assessments by focusing on the most dose-contributing nuclear tests.

With Kazakh author Olzhas Sulemeinov as a prominent spokesperson and backed also by the movement Nevada-Semey, the issue of nuclear testing had played a role in the formation of opposition during the Gorbachev era, following the Zheltoksan (December) protests in Alma-Ata, which had been violently met by police and military.²⁰ Closing the Soviet nuclear test site was

a highly symbolic and significant act that almost immediately followed the declaration of an independent Republic of Kazakhstan in December 1991.

With independence, USSR institutions were slowly fading from relevance, sometimes revived, given up, or rebuilt and transformed to fit the new Republic of Kazakhstan. As Alexei Yurchak noted, “everything was forever, until it was no more.”²¹ Visible and invisible infrastructures, institutions and everyday routines were disrupted. The administration of the new independent state changed the cityscape by renaming streets and making more space for Kazakh figures, such as 18th-century Kazakh warrior Kabanbai-batyr or famous 19th-century poet Abai Kubanbayev (Abai Qunanbaiuly), born in Semipalatinsk province. In contrast, Lenin statues were taken down and removed from central squares of the city – yet, they have been protected from complete disappearance and reassembled in a semicircle just behind the hotel Irtysh (*Figure 9.2*).

The city’s name – Semipalatinsk – remained associated with Soviet nuclear weapons testing and hence also was up for revision. That Semipalatinsk was renamed Semey in 2007, was intended as a move toward sounding “somehow more light and friendly,” and, without the association with the test site, more open for investors, as I am told. Over decades, nuclear testing indeed had not only been felt by the regular trembling of the earth, but also shaped the lives of scientific communities. One of my interlocutors, a physicist, pointed out that working under secrecy had become routine for scientific ground staff:



Figure 9.2 Semipalatinsk city’s Lenin statues reassembled in a park near hotel Irtysh, after they were taken down in the city squares.

Source: Photograph by Susanne Bauer (1997).

“we were young, we were singing songs together during these shifts, it was a great collective and we firmly believed we worked for peace.” What was perceived as normal and peace-building changed drastically over professional lifetimes.

During the early post-Soviet period, journalists described nuclear testing as “genetic genocide”²² of the local Kazakh population, aligning fallout exposures with the long history of Russian imperialism and Moscow’s Cold War technoscientific agenda in Central Asia. Indeed, modernization in pre-Soviet Kazakhstan, following 18th and 19th-century colonization, despite many uprisings began to destroy the seasonal livestock economies adapted to the steppe areas. While parts of the Kazakh elites in the 19th and early-20th century adopted Russian sciences,²³ medical modernization also came at the price of violent interventions into knowledge of the people as well as the nomadic livestock economies altogether. Cold War technoscience and post-Soviet transitions added further layers of violent disruption to livelihoods in northeast Kazakhstan.

Soviet modernity was not only about Lenin’s saying that “communism is Soviet power plus electrification of the whole country”²⁴ but also about the establishment of a public health infrastructure – a promise that Sovietization held up to, albeit not without costs. During the Soviet era, medical modernization led to an increase in hospital beds and broad public health services, for instance through *fel’dshery*, i.e., the paramedical health staff introduced already with *zemstvo* medicine in the 19th century. During the post-Stalin years and throughout the 1960s, the USSR became internationally renowned for its comprehensive public health system, especially through the system of *fel’dshery* and public health nurses providing healthcare in addition to district hospitals in rural areas.²⁵

With the post-Soviet dissolution of institutions, official policies in the new Republic of Kazakhstan began to reorient the collective memory. New narratives often recombined pre-Stalinist and pre-Soviet history of Kazakhstan, evoking the nomadic tradition of the steppe in novel ways and as a counterpart to Russian settler colonialism in Central Asia. Interestingly, the new historical narratives have also kept significant traditions from Soviet history, such as the importance of commemorating the Second World War and the many veterans from Kazakhstan. The episodes of hunger during the 1920s and the Kazakh Famine of 1930–1933, during with 1.5 million people, approximately a quarter of the population died, had been tragic part of the formation of the Kazakh SSR, but did not become a central narrative in the new Republic of Kazakhstan.²⁶ In short, the post-Soviet administration and nuclear research institutions worked on reassembling the past – much beyond the design of state symbols and memorials, or a makeover of slogans in public places – toward the orderings of a newly built nation state.

Scientific medicine and radiation research again underwent transformation in post-Soviet Kazakhstan. Scientific-technical infrastructures were substantially impacted as the USSR had dissolved – this included the loss of scientific

archives, personnel as well as economic infrastructures to run and supply laboratories. Most archives of the science city of Kurchatov and especially those related to nuclear testing were transferred to the Russian Federation and some had been earmarked to be destroyed. As the relevant archives dealing with nuclear testing were ultimately turned over to military archives in the Russian Federation, researchers in Kazakhstan had to work with what the officials left behind before they moved back to Moscow. Legacies of Soviet nuclear infrastructure also comprised several sites of uranium mining, which in the USSR had been conducted in Central Asia for example in Stepnogorsk, Kazakhstan, by the Leninabad Mining, and Chemical Combine in Tajikistan as well as in Tyuya-Muyun and Mailuu-Suu in Kyrgyzstan.²⁷

Central Asia has been described as “nuclear backyard” to Soviet Cold War sciences, both for its mineral resources and as the site for nuclear weapons development and testing. The atomic program and nuclear weapons industry needed human resources, which were recruited unequally across the USSR. Scientists were in part recruited from the western metropolitan centers of the Soviet Union – Moscow and St Petersburg – but also locally through the Medical and Polytechnic Universities, for instance in Southern Urals and the branches of the Academy of Sciences, for instance in the Soviet republics of Kazakhstan, Kyrgyzstan, or Tajikistan. In addition to the Academy of Sciences as the USSR’s main research institution, there was a system of closed nuclear research centers under the auspices of SredMash in need of physicists, engineers, technicians, and physicians.²⁸ Centralized government policies prioritized those fields relevant to the Cold War nuclear sciences and these priorities shaped the institutions and the very organization of scientific research in the Soviet republics.

Closing the nuclear test site also meant to be left with the nuclear infrastructures at Kurchatov on the “polygon,”²⁹ which was later reorganized as Kazakhstan’s “National Nuclear Center” that also held the mandate over radiation protection in efforts to develop the area through mining and other economic activities.³⁰ With the dissolution of the USSR, a new mode of transnational biomedical risk assessment entered the Semipalatinsk region, building on, inventorizing Soviet data and reevaluating fallout effects. In the early 1990s, institutional funding broke down, with employees having to move into parallel informal sectors as their employers were no longer able to pay salaries. For scientists in nuclear weapons research, conversion programs were set up to enable them to transition to the civil sector.³¹ While science as a profession could no longer pay for a living, a whole generation of scientists found themselves interpellated to adopt new styles of business, such as pitching and selling one’s research and data to funding agencies rather than delivering and receiving their share from a bureaucratic state which prioritized science. Frameworks of “transitioning,” ad hoc “projectness” with international collaborators and donors now reorganized scientific practices, replacing the firm scientific infrastructures, state planning and reporting.

In the sections that follow, I bring to the fore the laborious memory practices in late Soviet and post-Soviet radiation risk assessment sciences, in particular those concerned with transgenerational effects. I proceed by examining two instances of this process of reassembling in risk assessment research that address the motive of “the mother and the child” in scientific accounts of risk assessment sciences. I describe how institutional scientific memory practices of atomic heritage grapple with the past of Soviet nuclear weapons testing, when it comes to studies of genetic and long-term effects of fallout exposures due to nuclear testing at Semipalatinsk.

Transgenerational Nuclear Memory: “Mother and Child,” as Rendered in Population Genetics

Soon after the test site at Semipalatinsk was closed, politicians and government institutions began negotiating a compensation program, which was released as early as 1992.³² Just after the test site was closed, the assessment of the immediate radiological situation and exposure effects were the main focus of risk assessment. The government of Kazakhstan invited international missions to take part in assessing the radiological situation and called the UN for help on assessing and containing the risks that remained from the nuclear installations and legacies of four decades of atomic weapons testing at Semipalatinsk.³³ Over the years, groups of Kazakhstani and international scholars have also addressed the long-term legacies of nuclear exposure, including transgenerational effects among the children and grandchildren of those exposed to nuclear fallout. As with epidemiological studies, these assessments were conducted as different observational studies analyzing data retrospectively as well as in a prospective way, by establishing health monitoring infrastructures that could register effects of radiation.

Reproductive health has been a key concern of Soviet modernization in medicine.³⁴ Not only motive of the official memorialization in public monuments, the “mother and the child” was literally built into Soviet institutions. During the late 1960s and 1970s, “Centers for the Health of Mother and Child” with mandates to advance obstetrics and reproductive health had been founded across the USSR. In the Soviet Republics of Central Asia, efforts to establish a modern healthcare infrastructure included reproductive health centers as well as cancer diagnostics and therapy. These two specializations of medical care were particularly entangled with the Soviet nuclear program and its research into diagnostic and therapeutic radiation medicine.

In Alma-Ata, a Center for Reproductive Health was founded in 1975 to carry out clinical services and consultations, including cytogenetics and other laboratory analyses as well as research in obstetrics and medical genetics. During the 1980s, there were close ties with the Moscow-based Institute for Medical Genetics of the USSR Academy of Medical Sciences, established as the leading USSR research center on cytogenetics after 1969. Cytogenetics as a field and practice within biology had a troubled history in the USSR.

Early Soviet visions for radically different future humans were disrupted through Stalin's politics, from biology – mainly based on versions of genetics linked to the increase of agricultural production following Lysenko's ideas, up to the complete ban on classic Mendelian genetics, which was featured as bourgeois and to be replaced by creative Darwinism, the Soviet version of genetics.³⁵ This was the exclusive policy for all biology institutes and departments at the Soviet Academy of Sciences, bringing classic genetics to a hold. This had consequences well into the 1960s, even after Lysenko was dismissed as head of the Institute of General Genetics. Nevertheless, there were a few niches where scientists continued to do research in classic genetics – and these were radiation biology and mutation research. This line of research dealt with environmental effects of radioactive and toxic agents and was key to parts of the research taking place in secret nuclear cities and military institutes. In research centers related to the nuclear program, radiation biology, the study of mutation induced by radiation exposure, was a key part of biophysics – yet, importantly, institutionally within physics and not biology.

It was only during the late 1960s that researchers were able to reestablish fields such as medical genetics under the Academy of Medical Sciences. The Institute of Medical Genetics had been founded in 1968, expanding its research areas from radiation immunology and studies of hereditary disease, including field studies, into Central Asia. Interestingly, the Institute of Medical Genetics' departmental structure in the early years following its establishment included radiation immunology and mutation studies.³⁶ This was a way of drawing in the research into genetic and somatic effects that was done during Soviet time, which under Lysenko could not take place in biology institutions, but only under the label radiation biology or mutations research. It was at this Moscow-based institute, where researchers from the Center for the Protection of the Health of Mother and Child completed research stays and defended their PhDs in population genetics.

Scientific memory work through medical genetics has been contested, especially given its entanglements with eugenics. Some of the metrics and indices used in post-Lysenko population genetics indeed evoke categories connected to a biopolitics of improvement of the biological “population body.”³⁷ Indeed, Russia, like other European countries in the early-20th century, had developed their own socialist eugenics agendas. In the early Soviet era, these were connected to the making of the “New Soviet Human,” a better version of humankind enabled by technoscientific means. The concept of convergence (*sbližhenie*) and, ultimately, merging (*slianie*) were the envisioned goals to be reached over time, if needed in different pathways.³⁸ The ethnic groups and nationalities making up the population of the Soviet Union were envisioned to merge into one socialist people, while they were assigned different pathways toward communism, corresponding with their cultures and languages, which social scientists had classified into a new system of categories during the early Soviet years. Anthropologists and ethnographers had played a key role in the first census and the use of the categories *narodnost'*,

natsional'nost', and *natsiia* (terms for ethnic groups at different stages of development used by former imperial ethnographers) and by the mid-1950s the category *ethnos*, as “ethno-social formation” “distinguished by (...) historical and cultural traits.”³⁹ During the early Soviet years, ethnographic knowledge was mobilized for politics in different ways – in and as the anticolonial yet also eugenic biopolitics of the early USSR. That biopolitical condition was again at stake and thus reworked during the post-Soviet transformation.

Interestingly, the scientists of the Almaty-based Republican Research Center for Protection of Mother and Child Health also collaborated on studies of ethnoterritorial groups, using molecular techniques of genomics, based on studies of DNA polymorphisms.⁴⁰ Here, population geneticists were closely connected to biological anthropology.⁴¹ Researchers in the field also contributed to bodies of knowledge that intersected with questions about the origins of “Kazakhs” as a population group and their migration history. During the Soviet era, for example, biological anthropologist Orazhak Ismagulov, based in Alma-Ata, studied the ethnogenesis of the Kazakh people.⁴² Ismagulov worked with serological methods as well as “dermatoglyphs.”⁴³ These techniques, from physical anthropology, violently racialized human differences in colonial contexts of the early-20th century, yet they were perpetuated, albeit with different framings in the USSR. Coming to terms with “Kazakhness” and adopting a historiography based on modern science was one element that the new Republic assembled in the new state-building activities and their history policies.

The Almaty research center carried out work toward documenting health effects due to fallout from nuclear testing at Semipalatinsk. In particular, the center was involved in studying chromosome aberrations in different regions of northern Kazakhstan.⁴⁴ These studies compared incidence rates in different regions of Kazakhstan, for exposed and nonexposed areas. Trained in population genetics, the center’s scientists brought their own approaches and methods into investigations of the Semipalatinsk region. Their studies focused mainly on hereditary disease and congenital malformations (*vrozhdenie poroki razvitiia*)⁴⁵ through demographic studies, rates of hereditary disease, as well as the full range of indexes established in the epistemologies of population genetics. While some of the studies carried out focused on clinical genetic counseling using family trees, others related migration patterns to the gene pool and genetic distance, or reproductive patterns in populations. This work used classic genetics in order to follow radiation effects in nuclear families, situating potential radiation effects in the studies of hereditary conditions. They focused on alterations in the germ line and until birth, integrating the study of radiation effects with biomedical knowledge on embryology and teratology.⁴⁶ Teratology in particular became a field that was relevant to the concerns over prenatal testing, perinatal care, genetic disease, and population health – fields that became tied in to nation building in specific ways.

At the same time, the government supported and developed the new projects. This included building a “National Genetic Registry” for the New Republic of

Kazakhstan as well as a “system of genetic monitoring.”⁴⁷ The National Genetic Registry was introduced by 1998, following a “Law on Semipalatinsk” published in 1992.⁴⁸ A key goal of those monitoring practices was to study potentially radiation-induced “congenital malformations.”⁴⁹ After 10 years of data collection in the National Genetic Registry, geneticist Berezina reported a significant increase of major and multiple congenital malformations pointing to the influence of environmental conditions.⁵⁰ These were most pronounced in the East Kazakhstan region, which included the Semipalatinsk fallout area as well as the chemical and nuclear production sites of Ust-Kamenogorsk. With such monitoring data, medical scientists envision effective public health responses, in terms of “dynamic response systems to the evolving of the genetic disease burden in human populations.”⁵¹ It was at the level of sciences and respective memory work that Kazakhstani scientists were called upon to contribute to constituting the future of a fully modern, independent state that now dealt with the Soviet past on its own.

Chromosomal Memory: Molecular Markers of Radiation Effects

Researchers in the labs of the Center for the Protection for Mother and Child Health used molecular biology and genetics – traditional methods like cytogenetics or newer techniques based on polymerase-chain-reaction (PCR), to assess exposure effects in several ways. More directly related to the area of research and clinical work at the Center was prenatal testing and the use of cytogenetics, i.e., the microscopic analysis of changes in chromatids and chromosomes, but also studies of health effects related to exposure to chemicals or radiation. The techniques established at the Center mostly for clinical prenatal testing – karyotyping – can also be used to study radiation effects, especially those of recent or ongoing exposure. Cytogenetics labs were, hence, key to the study of chromosomal aberrations caused by radiation.⁵² Population geneticists at the Center for the Protection for Mother and Child Health in Almaty used cytogenetic tools to investigate genetic effects close to the Semipalatinsk nuclear test site. Relating and geographically mapping rates of congenital malformations, scientists strived to document radiation damage.⁵³ This presents a mode of radiation effects visualizing, projected on a geographic grid – mapping out a topography of chromosomal change.

In the Semipalatinsk region, a separate parallel research infrastructure had operated under secrecy and conducted research on radiation related diseases in the areas exposed to fallout from nuclear testing since the late 1950s. Additionally, the institutes on the Semipalatinsk polygon were in charge of nuclear technology as well as radiation protection and radiation monitoring.⁵⁴ Furthermore, the Russian program on research and compensation for those affected by fallout exposures due to the Semipalatinsk nuclear test site in the Altai region, also included some cytogenetic studies carried out by researchers based in Moscow and at the Center for Medical Radiation in

Obninsk.⁵⁵ Today's Scientific Institute for Radiation Medicine and Ecology in Semey is the successor institute of the code-named "brucellosis hospital": the "Dispensary no. 4." This unit was overseen by the Institute for Biophysics in Moscow and established for the purpose of studying radiation effects in the surroundings of the Semipalatinsk nuclear test site. Founded in 1959, it mainly followed up on the health status of exposed people in settlements exposed to fallout, focusing on particular in cancer incidence and mortality in the 1970s and 1980s. In addition to cross-sectional studies and cohort study, they also set up a program on cytogenetics. Analyzing blood samples of people living in exposed areas, radiation biologists compared the counts of chromosome aberrations, such as dicentrics and rings, using the method of karyotyping (the examination of chromosomes under the microscope) in the 1970s. Scientists examined these alterations in the sense of an effect marker, described as a clinical observation of radiation effects, comparing rates in the exposed areas with rates in areas outside known fallout.⁵⁶

Controversies during the 1990s revolved around questions of dosimetry, a multidisciplinary research field that deals with the reconstruction of exposure. Scientists distinguish between radiation qualities and pathways: radiation qualities refers to alpha, beta, gamma radiation – each having different biological characteristics and effects on tissue and which radiation qualities are present depends on the radionuclide composition of fallout and residual radioactivity as well as on the decay chains. Pathways can be external radiation (whole body exposure) and internal exposure due to ingested or inhaled radionuclides. After radiation accidents, particular significance has been given, for instance, to radioiodine, which accumulates in the thyroid gland, but also to much longer-lived strontium-90 which, like radium, mimics calcium and collects in bones, where it remains for years, leading to irradiation of bone marrow. Methods for dose reconstruction – which examine and quantify radiation exposure – include physical, chemical, and biological techniques. Biodosimetry has become increasingly important in determining radiation dose after nuclear accidents. In epidemiological risk assessment projects, biodosimetrists used cytogenetic techniques to trace chromosomal alterations in human blood cells in order to quantify radiation dose at the individual level. Hence, this measurement setting became a biological memory device registering past exposure within the very human body.⁵⁷

Given that there is sufficient stability of the aberrations over time – which for most markers are only a few months – these are used to confirm and even quantify radiation exposure. In these configurations, the human body is rendered not only as "at risk" due to fallout, but as a dosimetric memory in which radiation inscribes itself, similar to the dosimeter device carried by nuclear workers. Repurposed as memory work for "biodosimetry," chromosome aberrations became a human cellular that would be recognized as proof of exposure. Whether the marker is conceived of as a clinical marker of effect or whether it is a tool for dose estimation – seems to perhaps be a technical detail, but this small shift is relating fallout matters in a very different way.

Seen as “hallmarks of exposure to ionizing radiation,”⁵⁸ the presence of such markers is interpreted as indicators of whether there truly was a significant exposure. This locates the site of proof (and inscription device) within the exposed body rather than in the residuals in the environment or the knowledge about exposure of the past in an area of nuclear test fallout. It shifts the site of proof into exposed bodies and chromosomes of the blood cells in individuals, which positions the individual as the carrier of a somatic mutation and individualizes the burden of proof of documenting exposure. Results from some of these studies have fueled doubt about exposure and questioned compensation programs that already had become law.

Internationally cytogenetic techniques changed and moved on rapidly with PCR-based methods in genomics. Western scientists also used new techniques – glycophorine A (GPA) assays, minisatellite, and fluorescence in situ hybridization (FISH) that made visible more markers at Semipalatinsk to examine radiation-induced chromosome alterations.⁵⁹ Yet, acquiring the machinery and chemicals of genomics proved nearly impossible in the post-Soviet economic crisis for these institutions. Most research groups, during the early post-Soviet years, lacked funding to maintain the technological infrastructure, since the Soviet supply of equipment and access to common scientific publication channels and to researcher salaries were cut off. The post-Soviet crisis already had forced scientists into an improvised everyday research life that required them to take on secondary jobs, subsistence and care work within extended families, and occasional funded projects. Completing a project with funding from abroad became a job within the job, providing paid works in otherwise uncertain situations with salaries put on hold or delayed for months and handling precarious positions in an era where working in academia did no longer provide enough to cope with the economic crisis. With the formal salary infrastructures gone, the state once providing for them dissolved and with no new infrastructure yet, memory practices took place in an unofficial, informal project mode often negotiated ad hoc.

Bureaucratic Memory: Mining Vital Statistics of the Population

Like for all modern political entities, keeping population statistics was central to the making of a post-Soviet state.⁶⁰ With the end of the USSR’s administration of the research systems in the Central Asian Republics, scientific funding structures dissolved and it proved difficult to sustain and realize long-term projects.⁶¹ For epidemiological risk assessment, also the administrative infrastructure in other sectors were crucial to data access and the administrative memory of public health. Of particular importance to epidemiologists was the ZAGS system,⁶² the vital statistics authorities of the USSR, which registered data on births and deaths.

Following modern epidemiology’s generic definition, as “the study of distribution and determinants of disease in populations,” radiation

epidemiology is a scientific discipline that has been highly dependent on state infrastructures for standardized, long-term collection of data. Once the methods of counting are changed, the numbers are no longer comparable, requiring complex validation studies, modeling and translation work to render data combinable – and the more of these transformations are done, the more uncertainties are generated. Epidemiological studies ideally require standardized and unchanged data collection over a long time that is independent of exposure, so that there is no systematic error introduced in the data collection. This makes routine data recorded by the state, such as causes of death records important data sources. Conducting an epidemiological study is a complex scientific memory practice, with data recording and measurement changing with improved diagnostics and therapeutics. Isolating the effect of radiation exposure at aggregate levels implies many assumptions, especially in the lower dose range and in retrospect when case ascertainment is different and often insecure. For instance, epidemiological studies of fallout-related leukemia at Semipalatinsk have proved difficult to carry out, with cases expected to have peaked 10 years after exposure – likely to be undiagnosed in the rural areas during the 1950s and 1960s, let alone what physicians outside the secret radiation research centers dared (not) to write into the medical death certificates.

Establishing a kind of “nuclear census” is a prerequisite to reconstruct exposures and retrieve disease to assess radiation risk. During the 1990s, both local and international research efforts focused on the establishment of registries, i.e., exposure and disease registries. Unless epidemiologists – as done in some prevalence studies – carried out an entirely new data collection from scratch, all studies had to work with data collected in the past. These epidemiological memory practices proved highly entangled with the political and administrative systems as well as with the enactment of Soviet modernity through public health. This was routine data, recorded by the USSR administration – in rural places it were the obligatory birth and death records as well as the *kolkhoz* books that functioned as registries for the exposed rural populations. Especially for the period of atmospheric nuclear testing 1949–1963, they were used as replacements for the lacking passport system for the rural USSR population.

Following up on concerns by health authorities and the UN resolution on Semipalatinsk of 1998, WHO commissioned a reproductive health study to be conducted in collaboration with institutes in Semipalatinsk, UK epidemiologists, and WHO researchers. Called upon by WHO to produce “a scientifically sound” epidemiological study, western scientists looked into and surveyed the possibilities and availability of records. Putting methods and exclusion of possible bias first, they decided to work with those long-term Soviet administrative data from vital statistics offices, for which completeness could be ascertained; the expectation was that they would be recorded exactly the same way independent of whether the area was exposed or not, thus avoiding bias in the data. This however restricted the outcomes that

could be studied and the decision of what to study: were variables available for the entire time span of the retrospective studies and were they beyond suspicion of bias? A systematic error that would result from differences in recording between exposure groups or disease groups compared to those unexposed or healthy. For a study on reproductive health, this restricted the study to using records available for the entire population, i.e., birth certificates, marriage certificates, and death certificates.

Variables on these administrative documents ended up performative in the sense of what could be studied: causes of death data, for instance for childhood cancer between the 1950s and 1990s, were considered too heterogeneous in case ascertainment, with diagnostics established only for the later decades. Hence, the results of such a study would rather be reflecting the data recording and diagnostic practices than the effects of radiation exposure, or these two would be impossible to disentangle. Following the logic of epidemiological methods, these considerations determined what could be studied and what was left unstudied.

Prioritizing a scientifically sound study on reproductive health, as commissioned by WHO, scientists studied, for instance, sex ratios, an outcome shown to be related to radiation exposure.⁶³ Another study examined twinning rates which also could be studied based on administrative documents on marriages and births.⁶⁴ These were method-wise safe and sound studies, yet concerns over childhood leukemia and congenital malformations remained unaddressed in these studies, despite their scientific relevance and public concern. In that sense and in order to put sound science first, researchers found themselves trading public health relevance against methodologically clean studies.

Preoccupied with databases as memory infrastructures and metrics, scientists work with processes and politics of documentation. They grapple with the effects of exposure, in this case human-made exposure due to nuclear testing in the past but the effects of which linger in the present and are known to reach into the future. This is due to long half-lives of many radionuclides released in nuclear explosions, including cesium, strontium, and plutonium. While some exposures referred to (such as iodine in milk) were most pronounced in the months and years after atmospheric nuclear tests and thus an issue mostly for the generations young at time of atmospheric nuclear testing, the long-term effects of exposure, the internal exposures due to incorporated long-lived nuclides such as strontium accumulating in bones as well as the residual radionuclides in the ground that can be refracted and enter the food web, will remain for decades.⁶⁵

Biomedical research into radiation effects studied the damage to people in affected territories. This, however, operated on epistemic conditions shaped by Cold War research infrastructures of risk assessment and risk factor epidemiology. They brought with them their own ways of knowing the health effects of radiation based on a certain set of study designs and concerns that often differed from those of local researchers and the concerns

of clinicians. The memory work of Cold War risk assessment focused on deriving accurate relative risk estimates attributable to radiation alone. This contributed to a culture of research shaped by US scientific programs on the atomic bomb survivors in Japan. Here, researchers first and foremost looked at radiation as an isolated factor with different radiation qualities in order to contribute data to mathematical models. It assumed regularities (with threshold, no threshold, or linear shapes of the dose-effect curve) that would be described by purified mathematical functions, once proper study populations and databases were established. This idea of establishing and documenting damage by means of population studies of different exposure conditions would result in a purified data set, catering to the improvement of universalized risk estimates and dose-response curves.

Coda

This chapter has followed selected trajectories of how Soviet nuclear legacies have been assessed and reassembled, especially concerning long-term, transgenerational effects of fallout exposure. At Semipalatinsk, risk assessment sciences have been an integral part in memory practices and the ongoing post-Soviet reassembling of the past in order to envision futures for the new state. Focusing on scientific modes of documenting radiation effects shows the ongoing scaling and calibrating of risk assessment: there are transgenerational-individual, chromosomal-molecular as well as populational-aggregate scales and versions of risk research, each assembling different strands, disciplines, measurement devices, and scientists. Whether public science, open science, or secret science, scientific memory practices do ordering work, while brought to align with nation building or globalized regulatory regimes.

Different memory practices, material objects, scientific disciplines, and methods traditions participate in biomedical assessments of radiation effects at various scales: the transgenerational scale is tied to reproductive medicine, the chromosomal scale to microscopes, chemicals, and technical skills of visualizing invisible damage, and the population level to administrative procedures in vital statistics offices and bureaucratic data labor. There are somatic and genetic memory mechanisms at molecular levels, transgenerational effects as well as the documentation effects visible in epidemiological data at the aggregate level. All these constitute memory configurations as they were transformed in a long and gradual process of institutional change after the dissolution of the Soviet Union. One of those was the transformation of the Semipalatinsk polygon from a Soviet weapons test site into Kazakhstan's National Nuclear Center, now overseeing radiation protection as well as herding and mining activities on and near the site.

Closing the test site and promoting a Central Asian Nuclear-Weapons Free Zone were part of this nation-building process, which enabled a recognition of the suffering due to weapons tests and fallout affecting the people living

close to and even within the nuclear test site borders. Nuclear legacies have been inscribed into the census and tracked through population counts, but also in individual exposed bodies in biodosimetry. After the first decade of research though, science policy shifted and began to strive toward bringing the post-Soviet chapter of handling the Semipalatinsk aftermath to a political close. At the same time, Kazakhstan embarked on new economic paths that comprised extractive economies, oil and gas, mining, metals, and in particular extensive uranium mining. As for Semipalatinsk, closing the radiation issue also implied redirecting research to studies of nuclear risk perception in terms of internalized mental health problems and as an issue of “radiophobia” in communities in regions near the test site. This turned attention away from the fallout’s residuals in the environment, which could enter – literally via food webs and ingestion – into people’s bodies and, in the case of incorporated radionuclides, result in chronic internal exposure.

When it comes to toxic or radioactive legacies in the environment post-Soviet kitchen conversations frequently arrive at “we are all mutants, after all.” The long-term and genetic effects of radiation that would be transmitted to the next generation have been among the main public concerns. This motive is also alluded to in the monument “Stronger than Death” that epitomizes Cold War reproduction as core concern. Reproduction, childcare, and gender roles all have been shaped by a long history of state intervention, and the monument evokes and reproduces a particular burden on and myth of the mother and child, which haunted Soviet modernity. In contrast to the trope of the heroic mother in the shadow of the atomic mushroom cloud, conceiving oneself as a “radioactive mutant,”⁶⁶ as immune to radiation, or nuclear test survivor may enable or claim different forms of agency within the post-nuclear condition.

Kazakhstan’s post-Soviet project of nation building has emerged as a multi-scale endeavor that, in a biopolitical sense, reaches from state history policies, governance of the nuclear past, and politics of knowledge into citizens’ subjectivities and embodiments. Studying the biologies of memory may open up for resistant and generative critical capacities in the Anthropocene that exceed victimization and, instead, join efforts of reimagining and intervening into Cold War epistemologies that continue to linger in the global nuclear aftermath.

Notes

1. Recent exhibitions of these archeological artifacts bear witness of the changed role assigned to these institutions by government. See Nursan Alimbai, *Tsentralnyi gosudarstvennyi muzei Respubliki Kazakhstan: kratkii istoricheskii ekskurs, strukturnye preobrazovaniia, problemy. Trudy Tsentralnogo Muzeia II* (Almaty: Gylym 2004), 11–18.
2. OSCE is the Acronym for the Organization for Security and Co-operation in Europe, founded as Conference on Security and Co-operation in Europe in 1975 in order to establish a dialogue to address security issues during the Cold War constellation. See Susanne Bauer, “Beyond the Nuclear Epicenter. Health Research, Knowledge Infrastructures and Secrecy at Semipalatinsk,” *Cahiers du Monde Russe*, 60/no. 2–3, (2019): 493–516.

3. See for instance the statements at the OSCE summit of 2010, https://www.osce.org/event/summit_2010 and the UN Treaties documentation, <https://www.un.org/nw/z/content/treaty-nuclear-weapon-free-zone-central-asia>.
4. Olivier Roy, *The New Central Asia. Geopolitics and the Birth of Nations* (New York, NY: New York University Press, 2000): 177.
5. Scholarship on Kazakhstan was promoted and gained visibility through the creation of new sections in state libraries as well as the development of textbooks foregrounding a new canon of Kazakh philosophy, see for instance: O.A. Segizbaev, *Kazakhskaiia Filosofiiia XV-nachala XX veka.* (Almaty: Gylym, 1996).
6. Roy, *The New Central Asia*, xx.
7. For an overview on programs in Kazakhstan and the Altai region, see Susanne Bauer, *The Health Impact of Atmospheric Nuclear Testing. Cancer Epidemiology in Areas Adjacent to the Semipalatinsk Nuclear Test Site, Kazakhstan.* (Frankfurt am Main/New York, NY: Peter Lang Publishing Group, 2006); for the Kazakhstan program, see Susanne Bauer, Boris I. Gusev, Tatiana Belikhina, Timur Moldagaliev, Kazbek Apsalikov, “The Legacies of Soviet Nuclear Testing in Kazakhstan. Fallout, Public Health and Societal Issues,” in Deborah Oughton and Sven-Ole Hansson (eds.), *Social and Ethical Aspects of Radiation Risk Management* (Amsterdam: Elsevier Science, 2013), 239–258.
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9. Pierre Nora and Lawrence D. Kritzman, *Realms of Memory: The Construction of the French Past* (New York, NY: Columbia University Press, 1998); Jan Assmann, “Communicative and Cultural Memory”, in A. Erll and A. Nünning (eds.), *Cultural Memory Studies. An International and Interdisciplinary Handbook*, (Berlin, New York, NY: Walter de Gruyter, 2008), 109–118.; Maurice Halbwachs, *On collective memory* (Chicago, IL: The University of Chicago Press, 1992).
10. The notion of fallout memory practices takes up the concept from Geoffrey Bowker, *Memory Practices in the Sciences* (Cambridge, MA: MIT Press, 2006).
11. Anna Storm, Fredrik Krohn Andersson, Eglé Rindzevičiūtė. Urban nuclear reactors and the security theatre: the making of atomic heritage in Chicago, Moscow and Stockholm, in Heike Oevermann and Eszter Gantner (eds.), *Securing Urban Heritage: Agents, Access, and Securitization*, (London: Routledge, 2019), 111–129.
12. Hannah Landecker, Antibiotic Resistance and the Biology of History, *Body and Society* 22, 4 (2016): 19–52.
13. The concept of reassembling is foregrounded in order to empirically open up the ways these scientific memory practices align with politics. See Bruno Latour, *Reassembling the Social. An Introduction to Actor-Network Theory* (New York, NY: Oxford University Press, 2005).
14. Gabrielle Hecht, “Nuclear Ontologies,” *Constellations*, 13, 3 (2006): 320–331.
15. The test site of China’s nuclear weapons program at Lop Nor is situated in this region, comprising 22 atmospheric nuclear tests (1964–1980) and 22 underground tests (1970–1996), see B.B. Bennett, L.E. de Geer, D. Dour, “Nuclear Weapons Test Programmes of the Different Countries”, in Sir Frederick Warner and René J.C. Kirchmann (eds.), *Nuclear Test Explosions. Environmental and Human Impacts* (Chichester, New York, NY: Wiley, 2000), 13–32.
16. Michael D. Gordin, *Red cloud at dawn. Truman, Stalin, and the end of the atomic monopoly* (New York, NY: Farrar Strauss and Giroux, 2009).

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27. See Roche, this volume; Arkadii Kruglov, *The History of the Soviet Atomic Industry* (London: Taylor&Francis, 2002), 14.
28. See contributions by Stephan Guth and Laura Sembritzki (this volume).
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38. Hirsch, *Empire of Nations*, 311; Roy, *The New Central Asia*, 63.
39. Hirsch, *Empire of Nations*, 10, 196, 313–314.
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