Georgia’s Nuclear Odyssey:

The Path from Soviet Atomic Legacy to Global Nonproliferation Regime

Tbilisi
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Scientific Editor:
Miles Pomper, the James Martin Centre for Nonproliferation Studies of the Monterey Institute for International Studies

Cover Design:
Eka Tsagareli

Layout Design:
Alexander Jikuridze

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Georgia’s Nuclear Odyssey

> *“The aim of the historian, like that of the artist,*
> *is to enlarge our picture of the world, to give us*
> *a new way of looking at things.”*
>
> ***James Joll***

Introduction

Georgia’s Soviet nuclear legacy played an important role in the integration of the newly independent state into the international nonproliferation regime. Georgia retained nuclear scientific institutions which were eager to quickly integrate into global norms and institutions. Yet, amidst the difficulties of state-building, economic hardship and internal conflicts, Georgia in the immediate post-Soviet era found it difficult to immediately respond to the emerging challenges of nuclear and radiological security and to ensure the safe and continuous functioning of its scientific centres. Fortunately, however, by the time of the Soviet collapse, Georgia’s nuclear weapons-related infrastructure had been withdrawn to Russia.

The present study examines Georgia’s past and present from a nonproliferation perspective. The publication consists of three main chapters, which detail Georgia’s odyssey towards conformity with the global nonproliferation regime, beginning with the founding of Georgia’s two nuclear research laboratories in 1945. It adds to the existing literature on Soviet nuclear issues by tapping new and unexamined or under-examined sources. These include the Georgian Communist Party’s Central Committee Archives, related NATO archives (declassified materials and books by the NATO Military Committee from the period 1958-1979), oral histories from Georgian scientists, and dozens of interviews with scientists, facility operators and other practitioners, military officers and other government officials.

The first part of the study, “The History of Nuclear Research in Soviet Georgia”, examines how science, and nuclear physics in particular, was organised, planned and administered in the USSR, shedding light on the limits of science in a totalitarian system. The chapter assesses the role and importance of the nuclear research conducted in Soviet Georgia through research and analysis of nuclear sector management and decision-making practice looking at the achievements, false successes, obstacles and prospects for the development of Georgia’s nuclear scientific facilities.

The chapter brings forward some interesting findings that may encourage additional research. First of all, the paper shows that scientists and engineers of nuclear research programmes had very limited, if any, access to more general information about the programmes in which they were involved. Secondly, it describes how Georgian physicists made attempts to broaden their scientific independence but were forced to abandon new initiatives. This experience runs contrary to the established view, according to which Soviet nuclear physicists enjoyed unusual intellectual autonomy from the totalitarian political system in which they lived. The paper suggests that such practices were aimed at limiting the independence of scientists and establishing strict control over the topics they examined, as well as their scientific career paths. In addition, the chapter discusses how the material and technical resources of nuclear research facilities were under the tight control and supervision of the Central Committee of the Communist Party, while access to substantial financial resources for nuclear research were closely linked to the Soviet military-industrial complex. The paper shows how, as a result, Georgian scientists would sometimes attempt to enlarge their research agenda and draw the central government's attention to their work by conducting rather risky experiments.

The second chapter is an attempt to answer an open historical question: What role did nuclear weapons play in Georgia and the South Caucasus during the Soviet era? Based on interviews with relevant actors and an investigation of available historical documents, this study attempts to offer a reasonable – if not conclusive – answer to this question. It indicates that Soviet commanders envisioned the potential use of tactical nuclear weapons from Georgia in any conflict with NATO in Turkey. It also demonstrates that there was a high probability that non-strategic nuclear warheads were in the region, either in storage or deployment, and perhaps stored at the Vaziani central supply-base in Georgia. However, it is impossible to give an unequivocal answer to the question whether the nuclear components were typically deployed with military units in the South Caucasus or remained in storage.

This chapter begins with a look at the strategic rationale for placing Soviet nuclear weapons in the region during war. It goes on to describe the structure of the Transcaucasus Military District (GRVZ) and the military units and facilities that hosted or could have hosted non-strategic nuclear weapons. It then looks at the likely course of the withdrawal of these weapons as the Soviet Union was imploding. Given the dynamics of changes in the military district and the history of the development of non-strategic nuclear weapons in the Soviet Union, the study mostly focuses on the period from 1970 to 1990, when the structure of the Transcaucasus Military District remained comparatively unchanged and it was possible to resort to full-scale operational deployment of tactical nuclear weapons.

The third and final chapter describes independent Georgia's participation in the international nuclear regimes and reviews the challenges that faced the young state. These challenges were largely related to ensuring nuclear and radiation safety, combating illegal trafficking and addressing issues of radioactive waste management. The chapter has three sections. The first describes the initial years of independence and analyses the state of nuclear and radiation security. The section reviews, in particular, how state institution-building in 1992-1996 affected nuclear and radiological safety and security. It outlines difficulties associated with nuclear and radiation threats originating at academic research laboratories, as well as other problems relating to the proliferation, illegal trafficking and waste management of orphaned radioactive sources.

The second section details the establishment of national instruments for promoting nonproliferation, the creation of legal foundations for radiation safety and security, and their limits and associated challenges. Finally, the third section focuses in detail on transnational threats such as illicit nuclear trafficking, the steps Georgia has taken with support from the international community to respond to such concerns, and the need for Tbilisi to cope with an emerging set of challenges.

This part of the research highlighted a number of nuclear nonproliferation issues to which Tbilisi has devoted insufficient attention. In particular, among the issues that need to be prioritized by the government are the development of a consistent foreign policy serving non-proliferation goals; strengthening cooperation among state institutions, establishing an efficient national legislative framework, effectively addressing the root causes of illicit trafficking, (related to poverty, lack of public awareness, low level of integrity of law enforcement structures, etc); and improving the nation's security culture to foster stability and more reliable safeguards against transnational threats in the future.

The thee chapters, therefore, combine to provide the reader with a picture of Georgia's nuclear past and present and provide some initial thoughts on future policy directions for the young state. One of the more urgent matters is the need to broaden not only the discourse, but also Georgia's policy vision. The Georgian public has very little knowledge and understanding about Soviet nuclear science projects conducted in Georgia and is even less aware about nonproliferation objectives. Moreover, Georgian politicians, experts, media and society have rarely discussed nuclear science-related issues since independence. During the Soviet period nuclear issues were taboo and this inertia has continued.

Many recent studies conducted in Georgia are focused on assessing political and social developments and analysing the country's difficult transition towards democracy. But the authors of this study believe that better understanding of the past and present of the state of affairs in science and technology should not be left out of the overall development process as it significantly influences the building of public values as well as political and social organization. In particular, education related to nuclear physics/radiology is not in demand among Georgian youth and relevant university faculties face problems attracting students. This could lead to a future shortage of specialists in radiation safety, nuclear medicine and other related sectors.

The authors hope that this study will contribute to broadening the public discourse on the prospects of science and technology development in Georgia and help interested professionals rethink the role of education in this context. The study also provides a good opportunity for scholars, policymakers, and civil society actors to expand their knowledge and awareness of the issues on nuclear and radiation security and safety, broaden not only the discourse, but also the policy vision, for Georgia to become a proactive member of the nonproliferation regime.

This publication would not have seen the light of day without the hard work and close cooperation of a team of Georgian researchers representing various scientific disciplines. The team consisted of scientists from the Andronikashvili Institute of Physics, the Georgian National Academy of Science, Georgian Technical University, former Soviet scientists from different scientific institutions, and political scientists working in the field of nonproliferation education. The research team showed their dedication to the subject and sought to trace the events of the past and present them as a means of understanding the present.

The team members would like to express their gratitude to Lars Van Dassen and Viviana Sandberg from the Swedish Radiation Safety Authority for their role in inspiring this project. We are grateful for their support and encouragement. The effort of the research team was realized with the kind support of the Swedish Radiation Safety Authority in the framework of the Georgian-Swedish bilateral cooperation agreement.

The research team also would like to express special thanks to Miles Pomper from the James Martin Centre for Nonproliferation Studies of the Monterey Institute for International Studies, for his valuable contribution, to the process of reviewing and editing the current publication. His suggestions and queries were extremely helpful.

Nuclear Research in Soviet Georgia

Chabashvili M., Japaridze G. I., Lortkipanidze Sh.,
Pataraia T., Rostomashvili Z.

Nuclear physics as a scientific discipline emerged in Soviet Georgia in 1945, at the end of World War II. This period coincided with the launch of the Soviet atomic bomb project which resulted in the design of the first Soviet atomic bomb, tested in 1949. For the purpose of manufacturing atomic weapons various experimental laboratories and research institutions were established across the Soviet Union beginning in 1943. Among the first atomic laboratories set up during this period were Moscow-based Lab No 2, later known as the Kurchatov Institute of Atomic Energy; the Institute of Inorganic Materials NII-9 (Moscow); Laboratory “V” in Obninsk, Ural; Leningrad-based Plant “12” Elektrostal; and Laboratory “B” in Sungul, Snezhinsk. The scientific tasks assigned to these research institutes and labs included uranium enrichment, plutonium production, atomic warhead assembly and component manufacturing[1].

This chapter examines the Soviet Republic of Georgia’s role in and contribution to the development of Soviet nuclear science and technology. It begins with a history of the establishment of large scientific research centres and provides an insight into their operational specificities. It then evaluates the role and importance of nuclear research conducted in Soviet Georgia through research and analyses of the following issues: specifics of nuclear sector management and decision-making practice; achievements and development prospects at nuclear scientific facilities; cooperation between nuclear scientific centres in the USSR and with other states.

The main sources of information used in the analysis are of local origin, in particular, interviews, monographs of local scientists, information brochures published by local scientific centres, newspaper articles, scientific periodicals published in the Georgian language well as handwritten manuscripts of Georgian scientists. These were supplemented by international and national archival materials such as documents from the Georgian Communist Party and NATO Military Committee archives.

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[1] Oleynikov P. V., Summer 2000. “German Scientists in the Soviet Atomic Project,” *The Nonproliferation Review*.

1. The Early Years

1.1 Ilia Vekua Sokhumi Institute of Physics and Technology

In 1945, two nuclear research laboratories, so-called Institutes “A” and “G”, were set up on the Black Sea coast at Sinopi and Agudzera, not far from Sokhumi, the capital of the Abkhazian Autonomous Republic of Georgia. These institutes were the first nuclear research facilities established in Georgia. At the time, both laboratories were subordinated to the state atomic bomb committee.

The Institutes were officially inaugurated on 27 July 1945, following a relevant decision of the Soviet Committee of Defence chaired by Premier Joseph Stalin. However, according to some sources, their founding dates back to an earlier period. Alexander Mirtskhulava, who served at the time as chairman of the Council of the People’s Commissariat (Council of Ministers) of the Autonomous Republic of Abkhazia, placed this key event in March 1945, five months before US atomic bombs were dropped on Hiroshima and Nagasaki and four months earlier than indicated in previous accounts, which reflected the date of the official decision.[2]

Mirtskhulava recalled that the placement of laboratories near Sokhumi was mainly determined by the fact that Lavrenti Beria, then chief of People’s Commissariat for Interior Affairs, NKVD, and the head of the Soviet nuclear project, was a native of the city. In a 1996 interview with the *Sakartvelos Respublika* newspaper, Mirtskhulava said:

“*In March 1945, we received a phone call from Lavrenti Beria... He enquired about the condition of the Sinopi sanatorium in Sokhumi. I replied by saying that as the war began all sanatoriums and recreation facilities had been transformed into hospitals. He instructed us to immediately move the hospital at Sinopi elsewhere and to refurbish the complex. He promised to extend every kind of help to us and told me that he would dispatch his representative to ensure that the task was accomplished*.” [3]

According to Mirtskhulava, three days later General Zavenyagin of the NKVD arrived and told him that they were planning to transfer a scientific institute from defeated Germany, which had earlier conducted intensive work on manufacturing nuclear weapons, and that Stalin had already approved a

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[2] Salukvadze R. , 1996, “Ilia Vekua Sokhumi Institute of Physics and Technology: Past, Present, and Future, Science and Technology”, newspaper *Sakartvelos Respublika* , Georgia.

[3] Salukvadze R., 1996, “Ilia Vekua Sokhumi Institute of Physics and Technology: Past, Present, and Future, Science and Technology”, newspaper *Sakartvelos Respublika* , Georgia

relevant resolution of the Soviet Defence Committee regarding the placement of this Institute at the Sinopi sanatorium in Sokhumi. In Mirtskhulava's words, the general put the document on the table and then went to inspect the site and adjacent territory. Soon afterwards, the two hospitals, located in Sinopi and Agudzera, were moved to Gagra, a city close to Sokhumi, and repair work started at both sites in order to prepare basic infrastructure for experimental laboratories in nuclear research. Moscow provided all necessary resources and by the end of April everything was ready for receiving the guests from Germany. Then, Mirtskhulava recalled, "at the end of May, Beria phoned again to inform me that the operation would commence soon."

The German contribution to the Soviet atomic bomb project, namely German experts' involvement in the creation and operations of nuclear research laboratories in Sinopi and Agudzera, has been detailed in many academic works.[4] According to these sources, in May and June 1945 the NKVD carried out a special operation to bring a large group of outstanding German physicists (varying estimates put their number at somewhere between one and several thousand) to the Soviet Union, including such famous names as the leading physicist, experimenter and inventor Manfred von Ardenne (1907-1997); Nobel Prize laureate and head of the Siemens corporation laboratory Gustav Ludwig Hertz (1887-1975); professor of the Humboldt University and department head at the Kaiser-Wilhelm Institute für Physikalische Chemie und Elektrochemie Peter Adolf Thiessen (1899-1990); and professor of the Berlin Technische Hochschule and director of the Institute of Physical Chemistry Max Volmer (1885-1965).

These scientists were then placed at the two nuclear research laboratories at Sinopi and Agudzera. The two labs were independent of each other but both were tasked with developing the means to use highly enriched uranium as the fissile material in nuclear weapons. This required "enriching" the uranium—that is increasing the concentration of the fissile uranium-235 in natural uranium from below one percent to as much as 90 per cent for weapons-grade uranium. In particular, the labs were charged with developing the technical means to separate the uranium-235 isotope from its far more numerous uranium-238 brother, measuring the ratios of uranium isotopes, and monitoring and controlling related radiation. To fulfil these functions, Hertz was appointed head of the Agudzera lab (Institute "G") and von Ardenne was appointed head

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[4] Holloway D., 1994, *Stalin and the Bomb: The Soviet Union and Atomic Energy, 1939-1956*, Yale University Press, New Haven & London, p:190

of the Sinopi lab (Institute “A”) and the labs began investigating several different approaches to this technical challenge.

In particular, the Ardenne Institute in Sinopi (Institute “A”) and the Hertz Institute in Agudzera (Institute “G”) applied the following methods for the separation of uranium isotopes and the perfection of relevant tools and equipments[5]:

Ardenne Institute in Sinopi:	Hertz Institute in Agudzera:
1. Electromagnetic methods of uranium separation – led by Prof. Manfred von Ardenne; leading scientists Max Steenbeck, D. Chkuaseli, V. Gusev and R. Demirkhanov.	1. The mass gas diffusion method – led by Prof. Gustav Hertz, leading scientist I. Gverdtsiteli
2. Gas centrifuge method of uranium enrichment – led by Prof. Max Steenbeck; leading scientists H. Zippe, I Kirvalidze. Steenbeck’s group was the largest in Sokhumi and included 60 to 100 staff at different periods of time.	2. Research on filter protection from corrosion caused by uranium hexafluoride (UF6) – conducted at both facilities by V. Khachishvili in Agudzera and Prokudin in Sinopi
3. Physical and chemical processes of the design of the porous filter, an important element of the gas diffusion method – led by Petre Thiessen; leading scientists Zigler, Sh. Burdiashvili.	3. Research of methods of measuring uranium isotope concentration and the improvement of a relevant device – led by Dr. A Schutze, as well as K. Orjonikidze and V. Shekhavtsov.
4. Theoretical foundations of the gas diffusion method – led by H. Barvich, assisted by Gartman and R. Kucherov.	

The first phase of the research ended in 1948. Special equipment and devices had been developed for all functions. A sufficient amount of appropriately enriched uranium had been produced in all experiments. In terms of nuclear history the most innovative research may have been on the gas centrifuge method, pioneered by Steenbeck, Zippe and their colleagues, which over the last few decades has become the dominant technology for enriching uranium. With this technology, uranium hexafluoride (UF6) is enriched using a gas centrifuge. In the process, a rotor spins rapidly inside a centrifuge with a force thousands of times greater than gravity. As a result the lighter U-235 molecules are separated from the heavier U-238 isotopes, and move to the centre of the cylinder, where

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[5] Interview with Oziashvili, Helene, Physicist at Sokhumi Institute of Physics and Technology until 1961.

they can be collected. The gas with higher concentration of U-235 can then be transferred to another centrifuge. This process can be repeated over and over again: uranium enrichment plants can contain thousands of centrifuges, with smaller groups of centrifuges (cascades) feeding one into the next and enriching the material a little more each time. Nonetheless, despite the success of the research led by Steenbeck at the Sinopi laboratory, the gas centrifuge methodology did not end up being used for uranium enrichment during the early stages of the Soviet atomic bomb programme.

Rather, Soviet leaders chose to move forward with the gas diffusion method of uranium enrichment and accordingly, research teams at Sinopi and Agudzera institutes prioritized research on gas diffusion and related equipment. Gas diffusion relies again on the relative weight of the isotopes: the fact that uranium 235 isotopes are lighter allows them to pass through a membrane more quickly. As with centrifuges, repeating this process many times enables enrichment.

Presumably, Soviet leaders believed that prioritizing the research on the gas diffusion method of isotope separation could increase chances for success and quick completion of the atomic bomb project. Indeed, the approach replicated methods applied in the United States under the Manhattan project. Many sources suggest that the Soviet Union made this particular decision on the basis of technical information Soviet leaders had received about the Manhattan project through intelligence sources[6].

During their research German scientists designed and industrialized production of the mass-spectrometer in the USSR, which is used for measuring the abundance of particular isotopes. Werner Schuetze, who designed the mass-spectrometer that was put into production and used at the gaseous diffusion plant in Sverdlovsk-44, received high awards from the Soviet regime. He was awarded the Stalin prize of the second rank for his work.[7] Another important success was the work of Reinhold Reichmann, who, parallel to Peter Thiessen, designed a technique for producing ceramic filters that could be protected from corrosion caused by uranium hexafluoride. The achievement was rewarded with high awards from the government: Thiessen and Mr. Sh. Burdiashvili were decorated with the Stalin award. Reinhold Reichmann died in 1948 and was

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[6] Schwartz, Michael, I., Summer 1996, “The Russian-A(merican) Bomb: The Role of Espionage in the Soviet Atomic Bomb Project.” J. Undergrad. Sci. 3: .103-108. http://www.hcs.harvard.edu/~jus/0302/schwartz.pdf

[7] Oleynikov P. V., 2000, German Scientists in the Soviet Atomic Project, The Nonproliferation Review/Summer p 1

posthumously awarded the Stalin Prize[8] . A number of other staff were awarded special orders.

From 1948 to 1953 Georgian labs were staffed mainly with German specialists, including world-renowned scientists and other high-level specialists, engineers, constructors, physicists and chemists. However, they were not involved in actual bomb development – rather their studies were limited to research on isotope separation, gaseous diffusion and related chemistry. As Ardenne recalled, "naturally, as time went on, it became possible to set new tasks or reshape old ones but our major priority was to perfect the methods of splitting uranium isotopes and their industrialisation. In order to fully resolve the problems identified by Hertz and our Institute, we decided to employ German scientists, technicians and mechanics from POW camps – for many of them it was in fact the only chance for survival." The early generation of German scientists and engineers predominated among lab personnel, though they were managed and tightly controlled by Soviet authorities and security agencies.

From the very first day of their creation, the laboratories were governed by NKVD Gen. Alexander Kochlavashvili, who was an official representative of the USSR Council of People's Commissars and effectively led both facilities from 1946. The same year Professor Ilia Kvartskhava was appointed deputy director of the laboratories in the sciences sector, and a small group of scientists from various cities of the Soviet Union (Moscow, Tbilisi and Leningrad) arrived to work there.

By 1953 the majority of the German specialists were allowed to return to Germany and from this period Soviet scientists increasingly began to take on the leadership of research and development projects in the labs. The research laboratories in Sinopi and Agudzera were reorganized and merged into a single institution, the Sokhumi Institute of Physics and Technology (SIPT), which was also known under its P.O. Box alias "Scientific Research Institute No.5 (SRI-5)". The formerly independent labs were transformed into departments of the new institute. At first SIPT was under the 9th department of the USSR Interior Ministry, while in 1953 it was re-subordinated to the Ministry of Medium Machine-Building Industry, the official name of the Soviet nuclear complex.[9]

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[8] Oleynikov P. V., 2000, German Scientists in the Soviet Atomic Project, The Nonproliferation Review/Summer p 13

[9] Newly arrived scientists at Sokhumi Institute were *Gverdtsiteli, K. Orjonikidze, O. Poroshin, S. Burdiashvili, D. Chkuaseli, I. Kirvalidze, V. Gusev* and *M. Guseva, R. Demirkhanov*, and others. The Ministry of Medium Machine-Building Industry of the USSR (Ministerstvo Srednego Mahsinostroenia) was one of the central government agencies of the Soviet Union, established by Decree of the Presidium of the Supreme Soviet of 26 June 1953, which was responsible

1.2. Nuclear research reactor

The year 1957 saw an important milestone for nuclear physics in Georgia. Construction began on the first-ever nuclear reactor in the South Caucasus – a research reactor near Tbilisi under the auspices of the Institute of Physics of the Georgian Academy of Sciences. Construction of the nuclear research reactor (NRR) was completed in autumn 1959 and it went operational that November. In the period from January 1960 to the end of 1987 the NRR normally operated five days a week.

The period of the reactor's construction was one of increased interest by the Soviet authorities in the peaceful use of atomic energy. At around this time, the construction of nuclear power plants began in research laboratories and institutes in different parts of Soviet Union as well as in allied states: China, Poland, Czechoslovakia, East Germany, and Romania. For the USSR, Russia's Kurchatov Nuclear Energy Institute and the Institute of Energy Technology Engineering were in charge of developing the main scientific concepts and design decisions for both research and power-generating nuclear reactors. IRT-2000 research reactors similar to those in Tbilisi[10] were also built in Moscow (the Institute of Nuclear Energy and the Moscow Educational Engineering and Physics Institute), Riga (1961), Minsk (1962), and Sverdlovsk (1962). In addition, with Soviet scientific and technical assistance, such research reactors were built in Bulgaria (1961), the People's Republic of China (1962), the Democratic People's Republic of Korea (1965) and Iraq (1967).

To launch the reactor, a delegation of scientists and specialists from the Moscow Atomic Energy Institute, led by V. V. Goncharov, head of the research nuclear reactors department, arrived in Tbilisi in 1959. The Georgian side was represented by a number of scientists from the Tbilisi Institute of Physics (TIP), including several researchers who graduated from the Moscow Engineering Physics Institute in 1957 and underwent special training at the Atomic Energy Institute during the construction of the NRR.[11] They were also involved in the production of various devices and special purpose systems for the reactor.

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for supervising the Soviet nuclear industry, including nuclear weapons production and R&D programmes in this sphere.

[10] The IRT-2000 reactor is a research reactor with a thermal power of 2000 kW, designed for research in the areas of reactor physics, neutron physics, radiation physics of semiconductors and dielectrics, radiation materials science, and nuclear physics.

[11] G. Karumidze and G. Garsevanishvili (both graduated the Moscow Engineering Physics Institute in 1957), as well as A. Manjavidze, N. Katamadze, S. Abramidze, and M. Tsulaia.

In the presence of the Russian delegation all the reactors' systems were checked and it was put through operational tests at different levels of power, including its full 2000 kilowatt operational capacity. On the basis of these checks, representatives of the Atomic Energy Institute and TIP[12] signed a document on the transfer of the IRT-2000 research nuclear reactor to the control of Georgian Academy of Sciences and gave the green light to its operation.

2. Georgian Nuclear Research in the Soviet Era: Pressures and Limits on Scientists

The launch of the reactor in Tbilisi and the laboratories near Sokhumi provided opportunities for many areas of nuclear research in Georgia. However, these opportunities came with limits on the benefits to Georgia and with strings attached that skewed the nature and direction of research, sometimes in a way that hindered advancement of the field. Georgia's Cold War research successes and failures, as well as some apparent achievements that look less successful in retrospect, are detailed below in sections 2.2-2.4.

The Soviet system tightly controlled the work of nuclear researchers and administrators at both military labs and ostensibly civilian facilities. Information about the exact location of nuclear facilities, their research programmes and the identity of researchers were classified. Even at the Tbilisi Institute of Physics, affiliated to the Georgian Academy of Sciences, topics of certain programmes and projects were classified and thus their implementation was controlled by the central Soviet government.

A 1971 NATO document[13] highlights the hierarchy of organizational relationships among different political institutions in Soviet Union. It shows the close links between the research and development community and the military-industrial complex and their subordination to the Council of Ministers of the USSR and its Commission for Military Industrial Affairs. The figure shows that the formulation as well as execution of the decisions related to military R&D policies were among the primary responsibilities of the Communist Party of the Soviet Union (CPSU): "The Central Committee of the CPSU is also supported by the responsible ministries and agencies for defence-oriented industries, science and education,

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[12] Representatives of the Atomic Energy Institute: I. G. Nikolayev, I. F. Chernilin, V. I. Bespalov and V. M. Vertogradsky; and TIP : V. I. Gomelauri, A. G. Manjavidze, N. M. Katamadze and G. N. Garsevanishvili

[13] "Report by the Military Committee on Soviet Science and Technology" MC 265/71, NATO Archives Science and Technology, 1971, p. 20,

which are also subject to party control and ideological indoctrination in defence plants and scientific and educational institutions"[14] (Picture 1).

NATO sources also confirm that the Soviet science and technology management system was highly centralized, with the outcomes of classified research programmes not made available to other Soviet scientists and engineers. At the same time, researchers and institutes had access to information about scientific developments reported in unclassified Soviet and foreign publications.[15]

In addition to control through official government institutions, the CPSU also kept a tight grip on the labs. For example, the Communist Party Central Committee archives show that the Tbilisi Institute of Physics (TIP) submitted regular reports to it as well as to the Council of Ministers and Ministry of Public Health about the situation and ongoing experiments at the Tbilisi research reactor.[16]

All repair or upgrade work at NRR was supervised by the Central Committee of the Communist Party (CPCC) of the Soviet Socialist Republic of Georgia as well as the Ministry of Public Health, the Department of Science, Culture and Education, the State Security Committee of the Council of Ministers, the Tbilisi City Council (the location of the Vaziani nuclear waste dump was within its jurisdiction), and the Physics Department of Tbilisi State University. Related official documents and correspondence were often endorsed by the CPCC First Secretary. Although there is no indication in the available archive documents that these officials were monitored by the State Security Committe (KGB), it may be assumed that the CPCC Georgian First Secretary rarely made independent decisions and most likely followed Moscow's strict instructions and directives.

The central authorities used both carrots and sticks to control nuclear research. According to Georgian scientists, scientific programmes and institutions that operated under the aegis of the Commission for Military-Industrial Affairs of the USSR Council of Ministers in Soviet times were given top priority in terms of funding and logistical support and supplies (in Soviet reality the latter was sometimes even more important than money).[17] Being shortlisted by the

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[14] Ibid.

[15] Ibid.

[16] File 39. 1958 – Minutes of the 11 July, 25 July and 15 August meetings (protocols 18, 20, 22) of the bureau of the Communist Party Central Committee, on measures to speed up the development of a nuclear reactor in Georgia, pp. 81, 88-89, 103-113.

[17] Dr. Aslan Suladze, (interview, 24.04.2012), a senior expert at the Caucasus Institute of Mineral Resources, 1976-1982, secretary of the problem application scientific council of the Academy of Sciences (interview, 24.04.2012)

commission was a great honour for any Soviet scientific institution. That is why all Soviet research and scientific centres and institutes, including those in Georgia, used to do their best to be included in the commission’s priority list. Among Georgian scientific institutions, the Sokhumi Institute of Physics and Technology and the Tbilisi Institute of Light Isotopes were in the commission’s list all along.

In addition, the Institute of Physics and the Institute of Cybernetics of the Georgian Academy of Sciences and the Institute of Applied Mathematics of Tbilisi State University received substantially more funds from the commission for their research than other Georgian scientific centres. This funding tended to skew priorities and encourage bold experiments aimed at securing funding, such as the Institute of Physics’ attempt to build a new, three-pool reactor (detailed below).

Meanwhile, other necessary but less remunerative aspects of operating these facilities tended to get short shrift from administrators, particularly safety norms. For instance, one of the archive files contains evidence that the CPCC held a special meeting in 1963 to discuss safety issues and the work conditions at the Tbilisi research reactor. The minutes of the meeting show that at the time the NRR was not entirely safe. Security at the site was inadequate, and there were not enough protective radiation suits and individual clothes lockers for the personnel (as a result, many of the personnel were forced to work in their casual clothes). There were also few washing devices and substances to clean the protective suits. Sanitary regulations were often violated there – for instance, personnel were allowed to eat at the site. One of the archive documents is an official order requiring operators to strictly adhere to the sanitary regulations.

Another sensitive issue addressed in the CPCC archive documents relates to the use of the Karsani dump for NRR radioactive waste storage in 1958-1961. According to the documents, the NRR stored radioactive substances in a temporary dump near the village of Karsani, in Mtskheta District without fencing or warning signs. From time to time scientists took radiation level readings at the site. Documents suggest that the radiation level fluctuated there – sometimes it was 4-5 times higher than the safety limit. Despite the danger of radiation exposure, local residents and livestock were able to enter the site and move around freely. That is why there was an obvious need to build a new dump (for both liquid and solid waste). The CPCC of Georgia established an ad hoc commission to examine the conditions at the NRR and the nuclear waste dump location at Karsani. The commission reported its findings and conclusions to the CPCC and Council of Ministers. Namely, the commission concluded that it was necessary to build a new nuclear waste dump (for both liquid and solid waste).

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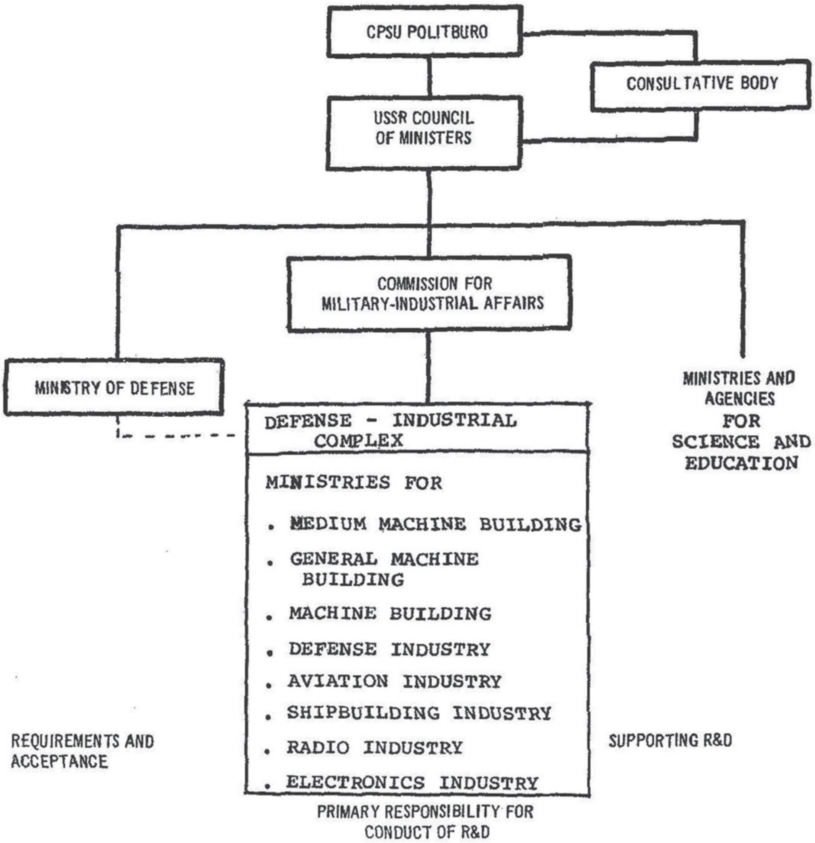

FIGURE 1-2 : MILITARY PRODUCT R&D ORGANIZATIONAL RELATIONSHIPS

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Part 1, Section 2

Figure 1: Military Product R&D Organizational Relationships

On the basis of the commission's report, on 5 June 1962 the Council of Ministers authorised the construction of a new dump in Vaziani.

2.2 Georgia's role in staffing and managing Cold War nuclear research in Georgia

For much of the Cold War, Georgian officials and scientists generally had little control over their research agenda or funding and Georgian research institutes were not necessarily staffed with Georgian graduates.

For instance, after 1949 SIPT had few opportunities for foreign cooperation and its administration was not entitled to decide appointments and other personnel-related issues independently. Its contacts with Georgian higher education institutions were also limited. That is why SIPT was staffed predominantly by researchers – graduates of various Soviet institutes and universities – from other regions of the USSR. It was not until 1953 that the first Georgian university graduates were assigned to the SIPT.

It should be noted that it was not until 1974 and thanks to the efforts of SIPT director R. Salukvadze that E. Slavsky, the minister for medium machine-engineering industry, authorized Tbilisi State University and the Georgian Technical University to serve as the main institutions to assign graduates to SIPT. The local university in Sokhumi was given the same role in 1981. After that date, local specialists were regularly appointed to various positions at SIPT; they were also able to maintain strong scientific relationships with the institutes of physics, cybernetics and metallurgy of the Georgian Academy of Sciences. However, SIPT scientific reports were never submitted either to the academic journals issued at the Georgian Academy of Sciences, or the Georgian Committee of Science and Technology or even the Department of Science of the Communist Party Central Committee.

In the late 1970s, the Soviet Academy of Science became a more influential actor and was responsible for coordinating the plans of all research institutions subordinated to the Academy System that were engaged in physical and social science research work.[18] During the same period, the State Committee for Science and Technology was tasked with coordinating plans for scientific research work and experimental development work carried out primarily in the nation's industrial research institutes and design bureaus[19]. The Georgian Academy of Sciences responded to the new developments by attempting to

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[18] NATO Archives, 1979, Report of the Military Committee on Science and Technology, p 26

[19] Ibid.

foster a greater role for local initiative. In particular, it formed a scientific council for applied problems – the first to be created in Georgia – in 1976. Its main purpose was to coordinate the classified research programmes of the research institutes and institutions of higher education (The USSR Academy of Sciences also had a similar body, an applied problems sector). In doing so, the Academy administration (President Ilia Vekua, Vice-President Irakli Gverdtsiteli) sought to ensure that the Academy had at least partial control over the classified research programmes and respective funds. The Academy's decision paved the way for a cooperation agreement between the Georgian Academy of Sciences and the Sokhumi Institute of Physics and Technology (under central subordination). It was in this context that the Georgian Academy of Sciences investigated the possibility of building a nuclear power plant in Georgia in the late 1970s (details below).

This effort to give freer rein to local initiative was short-lived, however. In 1978, E. Sekhniashvili was appointed as head of the CPCC Science Department. Moreover, the president of the Georgian Academy (I. Vekua) passed away and the vice-president (I. Gverdtsiteli) was replaced. In addition, the chairman of the science and engineering committee of the Council of Ministers resigned. As a result, TIP's ambitious project to build a new reactor was shelved indefinitely, while TIP Director E. Andronikashvili was accused of "voluntarism" by the Mathematics and Physics Department of the Academy of Sciences. In addition, another focus of the TIP research agenda – the idea of fundamentally rebuilding the NRR and building a new nuclear research pool reactor TTPR (Tbilisi Three-Zone Reactor), which would have been equipped with numerous low-temperature channels of scientific purposes – was shelved (see below).

2.3 Successes

2.3.1 Tbilisi Institute of Physics (TIP)

Despite the fact that in the highly centralised Soviet science management system nuclear researchers were not supposed to pick research themes and areas on their own, Georgian researchers managed to achieve some impressive technical successes.

One early success came in response to the need (detailed below) to devise a new cooling system for the Tbilisi research reactor not too long after it began operation. Research on the processes of thermal exchange in the reactor core uncovered new information that led to a new "artificial roughness" design to replace the previous smooth surface of the reactors' ЭК-10 fuel element. It also led to new heat exchangers [20]

These results allowed the reactor to increase its operating power safely: doubling the reactor's power to more than 4,000 kilowatts without increasing the maximum temperature on the surface of the ЭК-10's most thermally intense elements beyond 95˚ C, the accepted limit for safe operation of pool-type reactors. These impressive results were presented at international conferences[21] and published in the *Atomnaya Energiya* journal.[22]For this achievement, the USSR's Committee for Inventions and Discoveries presented to the Institute of Physics Patent Certificate 317327 for an invention called "fuel element for nuclear reactor" which was registered in the former Soviet Union's state registry of inventions on 13 July 1971. From October 1969, improved IRT-2M fuel elements, based on the Georgian design, were produced at Russia's premier Kurchatov Institute of Atomic Energy.

A 1972 letter to Tbilisi institute Director E. L. Andronikashvili from A. P. Aleksandrov, a researcher at the Kurchatov Institute, illustrates how important this Georgian research was to the overall Soviet nuclear energy programme:

> Intensification of thermal exchange in the reactor core could significantly increase reactor capacity and influence atomic energy development in general. In thermal reactors heat

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[20] The results of the comprehensive research on the influence of two-dimensional artificial ruggedness on the process of conventional thermal exchange intensification in the active zone of the reconstructed IRT-M reactor were presented at the 7th congress of USSR scientists on the scientific-research cooperation (Minsk, October 1968), as well as at a conference on the physics and technology of research reactors, which was held under the aegis of the USSR Atomic Energy Use State Committee and the USSR Academy of Sciences (Warsaw, December 1968). The results of the work which were linked with the increase in the IRT-M reactor capacity through the method of intensification of conventional thermal exchange under the influence of two-dimensional artificial ruggedness in the reactor's active zone were published in the Atomnaya Energiya magazine. In December 1968, the USSR's Committee for Inventions and Discoveries received an application for the invention of a rugged-surfaced thermal fuel element. On the basis of the submitted materials, the committee issued Patent Certificate 317327 to the Georgian Academy of Science's Institute of Physics regarding the invention called "fuel element for nuclear reactor". The certificate was registered in the former Soviet Union's state register of inventions on 13 July 1971.

[21] V. I. Gomelauri, Sh. P. Abramidze, December 1968, Report 5RC/122: "On the increase of capacity of the IRT-2000 nuclear reactor in Tbilisi to 4-6 megawatts". An international (limited to Socialist countries) Conference on Physics and Technology of Research Reactors, Warsaw.

[22] V. I. Gomelauri, Sh. P. Abramidze, 1969. "Investigation into the possibility of increasing the capacity of water-cooling reactors by way of intensification of thermal exchange at the expense of artificial rough edges," "Atomic Energy", 27, ed. 6, 547-549.

> transfer leads to a more efficient, smaller core, requiring less fuel and thus less expense.
>
> In this regard we would like your institute to become engaged in the development of highly productive fuel elements. At the moment, the task is limited to seeking a heat surface to ensure the operation of nuclear reactors at critical operational level.”[23].

Other TIP research at the NRR touched on such modern scientific disciplines as nuclear physics, neutron physics, solid-state radiation physics, low-temperature radiation materials, radiation chemistry and biophysics. One of the reactor team’s top priorities was to research solid-state physics and low-temperature radiation materials.

In 1961, the IRT-2000 reactor was equipped with its first experimental low-temperature channel, installed in one of the horizontal channels of the reactor. The construction of this low temperature channel made it possible to carry out low-temperature irradiation of samples allowing researchers to measure the changes in the qualities of samples subject to such irradiation (such as heat conductivity, electro-conductivity, mechanical firmness). These experiments modelled space conditions in the laboratories, at a time that the Soviet Union was reviving up its space programme.

During these years of the reactor’s operation, TIP officials designed and created more improved low-temperature channels of both horizontal and vertical type in order to carry out research at temperatures below that of liquefied nitrogen. In 1962, a relevant decree of the USSR Council of Ministers recognized TIP as the lead organization in low-temperature radiation material studies. In 1973, the institute became the base organization of the USSR Academy of Sciences’ United Scientific Council set up to resolve the complex problem of Solid-State Radiation Physics. The director of the Physics Institute, Academic E. L. Andronikashvili, was appointed chairman of this agency, a move which further strengthened the institute’s high scientific reputation.

In addition, scientists at the laboratory also designed and conrstructed equipment for research in the field of fundamental physics. In particular a neutron diffractometer was installed in the fifth channel of the NRR, which allowed the magnetic properties of materials to be studied with a cold beam of polarized neutrons. In late 80s the NRR terminated planned research and the experimental complex faced closure. In 1994 several scientists were invited to

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[23] Archive of the Institute of Physics, a letter of the director of the Kurchatov Institute of Atomic Energy, academic A. P. Aleksandrov to the director of the Institute of Physics, academic E. L. Andronikashvili (№ 46/187, date:10.07.72)

the Dubna Joint Institute of Nuclear Research (Russia) to continue studies. The Dubna institute purchased TIP's experimental complex at the cost of 1.7 million USD. In 1996, the experimental base was relocated to Dubna.

2.3.2. Sokhumi Institute of Physics and Technology (SIPT)

In SIPT's first years, similarly impressive research on plasma physics was carried out by the outstanding Georgian physicist and plasma physics specialist Ilia Kvaratskhava. SIPT carried out particularly intensive research into the sustainability of plasma systems,[24] which had been inspired by Sakharov's and Tam's ideas of the production of thermonuclear weapons, as well as by von Ardenne's research. In the 1950s, SIPT launched intensive research into thoroidal plasmas as well as the interaction between magnetized plasma and high-frequency electromagnetic fields[25].

In the 1950s, in parallel to Ardenne's and Steenbeck's research on an electromagnetic method of separation of uranium isotopes, SIPT physicists launched their initiative on the creation of the first high-energy beam injector for a particle accelerator. Research experiments conducted in SITP on plasmatrones demonstrated that the designed devices could be used to produce high-intensity protons and ion currents. These experiments laid the groundwork for the development of accelerator physics and technology in Georgia. Accordingly, the first ion injector (10 GEV sinchropazotron) in Dubna was produced by SIPT.

SIPT also conducted research in several directions of solid state physics. Metals, semiconductors and dielectric materials were intensively researched. The work was highly successful, with SIPT producing the Soviet Union's first monocrystals[26] of germanium and silicium.

In the 1950s, Kvartskhava led research which showed the existence of orderly space-periodic structures generated in plasma. In addition, discontinuous

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[24] According to Encyclopaedia Britannica, "a plasma is a gas that has had some substantial portion of its constituent atoms or molecules ionized by the dissociation of one or more of their electrons. These free electrons enable plasmas to conduct electric charges, and a plasma is the only state of matter in which thermonuclear reactions can occur in a self-sustaining manner."

[25] In a **toroidal plasma** an artificially created plasma is bent in a circle so as to close on itself for eliminating or minimizing end losses a cylindrical cross section – http://www.britannica.com/EBchecked/topic/599976/toroidal-plasma. In general, there are two basic methods of eliminating or minimizing end losses from an artificially created plasma: the production of **toroidal plasma**s and the use of magnetic mirrors (see nuclear fusion).

[26] Single crystal structures of more or less regular shape. Such monocrystals have been used in RTGs and have proven important in microelectronics.

acceleration of plasmons was found in the Z-pinch. These results prompted intensive studies by other scientists who confirmed the results obtained in Sokhumi. For example, American physicist G. McMillan confirmed the phenomenon of discontinuous acceleration of plasmons, which was later known as the Kvartskhava-McMillan electro-dynamic acceleration effect. In addition, certain progress was achieved in terms of the generation of high temperature plasma, when the plasma of density of $n=(2\div4)\ 10^{16}\ cm^3$ was produced at $T \leq 350{,}000^{o}$ temperature. For small size devices this could still be considered a relative success (in comparison with the experimental results obtained on big Tokamak systems).

At the beginning of the 1960s, under the directorship of Irakli Gverdtsiteli, SIPT became actively involved in the national-level Soviet programme on construction of autonomous electricity sources (radioisotope thermoelectric generators (RTGs)), which aimed to create sources of electricity to be used in space, underwater and other hard-to-reach places. These sources were designed to immediately transform heat from nuclear reactors or other radioactive sources into electricity.

Stable and problem-free operation of thousands of SIPT-made RTGs, which were tested and put to use in various conditions (underwater, in space, in deserts, etc) attest to their reliability. Among SIPT's achievements were Romashka (0.5 kilowatts), the world's first space RTG, created in 1964, and Lemon, a source of radionuclide electricity (2.2 watts), produced in 1966. Other SIPT-built devices include Etheri-Ma, which can be used underwater and other hard-to-access areas, and an RTG (3 kilowatts) working at 700^{o}C temperatures. Some other generators built in the SIPT received heat from the nuclear reactor through heat-transferring contours and were used in the Soviet Union as a source of electricity for onboard equipment on one of the serial satellites. It has been operational since 1975. In 1975-1987 the Soviet Union employed up to 50 RTGs in space.

In 1982-84 SIPT engineers created an independent source of electricity, titled Comfort, which can receive heat from any outdoor source (e.g. fire) though a thermal pipe and generate 60 watts of electricity. On the basis of this technology, in its final years SIPT created thermal couples, capable of operating within the temperature range of $+6^{\circ}$ to -25^{o}C, for freon-free refrigerators.

SIPT also was involved in the development of the unique space nuclear reactor TOPAZ, which relied on the use of thermionic emission in order to produce electricity from nuclear radiation more efficiently than that employed by

RPGs[27]. SIPT contributed to this project by designing, testing and debugging the electricity generating channel (the thermionic converter) and certifying it for mass production. The technology was sufficiently innovative that at one time in the early 1990s, the U.S. military was interested in buying two TOPAZ 2 reactors and they were displayed prominently at Albruck University in New Mexico. In all the above-mentioned projects SIPT maintained extensive scientific-technical cooperation with the I. Kurchatov Institute of Nuclear Energy and a number of other Soviet nuclear research centres, as well as with factories in such cities as Krasnaya Zvezda, Luch, and Ulbinsk.

From its early years SIPT put substantial effort into creating devices to gauge, control, analyse and manage radiation. Under the strong influence of German specialists, mass-spectrometers of unique parameters, beta and Pier Auger-spectroscopes, microscopes and other high-tech scientific devices were produced there. SIPT also created its own devices to measure parameters of hot plasma and, at the request of the Kurchatov Institute of Atomic Energy, it designed an electronic system of management for satellite nuclear sources.

After R. Salukvadze was appointed SIPT director in the 1970s, the institute began to research and develop radioelectronic instruments which were needed to build reliable secondary power sources for satellites. For example, when a common integrated satellite communications system was created in the USSR, several devices manufactured by SIPT were installed on each geostationary satellite as a secondary power source. Since SIPT was the only producer of a number of key devices and instruments in the Soviet Union, numerous Soviet scientific centres and enterprises closely cooperated with it. The customers demanded that SIPT start serial production of its instruments on its own. Only well-regarded enterprises were authorized by the central Soviet government to do so: the Moscow Institute of Radiation Technology and the Veshinsky Vacuum Institute, the St Petersburg-based plant Svetlana, the Moscow Radio Factory, the Krasnoyarsk electronic equipment plant, and several others. It is noteworthy that SIPT used to produce many devices that other centres were unable to manufacture. In its final years, beginning in 1989, SIPT became financially self-sufficient (which essentially meant that the central government stopped

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[27] Thermionic emission is the heat-induced flow of charge carriers from a surface or over a potential-energy barrier – Wikipedia**.** Thermionic emission, discharge of electrons from heated materials, widely used as a source of electrons in conventional electron tubes (e.g., television picture tubes) in the fields of electronics and communications. The phenomenon was first observed in 1883 by Thomas A. Edison as a passage of electricity from a filament to a plate of metal inside an incandescent lamp.
http://www.britannica.com/EBchecked/topic/591505/thermionic-emission

funding the institute) and began to manufacture sophisticated energy-efficient household equipment and products.

When SIPT was relocated to Tbilisi in 1993 (see below) it was able to survive only with financial assistance from the International Science and Technology Centre (ISTC) in Moscow and the Science and Technology Centre in Ukraine (STCU). In these years SIPT implemented more than 20 foreign-funded grant projects in close cooperation with both Georgian and former Soviet scientific institutions, as well as leading US and Western European scientific centres.

2.4 Challenges

The pressures on scientists in the Soviet Union often encouraged making claims of success that later turned out to be false or only partially true. One example concerned the Tbilisi research reactor. As indicated above, not long after the reactor's celebratory launch, it became clear that there were serious defects in both the fundamental structure of the core and its cooling system and plans were laid for its reconstruction.[28] The renovated reactor resumed operation in August 1968 and operated at around 5000 kilowatts from October 1969 to September 1973, using the newly improved IRT-2M fuel elements.

But the pressure on research institutes in the Soviet Union to compete for prestige and funding appear to have led soon thereafter to additional ill-fated projects at the Tbilisi Institute of Physics, including a second reconstruction of the NRR in 1973-1975. The reconstruction included the following measures: Replacing the aluminium reactor vessel with a corrosion-resistant tank; adding a newly designed horizontal experimental channel creating a strong low-temperature region within the reactor; adding a separate pool close to the reactor for temporary storage of the spent fuel cassettes containing ЭК-10 fuel elements and IRT-2M type fuel elements.

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[28] Hydrodynamic research showed that as the coolant passed through the active zone, ЭК-10 fuel element containing cassettes as well as these fuel elements, vibrated strongly because of the upward current of the coolant. Therefore, due to excessive use of the coolant in the active zone, to prevent serious accidents caused as a result of the generation of the vibration of the ЭК-10 fuel element containing cassettes, it was decided to reduce the 190-195 m3 per hour regularity of the coolant use in the first contour of the reactor's cooling system. As a result, the vibration of the ЭК-10 fuel element-containing operational cassettes was fully eliminated but, at the same time, the reactor's operational capacity fell from 2,000 kilowatts to 1,000-1,200 kilowatts, which for its part led to the decrease in the intensity of neutron currents in the reactor's experimental channels. The second substantial defect of the IRT-2000 reactor project was the structure of the active zone itself.

After the reconstruction, a decision was made by the administrations of NRR and TIP, to increase the NRR's operational capacity from 4,500 to 8,000 kilowatts, which meant upgrading the NRR to the maximum capacity with maximum permissible temperature (95 degrees Celsius) on the fuel element surface. Experimental checks following the decision, at power levels from 3500 to 8500 kilowatts, were said to indicate that the reactor could be operated safely (i.e. without fuel elements exceeding the maximum permissible temperature.

In December 1975, the results of the NRR experiments and its operational programme at the increased capacity of 8000 kilowatts were presented to scientists at the Kurchatov Institute of Atomic Energy. V. V. Goncharov, the head of the institute's nuclear research reactors department, responded with a telegram, reading: "We read with great interest your information about the increase of the capacity of the institute's research reactor to 8 megawatts. I congratulate you on this achievement. We would like to hear about your plans regarding further increase of the capacity. We would appreciate it if you could send us calculations and experimental evidence of the increased capacity. V. V. Goncharov, 11 December 1975."

In addition, in September 1976, P. M. Yegorenkov, head of the laboratory of the nuclear research reactors department at the Kurchatov Institute made the following comment: "The centre's staff in 1975 carried out experimental works and calculations to look into the possibilities of increasing the reactor's capacity under the current cooling system. As a result of the works, a test was carried out at the reactor at a capacity of 8 megawatts. It was shown that the reactor can operate at the capacity of 8 megawatts for six months a year. During the remaining six months the reactor's nominal capacity can be 6 megawatts."
So, one of the main events of 1976 related to NRR was the fact that the USSR Nuclear Safety Main State Inspector awarded the certificate № 6-1 ИР which confirmed that NRR could operate at the capacity of up to 8000 kilowatts (issued on 1 December 1976). Nonetheless, in the following years NRR operated at a power level of no more than 5000 kilowatts because operation at the 8000 kilowatt level required increasing the productivity of the secondary cooling loop which was not possible at that time . Therefore, in November 1986 on the basis of materials TIP had submitted to the GOSATOMNADZOR (USSR atomic regulatory body), the first department of this agency issued a new certificate (№ 6-2 ИР) to certify operations of the NRR at 5 megawatts capacity.

It is noteworthy, however, that today many TIP researchers claim that the 1976 experiments at NRR were too risky while their scientific value was questionable. Experts also say that the USSR Nuclear Safety Main State Inspector's permission to operate the NRR at the increased capacity endangered the safety of NRR personnel and the general public. Accordingly, one could suggest that such low-value but risky experiments were conducted at NRR due to bitter rivalry between various Soviet nuclear facilities, which often vied with each other for state funds. In addition, many Soviet scientists and scientific institutions considered such methods an appropriate way to gain prominence.

2.5 Unsuccessful initiatives

2.5. 1 Tbilisi Three-Zone Reactor

As mentioned earlier, the scientific council at the Georgian Academy of Sciences (chaired by E.L. Andronikashvili and created solely to work on the problem of the Solid-State Eradiation Physics) and the TIP leadership in the 1970s jointly initiated the idea of building a new nuclear research pool reactor (Tbilisi Three-Zone Reactor or TTZR) to be equipped with numerous low-temperature channels for various purposes. According to scientists this new equipment was necessary to expand the area of experimental research in the field of material studies of low temperature radiation (applicable to the conditions in space). In particular, a new layout was needed to provide the capability to simultaneously carry out various experiments. The initiative was supported by the Georgian Communist Party authorities: On 27 July 1971, the Georgian Communist Party Central Committee (CPCC) and the Georgian Council of Ministers adopted a joint decree №408-31 to construct a specialized three-zone reactor and operate it on the premises of the nuclear centre.

The construction of the TTZR began in August 1972 with the technology designed by TIP and the engineering/construction portion of the project designed by the SAKSAKHPROJECT (Georgian State Project) at the instruction of the Academy of Sciences' presidium with the participation of the Soviet Specialized Engineering Institute (Moscow Scientific-Research and Construction Institute of Energy Technology and the Engineering Institute of Energy Technology). But TIP Director E. Andronikashvili and his deputy, G. Karumidze, endorsed the project only in 1978, when much of the planned construction and design work had been carried out (a 9-metre deep hole to accommodate the lower technological part of the TTZR pool; the main TTZR building with 11,100 square metres and 1150 acres of adjacent territory, the upper part of the reactor and a water pool, for radiation protection. Yet, there were crucial lapses in the project- the project budget had not been fully defined and it appeared that the TTZR project was incomplete and, most importantly, its construction had not been coordinated and approved with the USSR regulatory body, GOSATOMNADZOR. Consequently, the project was halted and the construction work stopped. The facility was not completed until 1989, when the Georgian Academy of Sciences deemed it inexpedient to continue its work.[29]

2.5.2 Nuclear Power Plant in Georgia

Another ambitious plan—the construction of a nuclear power plant in Georgia—also fell through. The earliest reference to the nuclear power plant project can be found the archives of the Georgian Communist Party from 1974. The Georgian Academy of Sciences' probe into the possibility of building a nuclear power plant in Georgia was premised on the assumption that Georgia's energy-generating capacity would fall short of the country's needs. The energy capacity assessment report prepared at that time projected that in 1985-87 Georgia's power generation would fall into deficit and the country would need to add 7-8 megawatts to its generation capacity to overcome the shortage.

Moreover, the report contended that after Georgia's biggest hydroelectric power plant was connected to the USSR central power supply grid, Georgia would face a shortage of basic energy resources and not been able to rely on domestic sources for energy to satisfy its needs. The report claimed also that the shortage of energy in Georgia would reach dangerous levels in 1995-97.

At that time CPCC decided that nuclear power generation was the best way to address this challenge. According to documents found in the archives, a 51-member ad hoc commission was created in 1979 to find and explore potential sites for a nuclear power plant on Georgian territory. It was made up of scientists, engineers, and high-ranking Communist Party functionaries. The documents issued by the commission bore the signature of Eduard Shevardnadze, the first secretary of the Communist Party of Georgia, and were addressed to the Ministry of Medium Machine-Building industry. The commission even elaborated a technical design for a nuclear power station, which was also endorsed by the first secretary.

The commission used the following criteria to identify appropriate sites for building a nuclear power station in Georgia: Stable water supply; favourable weather; low seismic activity; analysis of biogeography and ground water; proximity to major highways and potential electricity users.

It examined five districts in Georgia – Gali, Gurjaani, Kutaisi-Zestaponi, Javakheti and Dedoplistkaro. For each geographical area two or more locations were

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[29] Resolution № 201 of the Presidium of the Academy of Sciences of Georgia, dated 6 July 1989

studied and special reports for each location were released. Each of these districts failed to meet the criteria listed above.

2.5.3 Uranium Expeditions in Georgia

Nor were expeditions to find uranium deposits in Georgia successful.
A special geological expedition was set up at the central Soviet government's order to search for uranium deposits in the Soviet Union in 1943. Georgia became one of the first USSR republics where such specialized uranium search expeditions was launched. [30]
Given the strategic importance of uranium resources, a large-scale survey operation, a Massive Uranium Search Project (MUSP), began in the country in 1943. A geophysicist was assigned to virtually every geological expedition. This position was usually filled by young physicists trained in nuclear physics and atomic energy. They were equipped with simple radiation detection devices and responsible for monitoring/analysing the level of radiation *in situ*. The data collected by all the expeditions was then combined and turned over to a special, relatively better equipped, expedition for in-depth analysis. In this case, the special expedition members were required to send all findings and conclusions to the so-called Koltsov Expedition (named after its head, based in the town of Yessentuki, in Russia's Stavropol Territory. The Koltsov Expedition was responsible for coordinating all search and survey expeditions both in the South Caucasus (Armenia, Azerbaijan, Georgia) and the Russian North Caucasus.

The USSR Ministry of Geology was operationally in charge of MUSP, while the USSR Ministry of Medium Machine-Building Industries was tasked to coordinate and supervise all of the work. There is no information as to who headed the first uranium search expedition in Georgia. After the 1960s, however, the identity of the expedition heads was no longer concealed, presumably because the Soviet authorities lifted the veil of secrecy from the subject. It is known that in different periods the Georgian expedition was led by geologists Kakabadze, Turmanidze, and Natsvaladze. The lower level of secrecy may be explained by the fact that no uranium deposits were ever discovered in Georgia[31].

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[30] This section is based on interviews with Georgian scientists – Murman Kvinikadze, Ph.D. in geology and mineralogy, the head of the department of geo-ecology and applied geochemistry of the Caucasus Institute of Mineral Resources, a laureate of the State Award of Georgia (interview, 29.04.2012); Givi Tumanishvili, Ph.D. in geology and mineralogy, a senior researcher of the department of geo-ecology and applied geochemistry of the Caucasus Institute of Mineral Resources, a long-standing member of special survey and search geological expeditions (interview, 29,04,2012)

[31] Dr. Aslan Suladze, a senior expert of the Caucasus Institute of Mineral Resources, 1976-1982, secretary of the problem application scientific council of the Academy of Sciences (interview,

Because no uranium deposits suitable for processing were found in Georgia, many geological expeditions ended up concentrating on the Kvirila area (western Georgia), which was well known as having the highest level of radiation in Georgia. The expeditions were to monitor and measure the level of radiation and identify local sites of radioactive pollution. For instance, one task was to detect and track the trail of atmospheric nuclear tests.[32]

In In 1987-89, in line with the central Soviet government's relevant directive, the special Georgian geological expedition focused its attention on looking for and monitoring radioactive pollution sites on Georgian territory caused by the Chernobyl nuclear disaster. In this period the expedition discovered extremely high levels of radioactive contamination in several areas of western Georgia, particularly in Zestaponi District. Some scientists interviewed during the research, admitted that in the late 1980s several laboratories detected contaminated food (meat, dairy products) imported from Ukraine. They confirm that these products were intended for public consumption and that, thanks to scientists' efforts the threat to Georgian consumers was neutralized (products were sent back to producers)[33].

Following the collapse of the USSR, the expedition was disbanded in 1991.

Although the special Georgian geological expedition was supposed to send all its findings and gathered materials to Russia and was prohibited from keeping any files in Tbilisi, the Georgian researchers managed to compile a large amount of hand-written data (more than 1,000 pieces) which is now stored at the scientific institute's archive. These materials provide a unique opportunity to map the dynamic of the environmental and radioactive situation in Georgia over the past 60 years.[34]

24.04.2012)

[32] Sources of information: interviews with Georgian scientists – Murman Kvinikadze, Ph.D. in geology and mineralogy, the head of the department of geo-ecology and applied geochemistry of the Caucasus Institute of Mineral Resources, a laureate of the State Award of Georgia (interview, 29.04.2012); Givi Tumanishvili, Ph.D. in geology and mineralogy, a senior researcher of the department of geo-ecology and applied geochemistry of the Caucasus Institute of Mineral Resources, a long-standing member of special survey and search geological expeditions (interview, 29.04.2012)

[33] Dr. Aslan Suladze, a senior expert of the Caucasus Institute of Mineral Resources, 1976-1982, secretary of the problem application scientific council of the Academy of Sciences (interview, 24.04.2012)

[34] Sources of information: interviews with Georgian scientists – Murman Kvinikadze, Ph.D. in geology and mineralogy, the head of the department of geo-ecology and applied geochemistry of the Caucasus Institute of Mineral Resources, a laureate of the State Award of Georgia (interview, 29.04.2012); Givi Tumanishvili, Ph.D. in geology and mineralogy, a senior researcher

In 1993 then-President Eduard Shevardnadze ordered the creation of a special geosphere monitoring expedition. The core of its researchers is formed by former members of the Georgian uranium search expedition. In addition, many of the expedition's former members currently work in the Caucasus Institute of Mineral Resources, in Georgia.

3. The End of the Soviet Era and Beyond

3.1 Nuclear Research Reactor

The nuclear accident at the Chernobyl Nuclear Power Station on 26 April 1986 had ramifications in Georgia far beyond affecting the focus of geological expeditions. In January 1988 GOSATOMNADZOR ordered the NRR to suspend operations in order to enable a special interdepartmental body to carry out a mandatory comprehensive examination of its pool and equipment. The decision was prompted by the Chernobyl accident, as in its aftermath, all USSR nuclear reactors were ordered to undergo safety checks.

The experts from GOSATOMNADZOR, led by a representative of the Moscow Research Institute of Energy, carried out a careful examination of the NRR in August-September 1988. At the commission's recommendation, the NRR control and emergency systems, as well as its main technological elements, were upgraded and improved. The work ended in March 1990 (the respective protocol was endorsed by inspectors of GOSATOMNADZOR on 19.03.1990).

However, on 30 March 1990, the Georgian Academy of Sciences' presidium decided to shut down and decommission the NRR, taking into consideration its limited operational potential and increasing protests of the Georgian public and newly established civil society organizations against the presence of a nuclear facility so close to the capital Tbilisi. In particular, several protests rallies took place close to NRR facility, led by the leaders of the Georgian Green Movement and supported by young activists, during which possibility of restoring it to operation it was sharply criticized. TIP and the Department of Mathematics and Physics of the Academy of Sciences were ordered to plan all necessary measures for NRR's termination and decommissioning. The decommissioning plan and programme were presented to the USSR Academy of Sciences, the USSR State Committee for the Use of Atomic Energy, the Kurchatov Atomic Energy Institute,

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of the department of geo-ecology and applied geochemistry of the Caucasus Institute of Mineral Resources, a long-standing member of special survey and search geological expeditions (interview, 29.04.2012) the Moscow Scientific-Research and Engineering Institute, the USSR Engineering Institute and the USSR Atomic Energy Oversight Agency.

Moreover, in 1989, when the Soviet Union was still in existence, the central Soviet government had issued a secret decree to stop funding for any classified research in Georgia.[35]

3. 2 SIPT and the Post-USSR Transition

Due to the 1992-93 Georgian-Abkhaz conflict that followed the demise of the USSR, the Georgian government lost control over SIPT. In September 1993 some 200 of the institute's staff fled the escalation of violence in Abkhazia and moved from Sokhumi to Tbilisi. They formed the core of the Tbilisi-based Sokhumi Institute of Physics and Technology. The rest of the personnel chose to stay and continue their work in Abkhazia under the supervision of the Russian Academy of Sciences.[36] In 1998 SIPT director Revaz Salukvadze admitted that, together with several Russian research institutes, the SIPT had participated in many classified research projects and in many cases SIPT administration did not have full knowledge of what substances and materials were kept in SIPT labs (for more details on e.g. storage of highly enriched uranium, see the chapter on "Nuclear Nonproliferation Policy Development in Independent Georgia".

4. Conclusions

As this chapter makes clear, the history of nuclear physics as a scientific discipline in Georgia originated in parallel with the Soviet atomic bomb project at the end of the World War II in 1945. It then led to the emergence of several large scientific centres.

The paper presents an in-depth description of how these research centres were established and provides insight into their operational peculiarities. The paper shows how science in general, and nuclear physics in particular, was organized, planned and administered in Soviet Georgia. The analysis of the nuclear physics development in Soviet Georgia brings forward some of the interesting findings that are open to follow-up discussions and research.

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[35] Interview with George Begiashvili, Ph.D., a senior expert of the Caucasus Institute of Mineral Resources, 1960-1982; a researcher at the Institute of Cybernetics of the Academy of Sciences, the head of a department, 1982-1987; director of the USSR research institute Volna, a laureate of the Council of Ministers' state award (interview was taken on 24.04.2012)

[36] In the same period some 250,000 ethnic Georgian residents of Abkhazia were forced to leave Abkhaz territory.

The paper demonstrates that scientists and engineers of nuclear research programmes, had very limited, if any, access to the information regarding the general nuclear programmes they were involved in. The paper provides an overall picture of the level of secrecy in nuclear research facilities and its influence over specifics of nuclear sector management and decision-making.

The research results indicate a lack of participation by scientists in long-term research plans development, which obviously limited their level of independence and ensured the CPCC’s strict control over the scientific career service. In addition, material and technical resources of nuclear research facilities also remained under the tight supervision of the CPCC, while access to wide-scale financial resources for nuclear research was closely linked to the Soviet military-industrial complex. The paper shows how Georgian scientists attempted to enlarge their research agenda and draw the central government’s attention to their work by carrying out rather risky experiments. However, the government turned out to be unable to properly assess and understand their approaches and denied them permission to expand nuclear research in what may have been more promising positive directions.

Contrary to the established view, which claims that Soviet nuclear physicists enjoyed unusual intellectual autonomy for a totalitarian political system, the given research showed that Georgian physicists experienced very limited scientific freedom. Efforts made by high ranking Georgian scientists to open up the level of scientific independence and initiate innovative programmes failed, while initiators were accused of “voluntarism”. In addition the failure of the Georgian Academy of Sciences to coordinate research activities, share achievements and plans among Georgian scientists, as well as ensure applicability of the research outcomes, decreased the continuity and efficacy of the research.

It can be concluded that Soviet experience of totalitarian management of science hampered Georgia’s ability to make its scientific resources and achievements applicable for further research and development in the long run. Independent Georgia’s political and administrative system, with its limited human and material resources, was unable to exorcise Soviet Georgia’s scientific legacy and keep all the facilities established during the Soviet period operational. It is true that Georgian scientists, nuclear scientists among them, personally continued to be quite successful in their careers and contribute intensively to scientific programmes around the world, but their personal achievements did not contribute to long-term sustainability of this technological infrastructure: the scale of nuclear research implemented in Georgia currently is nowhere near that of the Soviet times.

Soviet Nuclear Legacy in Georgia

Shalva Dzebisashvili

The role that nuclear weapons played in Georgia and South Caucasus during the Soviet era is an open historical question. Researchers have had access to information on the types of delivery systems that were deployed in the Transcaucasus military District, which included Georgia and to less degree Armenia and Azerbaijan. The historical record is also clear that no Soviet strategic nuclear weapons were deployed in Georgia. However, to what extent non-strategic (tactical) nuclear military capabilities were stored or deployed in the region remains an unsettled issue.

Based on interviews with relevant actors and an investigation of available historical documents, this study attempts to offer a reasonable if not conclusive answer to this question. It indicates that Soviet commanders envisioned the potential use of tactical nuclear weapons from Georgia in any conflict with NATO in Turkey. It also demonstrates that there was a high probability that non-strategic nuclear warheads were in the region either in storage or deployment and perhaps stored at the Vaziani (Georgia, near Tbilisi) central supply-base. However, it is impossible to give an unequivocal answer to the question whether the nuclear component were typically deployed with military units in the Transcaucasus or remained in storage. Some sources say that the total number of tactical nuclear weapons reached 320 in Georgian, 200 in Armenia, and 75 in Azerbaijan. According to other sources, compact nuclear warheads (for example, 152-mm shells) could be stored half disassembled and it would be possible to assemble them quickly in case of the imminent war. This was presumably due to the fact that the technical maintenance was difficult and it was necessary to replace components periodically. Our analysis also leaves open the possibility that nuclear combat materials could have been introduced for a short period in times of crises or major exercises.

This study begins with a look at the strategic rationale for placing Soviet nuclear weapons in the region during war. It describes the structure of the Transcaucasus Military District (ZAKVO/GRVZ) and the military units and facilities that hosted or could have hosted non-strategic nuclear weapons. It then looks at the likely process for the withdrawal of these weapons as the Soviet Union was imploding. Given the dynamics of changes in the military district and history of the development of non-strategic nuclear weapons in the Soviet Union, the study mostly focuses on the period from 1970 to 1990, when the structure of the Transcaucasus Military District remained comparatively unchanged and it was possible to resort to full-scale operational deployment of tactical nuclear weapons.

1. The South Caucasus in the Military (Nuclear) Planning of the Soviet Union and the NATO

During the Cold War, the military doctrines of both the Soviet Union and NATO regarded the South Caucasus region as an area of possible confrontation. For NATO, deployment of nuclear weapons in an area that could become the target of an attack was regarded as the best deterrence tool against the conventionally superior Soviet Union. Soviet nuclear weapon deployments to the region, in turn were largely an attempt to block this NATO counter and preserve conventional advantage.

1.1 NATO's Nuclear Calculus

According to NATO's strategic and operational assessments in the late 1950s, the 96 divisions of the alliance would by no means be able to cope with 175 fully equipped Soviet divisions. Therefore, the use of nuclear weapons would allow the alliance to reduce the number of necessary additional divisions to 30.

This was particularly true for Turkey:
"When Turkey joined NATO, the parties tacitly agreed that the Turks would help contain the Soviet Union. Should deterrence fail, Turkey would have made its facilities available to NATO and would have distracted as many Soviet forces as possible from a campaign in Central Europe. The military thinking of the Alliance focused on the central front as the main area of the Soviet/Warsaw Pact threat, putting an overwhelming emphasis on the contingency of a massive attack through Germany into Western Europe. ... The Soviet Union's growing military presence both in quantitative and qualitative terms across the southern flank of NATO prompted the Alliance in general and Turkey in particular to rely extensively (though gradually) on nuclear forces."

NATO's actions in this regard began with a 1957 decision to deploy intermediate-range Jupiter missiles.[1] Deployed in Turkey beginning in 1960, they were able to

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[1] http://old.nasledie.ru/voenpol/14_15/article.php?art=3, Тактическое ядерное оружие на рубеже XXI века; http://www.db.niss.gov.ua/docs/polmil/51.pdf, А.И. Шевцов, А.И. Ижак, А.В. Гавриш, А.Н. Чумаков, Тактическое ядерное оружие в Европе:перспективы

reach targets well into the Soviet Union[2] and to destroy all Soviet intercontinental ballistic missiles (strategic forces) within 1,500 nautical miles.[3]

Initially, these deployments of regional weapons were a matter of necessity before the development of the US intercontinental sea and land-based legs. But once they were in place, NATO members, including Turkey, found it difficult to part with them. In part, that was because the early intercontinental ballistic missiles deployed on US territory were not very precise and it was possible to destroy Soviet targets with more precision using shorter-range weapons in Turkey. But it was also because Turkey and other allies began to regard the deployment of US nuclear weapons on their territories as a major proof of US nuclear guarantees. For instance, Turkey in 1961 rejected Kennedy Administration suggestions that forward deployment of intermediate-range Jupiter missiles was no longer necessary with the development of Polaris submarine-launched strategic ballistic missiles. By March 1962, 15 Jupiter missiles were deployed in Turkey in an attempt to reassure Turks about US willingness to wield its nuclear deterrent.[4]

This tendency continued even after the longer-range regional weapons were withdrawn from Turkey several years later. As NATO declassified documents reveal, the alliance continued to rely on shorter-range tactical nuclear weapons in the Turkish theatre that were seen as necessary to balance Soviet conventional superiority and delay potential Soviet advances into east Anatolia. For instance on March 13, 1968 an Operational Plan for a Defensive Obstacle System for Eastern Turkey was proposed, which urged using Atomic Demolition Munitions (ADMs) due to the “extreme sensitivity of SACEUR’s plan to the security of the Turkish Third Army and the Defence of Eastern Turkey”.[5] The degree of NATO’s being concerned about Soviet military supremacy (even in aviation), is shown by another excerpt, which suggests that the comments of Military Committee seem to have been urgently forwarded without having received formal national guidance in all cases.[6] Indeed, until and even after the Soviet collapse U.S. B61-nuclear bombs have been deployed in Turkey **to reassure** the Turks about U.S. deterrent credibility. During the Cuban Missile Crisis (what the Soviet Union

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обеспечения стабильности, Днепропетровск 1999, Национальный институт стратегических исследований Днепропетровский филиал, p 9.

[2] http://www.u-s-history.com/pages/h1736.html

[3] http://www.globalsecurity.org/wmd/systems/jupiter.htm

[4] Phillip Nash. The Other Missiles of October: Eisenhower, Kennedy and the Jupiters, 1957-1963. Universit of North Carolina Press, (1997):1

[5] NATO, NAMC 55/68, 13 March 1968, IMS Control N 0040, Memorandum for the Members of the Military Committee, p.1

[6] Ibid. 2-3, on aviation see p.7

called the “Caribbean Crisis”), the United States expected the Soviet Union to occupy Turkey in retaliation for an invasion of Cuba.[7]

The solution to the Fall 1962 crisis in turn hinged on a trade of the Russian missiles in Cuba for the Jupiters in Turkey. In April 1963, the United States withdrew all of its Jupiter-type missiles from Turkey.[8] The only type of nuclear weapons that remained on the bases (Incirlik, Balikesir, and Akinci) were tactical B-61- gravity bombs[9] . Given the fact that aviation bombs were the only type of tactical nuclear weapons on Turkish territory and their number was not constant,[10] they could only be transported by the following aircraft: US Phantom F4, F16 or Turkish Phantoms, F-100, F-104 or F15,[11] which could deliver strikes on all targets in the Transcaucasus Military District within the radius of 860 km.[12] While this weapons (B61) lacked the reach of the Jupiters and required NATO pilots to overcome Soviet air defences, the deployment of US tactical nuclear weapons close to the Soviet border made it possible to complete some strategic missions—that is attacking the Soviet homeland-- using tactical systems, which confirmed that it was difficult to clearly divide strategic and non-strategic systems.[13]

Some tactical nuclear weapons in Turkey, in turn, were removed beginning in 1974, when the United States had to remove warheads from Greek and Turkish bombers and stockpile them due to the threat of war between the two countries.[14] By 1992, the number of bombs had been reduced from 467 to 150.[15]

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[7] Dynamics of trust and distrust : An analysis of the Cuban Missile Crisis, Alex Gillespie, University of Stirling, 2008, pp10-11.

[8] Phillip Nash. The Other Missiles of October: Eisenhower, Kennedy and the Jupiters, 1957-1963. Universit of North Carolina Press, (1997):144

[9] http://www.nuclearfiles.org/menu/key-issues/nuclear-weapons/history/cold-war/cuban-missile-crisis/timeline.htm, October 28, 1959.

[10] http://www.silkroadstudies.org/new/inside/turkey/2010/100412A.html, Turkey Analyst, vol. 3 no. 7, 12 April 2010, THE FUTURE OF NATO’S NUCLEAR WEAPONS ON TURKISH SOIL, Richard Weitz.

[11] http://www.armscontrol.org/act/2010_06/Kibaroglu, U.S. Nuclear Weapons in Turkey, Mustafa Kibaroglu, Reassessing the Role of U.S. Nuclear Weapons in Turkey.

[12] http://www.af.mil/information/factsheets/factsheet.asp?id=103

[13] Ibid. p.10

[14] http://www.nrdc.org/nuclear/euro/euro.pdf, U.S. Nuclear Weapons in Europe , A Review of Post-Cold War Policy, Force Levels, and War Planning, Hans M. Kristensen / Natural Resources Defense Council, 2005, 1200 New York Avenue, N.E., Suite 400, Washington, D.C. 20005, p 25.

[15] НЕСТРАТЕГИЧЕСКОЕ ЯДЕРНОЕ ОРУЖИЕ ПРОБЛЕМЫ КОНТРОЛЯ И СОКРАЩЕНИЯ, Центр по изучению проблем разоружения, энергетики и экологии Московский физико-технический институт 2004, А.С. Дьяков, Е.В. Мясников, Т.Т. Кадышев. – Издание Центра по изучению проблем разоружения, энергетики и экологии при МФТИ, Долгопрудный, 2004 г, http://www.armscontrol.ru/pubs/NSNW_print_v2d.pdf, Таблица 6. Динамика сокращения НЯО США в Европе, p 42.

1.2 The Soviet Nuclear Calculus

The Soviet nuclear calculus for the region was considerably different from NATO's. From the Soviet viewpoint, the Anatolian military theatre was not a decisive factor in achieving a general victory.[16] Document on command staff exercises only considered the intrusion of Soviet forces into the theatre in order to make it possible for the main Soviet forces to deliver a strike on the 1st Field Army in Thrace or elsewhere in Europe.

While NATO foresaw nuclear weapon use being potentially restricted to the use of tactical nuclear weapons in a restricted geographic area to counter Soviet conventional forces, the Soviet Union, believed that a conflict might lead to a total nuclear confrontation in the European and Transcaucasus theatres. Therefore like the United States, the Soviet Union was postured to deliver a nuclear first strike against its rival. In the event of a conflict, Soviet strategic plans envisaged joint efforts of strategic and non-strategic nuclear forces and conventional units for the full destruction of the enemy, the occupation of its territory, and final victory.[17]

According to the Soviet military vision, tactical nuclear weapons had a number of missions: medium and long-range sea and air-launched guided missiles were to destroy command, control, and communication centres; tactical aviation nuclear bombs and short-range air-to-ground missiles were to destroy units within the operational theater; and tactical surface-to-surface missiles were meant to cut off the striking areas by destroying enemy (striking area is not the operational theatre, which is much larger, but the area of actual impact-*author*) second echelons , supplies and reinforcement.[18] The Soviet military envisioned using tactical nuclear weapons to deter NATO from using its own tactical nuclear weapons, and, to significantly raise the combat potential of the Soviet conventional forces.[19]

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[16] http://vif2ne.ru/nvk/forum/arhprint/2223527

[17] http://www.db.niss.gov.ua/docs/polmil/51.pdf, А.И.Шевцов, А.И.Ижак, А.В.Гавриш, А.Н.Чумаков, Тактическое ядерное оружие в Европе:перспективы обеспечения стабильности, Днепропетровск 1999, Национальный институт стратегических исследований Днепропетровский филиал, pp 11-12.

[18] http://www.db.niss.gov.ua/docs/polmil/51.pdf, А.И.Шевцов, А.И.Ижак, А.В.Гавриш, А.Н.Чумаков, Тактическое ядерное оружие в Европе:перспективы обеспечения стабильности, Днепропетровск 1999, Национальный институт стратегических исследований Днепропетровский филиал, p 10.

[19] НЕСТРАТЕГИЧЕСКОЕ ЯДЕРНОЕ ОРУЖИЕ, ПРОБЛЕМЫ КОНТРОЛЯ И СОКРАЩЕНИЯ, Центр по изучению проблем разоружения, энергетики и экологии Московский физико-технический институт 2004, А.С. Дьяков, Е.В. Мясников, Т.Т. Кадышев. – Издание Центра по изучению проблем разоружения, энергетики и экологии при МФТИ, Долгопрудный,

After quantitative parity in tactical nuclear weapons was reached between the Soviet Union and the United States in the early 1960s,[20] Soviet military doctrine established a role for them: physical protection of Soviet territory, complete elimination of rival forces, and support in occupation of the enemy's territory.[21]

The main parameters of the tactical nuclear weapons systems that could also be used for conventional strikes can be found in the table below.[22]

Main Charateristics of Soviet Dual-Use (nuclear/non nuclear) Missile Systems				
Type	Deployment Year	Range (km)	Speed Max. M	Yield (number of aviation bombs)
Operational-Tactical and Tactical Missile Systems				
SS21 Scarab (9K79-1 Tochka)	1989	120	-	100
SS1c Scud D (9K72)	1965	300	-	-
Iskander	-	280	-	-
FROG-79 (K52-LUNA)	1964	70-90		
SS12 (9K76 TEMP-S)	End of 1960s	900		
Sea Based Anti Ship Missile Systems				
SS-N9 Siren (4K85 Malakhit)	1972	120	0,9	200
SS-N12 Sandbox (4K80 Bazalt)	1977	500	2,5	350
SS-N19 Shipwreck (Granit)	1983	500	2,6	500
SS-N21 Sampson (Granat)	1987	3000	0,7	200
SS-N22 Sunburn (3M80 Moskit)	1978	80	2,7	200
Jakhont	-	300	2,5	-
Tactical Aviation				
SU-24 Fencer (SU-24MK)	1985	(1100)	1,3	(2)
TU-22M3 Backfire	1981	(2500)	2,0	(4)

2004 г, http://www.armscontrol.ru/pubs/NSNW_print_v2d.pdf, p 3.

[20] http://voland983.narod.ru/raznstat/atomart.htm, Совершенно секретный конденсатор. Атомная артиллерия в США и СССР создавалась для ведения локальных войн.

[21] http://www.db.niss.gov.ua/docs/polmil/51.pdf, А.И. Шевцов, А.И. Ижак, А.В. Гавриш, А.Н. Чумаков, Тактическое ядерное оружие в Европе:перспективы обеспечения стабильности, Днепропетровск 1999, Национальный институт стратегических исследований Днепропетровский филиал, p 12.

[22] Ibid. P 18. Added the information on FROG-79 (K52-LUNA) and FROG-79 (K52-LUNA)

Main Charateristics of Soviet Dual-Use (nuclear/non nuclear) Missile Systems				
Type	Deployment Year	Range (km)	Speed Max. M	Yield (number of aviation bombs)
SU-37	-	-	2,0	-
Air Platform Based Missile Systems				
AS-4 Kitchen (X-22)	1964	400	3,3	1000
AS-16 Kickback (X-15)	1989	150	5,0	300

Sea-based tactical nuclear weapons have proved to be the most unclear and complicated field for this study, because the scant information available does not provide minimal grounds for establishing whether there were any sea-based facilities in Georgia housing tactical nuclear weapons It would be desirable to make additional research in this regard to obtain more data.

2. Soviet Nuclear Military infrastructure in Georgia/South Caucasus

In our research we have been unable to obtain precise and authoritative information on the types and number of tactical nuclear weapons stationed in Georgia, and whether they were deployed, stored centrally in Georgia, or elsewhere. However, we have been able to infer a high probability of such deployments from the type of force structure and military facilities in Georgia and the missions that Soviet forces were asked to carry out there and elsewhere.

2.1 Non-Strategic Missile Units in Georgia/South Caucasus

It is widely known that non-strategic nuclear warheads were stationed in all Soviet republics (stockpiled or combat ready).[23] In addition, the INF Treaty also makes it clear that the aforementioned weapons were stationed in all republics with the exception of the Central Asian republics.[24] According to Gen Anatoly Lebed, tactical nuclear weapons were delivered in particularly large numbers to those areas (military districts) in the Soviet Union, which were adjacent or geographically close to NATO countries.[25] It is also noteworthy that the system

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[23] http://www.db.niss.gov.ua/docs/polmil/51.pdf, А.И. Шевцов, А.И. Ижак, А.В. Гавриш, А.Н. Чумаков, Тактическое ядерное оружие в Европе:перспективы обеспечения стабильности, Днепропетровск 1999, Национальный институт стратегических исследований Днепропетровский филиал, p 8.http://gaidar-arc.ru/file/bulletin-1/DEFAULT/org.stretto.plugins.bulletin.core.Article/file/2352, p 1.

[24] http://window.edu.ru/resource/987/46987/files/mion-ino-center10.pdf

[25] http://nuclearno.ru/text.asp?4013, Авторы: Николай Соков и Вильям Поттер, Nuclear Watch, The Internation, 7 октября 2002, «Ядерные чемоданы»: переоценка опасности, Специальный доклад Центра по исследованию проблем нераспространения при Монтерейском институте международных исследований о современном состоянии

of `stockpiling nuclear weapons and materials was well-developed in the Soviet Union, with the number of depots located throughout the country exceeding 500.[26] Our study has shown that some of these depots could have been located on Georgian territory.

In 1958, the first missile brigades emerged within the Soviet ground forces stationed on Georgian territory. 300-kilometer-range-R17 missiles became part of the inventory from 1965. Based on Maz-543 (truck), they were codenamed 9K72 (NATO code – SCUD A-B). The missiles were supplied to almost all missile units and were operational up to the disintegration of the Soviet Union.[27] The tracked (not wheeled) version of the system – 8K14 – was removed from the inventory in 1980 and gradually replaced by the 9K52-LUNA (FROG-7) missile systems, which could be deployed in three to four sets of three batteries and one launcher in each) or four to six sets (with two batteries and one launcher in each).[28]

. The 31st Army Corps formed in Georgia within the 9th Army[29] included the 119th and 90th missile brigades (in Gombori and Shaumiani respectively).

Other brigades of the Transcaucasus Military District were stationed in Armenia and Azerbaijan. The 7th Army stationed in Armenia included the 176th missile battery (in Stepanavan) and the 4th Army stationed in Azerbaijan included the 136th missile battery (in Perekeskul – No 14342). At the initial stage, they were equipped with 9K72 (SCUD) missile systems.[30] Other sources confirm that these subunits were equipped with SCUD systems up to 1991. [31] The sources make it clear that the deployment lasted from 1985 to 1991 (90th – 18SPU, 119th – 18SPU, 136th – 12SPU, 176th – 12SPU; SPU (rus)-Launcher).[32] Although the aforementioned systems were replaced by LUNA-type systems from 1980, Lt Gen Guram Nikoleishvili maintained that it was SCUD missiles that were stationed

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портативных ядерных зарядов из бывшего СССР.

[26] Феськов В.И., Калашников К.А., Голиков В.И. Ф44 Советская Армия в годы «холодной войны» (1945-1991). – Томск: Изд-во Том. ун-та, 2004. – 246 с., p 19.

[27] Ibid. p 33.

[28] Ibid.p 33.

[29] Закавказский военный округ // Вооружённые силы СССР (конец 80-х – начало 90-х гг.). 2006. 31 июля. URL:http://www8.brinkster.com/vad777/sssr-89-91/districts/zkvo.htm.

[30] Феськов В.И., Калашников К.А., Голиков В.И. Ф44 Советская Армия в годы «холодной войны» (1945-1991). – Томск: Изд-во Том. ун-та, 2004. – 246, pp 62-63.

[31] URL:http://specnaz.pbworks.com/w/page/17658040/%D0%92%D0%9E%D0%95%D0%9D%D0%9D%D0%AB%D0%95%20%D0%9E%D0%9A%D0%A0%D0%A3%D0%93%D0%90%20(%D0%93%D0%A0%D0%A3%D0%9F%D0%9F%D0%AB%20%D0%92%-D0%9E%D0%99%D0%A1%D0%9A)

[32] http://militaryrussia.ru/blog/topic-200.html

in Armenia or Azerbaijan, i.e. in the 176th and 136th missile brigades,[33] which raises questions regarding the statements by Feskov and Kalashnikov that Elbrus (SCUD-B) systems were replaced by LUNA-type missiles in the 1980s. In addition, according to other sources, the geography and typology of the deployment of operational-tactical systems in the Transcaucasus in 1980-1984 was as follows:[34]

The 119th missile brigade – Temp-S, 12 Launchers (Ls)
The 90th missile brigade – ELBRUS, 12 Ls
The 136th missile brigade – ELBRUS, 12 Ls
The 176th missile brigade – ELBRUS, 12 Ls

Other sources confirm that TEMP-S-type systems (9K76, which is the same as SS12 according to the NATO classification) were part of the inventory of the 119th missile brigade. The sources also say that the aforementioned unit moved to East Germany in 1984, returned to the initial location in 1988 and was replaced with theLUNA-type missile system (9K52).[35] The fact that TEMP-S remained in the inventory up to 1988 can be explained by the 1987 agreement on the reduction of the number of short and medium-range missiles (INF), which called for elimination of the missiles beginning in January 1988 with the process effectively ending on 25 July 1989.[36] . An article published in the local Georgian magazine “Arsenali” also confirms that this type of missile was present in Gombori. The article is based on the memoirs of brigade chief Col. Khukalenko, who maintained that if necessary, the brigade, which was formed in 1971, could destroy Ankara, Istanbul, and Tehran with TEMP-S systems.[37]

Thus, we can regard the existence of the TEMP-S system in Georgia and the location of the unit (in Gombori) as confirmed. As regards other units, it is quite clear that they were equipped with the 9K72 systems,[38] which are the same as SCUD-B or ELBRUS. The former chief of the General Staff of the Georgian Armed Forces (in 1993, 1996-1997), Lt. Gen Guram Nikoleishvili, confirmed this information in an interview.[39] He states that SCUD-B-type missiles were stationed in Shaumiani (the 90th brigade). Like the Gombori brigade, this brigade consisted of three sets

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[33] Interview with former chief of the General Staff of the Georgian Armed Forces (in 1993, 1996-1997), Lt Gen Guram Nikoleishvili.

[34] http://voiska.ru/forum/lofiversion/index.php/t984.html

[35] http://military.tomsk.ru/blog/topic-193.html

[36] Ibid.

[37] Journal Arsenal N14(161) 6-19 July 2012. Launched From Gombori the Nadiradze’s missiles had to destroy Tehran, Baghdad and Ankara. Irakli Aladashvili, p 48.

[38] http://www.ugv.su/armija/istorija_tehniki/raket_kopl.php

[39] Interview with former chief of the General Staff of the Georgian Armed Forces (in 1993, 1996-1997), Lt Gen Guram Nikoleishvili.

with two batteries and two launchers in each division.[40] This coincides with the information in the "Arsenali" magazine, which argues that the 12 launchers were distributed equally in groups of four.[41] The article also asserts that the unit was withdrawn to Russia in 1992, which is somewhat doubtful, but it is possible that major hardware was largely removed at early stage and the withdrawal officially completed in 1992. [42]

As Gen. Nikoleishvili explained in an interview, nuclear warheads could have been kept under centralised control of the "6th section" of the "12th Department" at the Vasiani central base, and maintained by special mobile repair and technical centres (PRTB) under the code number "555".[43] Several top Georgian military officials do not share the aforementioned opinion. They claim that the available information is insufficient to confirm that the standard arsenal of a division in the army corps stationed in Georgia included the nuclear component. However, there is a common agreement that structurally, missile units were part of ground forces subordinated to the military district or the army, and although the decision to use nuclear weapons in combat was to be made in a military district, the right to issue such permission was under Moscow's full control.[44]

One issue that needs additional research is clarifying which 9K72 systems (tracked or wheeled) were deployed to the aforementioned subunits. This problem is relevant, since it could enable us to specify the number of batteries in missile divisions. In the information referred to above, the number of launchers of each missile battery stationed in the Transcaucasus was said to be 12, which enables us to conclude that the missile brigade had four sets with three batteries (one launcher in the battery)[45] in each; or three sets with two batteries (two launcher in the battery) in each[46], or, in case of 18 launchers, three divisions with three

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[40] Ibid.

[41] Journal Arsenal N14(161) 6-19 July 2012. Launched From Gombori the Nadiradze's missiles had to destroy Tehran, Baghdad and Ankara. Irakli Aladashvili, pp 48-49.

[42] Ibid, p 52.

[43] Interview with former chief of the General Staff of the Georgian Armed Forces (in 1993, 1996-1997), Lt Gen Guram Nikoleishvili.

[44] http://www.ru-90.ru/old/index.php?option=com_content&view=category&id=59:2010-03-12-16-05-42&layout=blog, Цивилизованный развод, Источник: Гайдар Е.Т. Гибель империи. Уроки для современной России. 2-е изд., испр. и доп. М.: РОССПЭН, 2006Гл. 8. Крах. С. 418-429.

[45] http://www.ugv.su/armija/istorija_tehniki/raket_kopl.php

[46] Interview with former chief of the General Staff of the Georgian Armed Forces (in 1993, 1996-1997), Lt Gen Guram Nikoleishvili.

batteries (two launcher) in each.[47] The missile brigade had a sufficient stockpile of missiles to make several launches from each launcher.[48]

Questions could also be raised in connection with reports that the Gombori missile unit was reequipped in 1988 with obsolete LUNA-Ms with a very modest range of 75 km.[49] It can be explained by the unwillingness to equip this unit with 9K72-type systems due to the strategic political situation that had taken shape on the eve of the Soviet dissolution, or due to the temporary nature of the step with the intention to re-equip with comparatively new OKA (9K714) systems. Although re-equipment with OKA systems had started on a massive scale,[50] open sources provide no grounds to assert that these kinds of systems were ever stationed in the Transcaucasus.

Additional research is also needed to shed light on the equipment of the following missile units[51].

Tbilisi - 959th training missile battery
Akhaltsikhe - 962nd separate missile battery
Batumi[52] - 641st separate missile battery
Akhalkalaki - 360th separate missile battery
Baku - 958th separate missile battery
337th separate missile battery
961st separate missile battery
Yerevan[53] - 352nd separate missile battery
Leninakan[54] - 357th and 692nd separate missile battery

It is also noteworthy that eight 9K72 systems and 24 R-17 missiles were handed over to Armenia in 1994-1997.[55]

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[47] http://voiska.ru/forum/lofiversion/index.php/t984.html

[48] http://www.ugv.su/armija/istorija_tehniki/raket_kopl.php

[49] http://voiska.ru/forum/lofiversion/index.php/t984.html

[50] Феськов В.И., Калашников К.А., Голиков В.И. Ф44 Советская Армия в годы «холодной войны» (1945-1991). – Томск: Изд-во Том. ун-та, 2004. – 246 с., p 33.

[51] http://forum.ge/?f=49&showtopic=34060860&st=330

[52] http://kombat-bvoku.ucoz.ru/publ/zakvo/chasti_i_soedinenija_kzakvo_shtab_tbilisi/12-1-0-86

[53] http://kombat-bvoku.ucoz.ru/publ/zakvo/7_aja_gvardejskaja_obshhevojskovaja_armija/12-1-0-88

[54] Ibid.

[55] http://militaryrussia.ru/blog/topic-200.html

Sources: http://militaryrussia.ru/blog/topic-200.html; SPU9P117 of the Armenian Armed Forces (picture – Sergey Balaklayev, Итоги. №15 / 1997); http://militaryrussia.ru/blog/topic-200.html; Four SPUs of the 9K72 systems seen during preparations for a parade in Stepanakert (Nagorny Karabakh) on 5 May 2012.

According to the source, it is highly likely that the aforementioned systems were handed over to Armenia from the 176th missile brigade, and Armenian specialists were trained at the Kapustin-Yar training range in May and June in 1996. However, the technical condition of the warheads remaining up to now and their classification on the basis of available materials are still unclear. The inscriptions on the systems shown in the pictures do not correspond to visual and technical requirements and give rise to considerable speculation , among others that shown systems have been modified by national (Armrnian) forces (High Explosive Shell) or represent a kind of mould work. As regards to Azerbaijan, a component of the missile fuel, *Melange*, that was found in the military underground depots on the Apsheron peninsula after the withdrawal of Soviet units, indicates the presence of tactical nuclear warheads on Azerbaijani territory.[56] However, like in case of Armenia, additional research is indispensable in order to shed more light on the matter.

2.2 Tactical Nuclear Weapons for Ground (Land) Force Units

On the basis of the 20 February 1968 directive of the General Staff of the Soviet Union, the 9K76 operational-tactical missile systems (the same as TEMP-S) were withdrawn from Strategic Missile Forces and handed over to Ground (Land) Forces.[57] Archived government correspondence of the time, (Yegor Gaydar in the capacity of Prime-minister) confirm that literally all land force divisions

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[56] Interview with Iashar Djafarli, Military Expert from Azerbaidjan, retired Colonel, co-founder of military portal www.milaz.info, June 2012.

[57] http://military.tomsk.ru/blog/topic-193.html

were equipped with tactical nuclear weapons.[58]There is another source that points to the earlier date of full nuclear inventory – mid 1970s.[59]All together the information indicates that out of total number of tactical nuclear warheads about 22,000 of them),[60] commanders of all ground corps or divisions, particularly those stationed in military districts bordering NATO countries, had a long list of nuclear "assets" to complete assigned missions.

As artillery developed, a significant part of artillery units became self propelled. The following artillery systems appeared (both towed and self-propelled :: 122-mm self-propelled *Gvozdika* (2C1), 152-mm *Giatsint*-B (2A36), self-propelled *Giatsint*-C (2C5), and particularly 240-mm self propelled mortar launcher *Tulpan*, 152-mm self-propelled *Akatsia (2C3)*, *Pion* (2C7), 2A65 *Msta*-B and 2C19 *Msta*-C (self-propelled),[61] which could launch nuclear shells.[62] However, it should be recognized that the mere fact of presence of 152-mm powered or towed artillery systems provides no firm grounds for asserting categorically that divisions had nuclear shells in their inventory for the assigned combat mission.[63]The structure and weaponry of the Soviet units stationed in the Transcaucasus were those of standard Soviet units. Correspondingly, it would be of high value to identify the systems and number of the weaponry, which could launch nuclear shells. Information will be limited to artillery units alone at this stage and antiaircraft units will be discussed later.

By 19 November 1990, a total of 33 Akatsia-type (2C3) powered artillery systems were stationed in the Akhalkalaki 147th motorised-rifle division,[64] which means that the aforementioned division of the 31st army corps was better equipped technically with self-propelled artillery systems (as well as with 36 2C1 Gvozdikas) than other units. The artillery systems in units stationed in Armenian and Azerbaijani territories were mostly towed, but some divisions were equipped

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[58] http://gaidar-arc.ru/file/bulletin-1/DEFAULT/org.stretto.plugins.bulletin.core.Article/file/2351 О ближайших действиях россии в области военного строительства, разоружения и космоса – Тактическое ядерное оружие в настоящее время выведено из Прибалтики, Закавказья, Молдовы. Настоятельно требуется возможно более оперативный вывод этого оружия и из других республик, так как оно имеется в каждой дивизии.

[59] Феськов В.И., Калашников К.А., Голиков В.И. Ф44 Советская Армия в годы «холодной войны» (1945-1991). – Томск: Изд-во Том. ун-та, 2004. – 246 с., p 34.

[60] http://nuclearno.ru/text.asp?15698

[61] Феськов В.И., Калашников К.А., Голиков В.И. Ф44 Советская Армия в годы «холодной войны» (1945-1991). – Томск: Изд-во Том. ун-та, 2004. – 246 с., p 33.

[62] http://voland983.narod.ru/raznstat/atomart.htm

[63] Gen Vakhtang Kapanadze, deputy chief of Georgia's Special Foreign Intelligence Service. Interview of 26 October 2012.

[64] http://www.youtube.com/watch?v=DTeCPpZPKMg, Besarion Gugushvili's conversation with Eduard Khachukayev.

with self-propelled Giatsints and Gvozdikas.[65] Lt Gen Guram Nikoleishvili, who headed an artillery regiment in the Transcaucasus Military District in the Soviet period, contends that there were artillery nuclear warheads in Georgia.[66] He states that a wide range of nuclear warheads was kept in the central base in Vaziani, which supplied nuclear warheads to appropriate units by means of the so-called PRTBs (transportation repair and technical bases). However, Georgian general Vakhtang Kapanadze disagrees. He believes that nuclear weaponry needed special protection measures and the *legending* (assign false signs, numbers, abbreviation purposefully to hide the actual content and purpose) of depots. The general says he knows nothing about such facilities in Georgia at least after 1970.

Gen. Kapanadze contends that the presence of artillery batteries with 152-mm mobile or towed systems does not provide sufficient conditions for peremptory assertions on inclusion of nuclear shells in combat inventory.[67] He acknowledges that the southern flank of NATO, in particular Turkey's 3rd Field Army and support units and divisions in this area, were regarded as the main rival of the Transcaucasus Military District during Cold War, and operational and strategic plans definitely took into account the need to equip the forces stationed in the Transcaucasus (including Georgia) with nuclear combat material.; Nevetheless, he says that the whole process did not rely on warheads in storages of the TCM-District, but on the capability to receive such warheads at a time of crisis and to transfer them to combat units in field artillery, aviation, and other forces. The main purpose would be to destroy the enemy force by means of nuclear attack immediately after they would be discovered. He argues that it would be logical to assume that for the purpose of disguise and defence, nuclear weapons could be delivered to forces stationed in first echelon peripheral areas of the Soviet Union (including Georgia) from Russia in conditions of growing crisis or at the very start of combat operations or in their course. In fact, he contends that one of the main reasons for the construction of the Roki tunnel (connecting Georgia with Russia) was to increase the the general capability to supply soviet forces in the Transcaucus Military District and its ability to withstand the effects of enemy nuclear strikes.

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[65] http://kombat-bvoku.ucoz.ru/publ/zakvo/4_ja_obshhevojskovaja_armija_shtab_baku/12-1-0-87, «Краснознаменный Закавказский». Тбилиси, 1982, с.274-275 * см. выше, о ЗакВО в целом см. : «Красная Звезда», 14 января 1992 г. *» Д.Т.Язов. «Удары судьбы». М., 1999, pp 288-298.

[66] Interview with former chief of the General Staff of the Georgian Armed Forces (in 1993, 1996-1997), Lt Gen Guram Nikoleishvili.

[67] Gen Vakhtang Kapanadze, deputy chief of Georgia's Special Foreign Intelligence Service. Interview of 26 October 2012.

2.3 Nuclear Air Defence and Aviation

In general, scant public information is available on the air component of nuclear weaponry. In this regard, it is important to consider the structure of antiaircraft units and identify the technical potential of bomber aviation. The 19th Antiaircraft Army (with headquarters in Tbilisi) included eight antiaircraft artillery brigades, of which the 144th brigade in Tbilisi, 643rd regiment in Gudauta , 96th in Erevan and 266th in Poti were part of the 14th antiaircraft corps. Nuclear warheads were part of their inventory.[68] C200-type missile systems (SA-5), which could be used for launching nuclear warheads in order to repel a mass air attack, were usually part of their weaponry.[69] According to this source, standard equipment for antiaircraft units in the 1980s[70] involved each division holding one nuclear warhead that could only be kept in a special depot. In addition to the aforementioned units, there were other antiaircraft artillery units on the territories of all Transcaucasus republics. In Georgia, these included: the 296th brigade[71] and the 1007th antiaircraft artillery regiment in Akhalkalaki,[72] as well as the 1053rd antiaircraft artillery regiment in Angisa.[73] The 59th antiaircraft artillery brigade subordinated to the army[74] was stationed on Armenian territory until 1991,[75] as well as the 1029th, 988th, and 971st antiaircraft artillery regiments.[76] As regards Azerbaijan territory, in addition to units already mentioned,[77] following units caould be added to the general list: 117th antiaircraft artillery brigade,[78] as well as the

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[68] http://ryadovoy.ru/forum/index.php?action=printpage;topic=47.0

[69] Феськов В.И., Калашников К.А., Голиков В.И. Ф44 Советская Армия в годы «холодной войны» (1945-1991). – Томск: Изд-во Том. ун-та, 2004. – 246 с., p 138.

[70] http://ryadovoy.ru/forum/index.php?action=printpage;topic=47.0. For example, the antiaircraft artillery brigade in Zira with C200 systems.

[71] http://www.youtube.com/watch?v=DTeCPpZPKMg

[72] http://forum.ge/?f=49&showtopic=34060860&st=330

[73] http://kombat-bvoku.ucoz.ru/publ/zakvo/chasti_i_soedinenija_kzakvo_shtab_tbilisi/12-1-0-86

[74] http://forum.ge/?f=49&showtopic=34060860&st=330

[75] http://specnaz.pbworks.com/w/page/17658040/%D0%92%D0%9E%D0%95%D0%9D%D0%9D%D0%AB%D0%95%20%D0%9E%D0%9A%D0%A0%D0%A3%D0%93%D0%90%20(%D0%93%D0%A0%D0%A3%D0%9F%D0%9F%D0%AB%20%D0%92%D0%9E%D0%99%D0%A1%D0%9A)

[76] http://kombat-bvoku.ucoz.ru/publ/zakvo/chasti_i_soedinenija_kzakvo_shtab_tbilisi/12-1-0-86

[77] http://specnaz.pbworks.com/w/page/17658040/%D0%92%D0%9E%D0%95%D0%9D%D0%9D%D0%AB%D0%95%20%D0%9E%D0%9A%D0%A0%D0%A3%D0%93%D0%90%20(%D0%93%D0%A0%D0%A3%D0%9F%D0%9F%D0%AB%20%D0%92%D0%9E%D0%99%D0%A1%D0%9A)

[78] Феськов В.И., Калашников К.А., Голиков В.И. Ф44 Советская Армия в годы «холодной войны» (1945-1991). – Томск: Изд-во Том. ун-та, 2004. – 246, p 63.

1041st antiaircraft artillery regiment in Naxcevan[79] and the 1035th and 1056th antiaircraft artillery regiments.[80]

According to Gen. Nikoleishvili, the air component was intensively developed on Georgian territory, comprising 22 military airfields, of which six were first-class, having runways at least 2,200 metres long and capable of receiving strategic bombers (Tu-95 and Tu-160).[81] These were airfields in Bombora, Meria, Kopitnari, Vaziani, Marneuli, and Dedoplistsqaro. The Dedoplistsqaro airfield was most prominent among them with its runway of 3,300 meter long and 60 metre wide. The number of days appropriate for flights reaches there 320 a year.[82] According to other sources, the Dedoplistsqaro (Didi Shiraki) airfield belonged to the bomber division which was part of the 34th Airborne Army, and a separate bomber regiment (Su-24) was stationed in Kopitnari.[83] It is known that Tu-22-type bombers as well as SU-24M bombers were able to carry nuclear bombs.[84] As Kristensen and Norris state, a total of 260 SU-24 bombers were introduced in aviation units in 1974.[85] And the declassified NATO MC-report indicate that over time the number of light bombers deployed in Transcaucaus Military District decreased from 30 (1975) to 15 (1978) and 15 (1981).[86] Correspondingly, it is quite possible that there were special depots for nuclear warheads at both airfields. However, according to Gen Kapanadze, no specially equipped depots for nuclear weaponry were found either at Dedoplistsqaro airfield or at the intensively used and repaired Kopitnari airfield after the withdrawal of the Soviet forces.

The map below provides a general picture of key unit locations is the region.

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[79] http://forum.ge/?f=49&showtopic=34060860&st=330

[80] http://kombat-bvoku.ucoz.ru/publ/zakvo/4_ja_obshhevojskovaja_armija_shtab_baku/12-1-0-87, «Краснознаменный Закавказский». Тбилиси, 1982, с.274-275 * см. выше, о ЗакВО в целом см. : «Красная Звезда», 14 января 1992 г. *» Д.Т.Язов. «Удары судьбы». М., 1999, р 288-298.

[81] Interview with former chief of the General Staff of the Georgian Armed Forces (in 1993, 1996-1997), Lt Gen Guram Nikoleishvili.

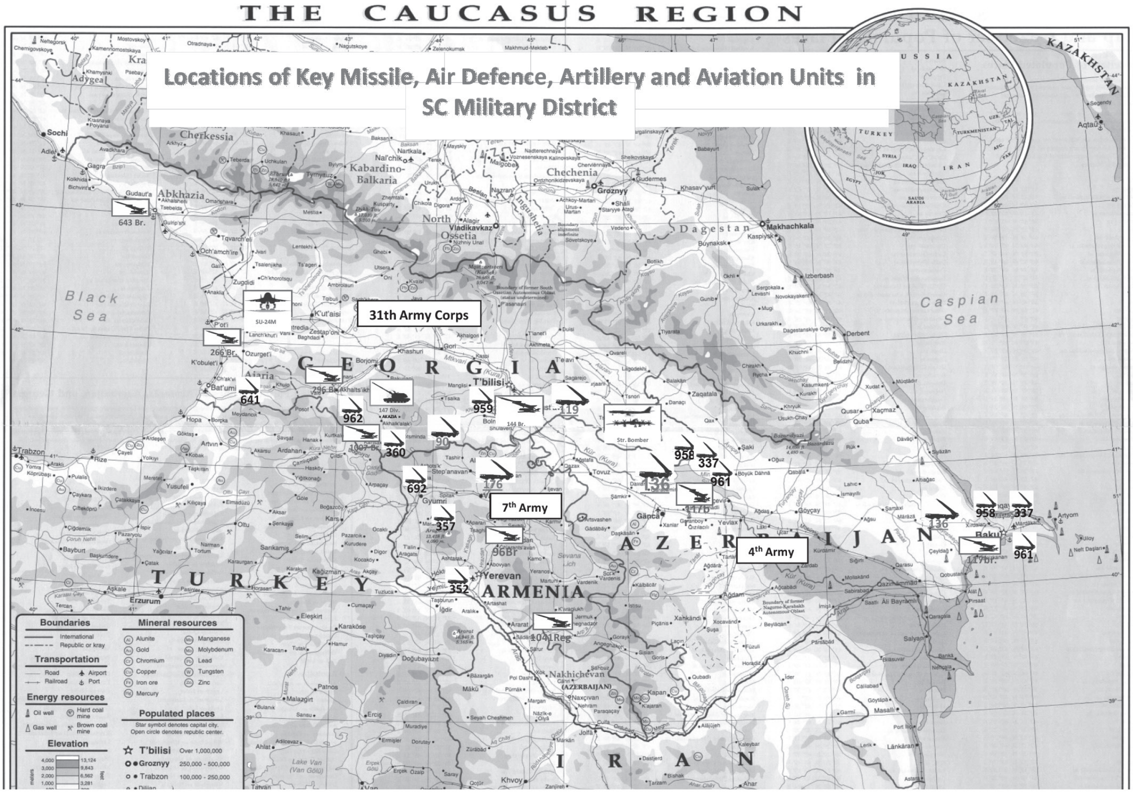
[82] Ibid.

[83] Феськов В.И., Калашников К.А., Голиков В.И. Ф44 Советская Армия в годы «холодной войны» (1945-1991). – Томск: Изд-во Том. ун-та, 2004. – 246, p 144.

[84] http://www8.brinkster.com/vad777/russia/RVSN.htm, p 20.

[85] Kristensen and Norris, 101

[86] North Atlantic Military Commttee Final decision on MC 161/72, A Report by the Military Committee on the Soviet Bloc Strength and Capabilities, June 1972, reclassified 1/84, part III, section 3, p.244



Map Source: http://louisadheen.files.wordpress.com/2012/05/caucasus-1994.jpg

3. The process of Withdrawal of Soviet Nuclear Weapons from Georgia/South Caucasus

The general timeframe of the withdrawal of nuclear weapons from the South Caucasus appears to have taken place between 1988 and 1992. In case of Georgia, however, the timeframes of withdrawal can be narrowed to 1988-1990. It goes without saying that the process was secret amid the crisis situation in the South Caucasus at the time. It is impossible at this stage to obtain written protocols or documents on unilateral decisions that would reflect the process of the withdrawal of nuclear weapons. In spite of this, indirect sources like interviews, memoirs, and analytical reports provide sufficient grounds for the establishment of the content and form of the withdrawal process.

Meeting obligations arising from international nuclear agreements played a significant role. Under the 1987 agreement between the United States and the Soviet Union (INF Treaty), a whole category of nuclear weapons – medium-range missiles – was removed from the inventory. Therefore, it would be useful to carry out additional research in this field.

As mentioned in previous chapters, it is a common belief that at the time of disintegration of the Soviet Union, the total number of tactical nuclear warheads in the Soviet Union was around 22,000,[87] a significant part of which was to be destroyed in accordance with international initiatives (PNIs).[88] It is also known that the aforementioned weapons were stationed in all Soviet republics and were withdrawn first from the republics with dangerous political situations and ethnic tensions.[89] Some reports say that components of nuclear weapons were withdrawn first from Georgia and the Transcaucasus (by the 12th department of the Soviet General Staff) and then from Ukraine, Belarus, and Kazakhstan in 1992-1996.[90] These reports seem quite convincing.

To establish a more precise time of the withdrawal of nuclear weaponry from Georgia and the Transcaucasus we compare information available in a number of sources. For example, the information from Gaydar's archive confirms that the amount of nuclear weapons withdrawn from the Transcaucasus region and the Baltic countries exhausted the storage potential of central depots located in Russia.[91] This information is interesting, as it decisively states that the withdrawal of nuclear weapons from the Transcaucasus was completed before 1992 and that the number of nuclear warheads was considerably high. It is also important that an excerpt from a report of the headquarters of the 4th army (Azerbaijan) makes it clear that missile units were withdrawn from Azerbaijan by rail and that by the beginning of 1991, all nuclear warheads (combat components) meant for the 9K72 (SCUD/ELBRUS) systems were withdrawn from Soviet republics to Russian territory.[92] An interview published in the Izvestiya newspaper on 13 March 1992 included a note of the Headquarter of the CIS Joint Force, which concludes that Armenia and Azerbaijan had been "freed" of nuclear weapons two years earlier.[93] This source makes it possible to conclude that the withdrawal

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[87] http://www.armscontrol.ru/pubs/NSNW_print_v2d.pdf, p.38: предназначенных для сухопутных войск (6700), фронтовой авиации (7000), ВМФ (5000), ПРО и ПВО (3000).

[88] Ibid., p 39.

[89] http://window.edu.ru/resource/987/46987/files/mion-ino-center10.pdf

[90] http://www.prizyvnik.info/forum/archive/index.php/t-50603.html

[91] http://gaidar-arc.ru/file/bulletin-1/DEFAULT/org.stretto.plugins.bulletin.core.Article/file/2352, p 2.

[92] http://militaryrussia.ru/blog/topic-200.html, книга «Генштаб без тайн», автор В.Н.Баранец.

[93] http://yeltsincenter.ru/digest/release/den-za-dnem-13-marta-1992-goda-0, День за днем. 13 марта 1992 года, «Известия» / Учредитель: журналистский коллектив «Известий». – 1992. – 13 марта, пятница. – № 62 (23636). – 8 полос, «В Закавказье ядерного оружия нет» – страница 1.

of nuclear warheads from the region was completed no later than by the end of 1990.

In addition, it is noteworthy that in 1991, Soviet President Gorbachev put forward the initiative of unilateral and drastic reduction of medium and short-range missiles,[94] which he would have been unable to accomplish without being sure that nuclear warheads had already been withdrawn to depots in central Russia from the Transcaucasus, engulfed in conflicts (as early as from 1988).[95] Gorbachev's statement was printed on 5 October 1991 – just three months before the disintegration of the Soviet Union. It is also interesting that after the collapse of the Soviet Union, all CIS countries became legal successors of the nuclear non-proliferation treaty, but only six of them – Russia, Ukraine, Belarus, Kazakhstan, Uzbekistan, and Turkmenistan – assumed practical obligations in terms of inspecting nuclear facilities in July-October 1992.[96] According to the 1987 agreement on the reduction of short and intermediate-range missiles, it would be logical for Moscow to be interested in carrying out inspections on the territories of the Baltic countries and the Transcaucasus that had already become independent. However, Russia had never raised this issue after 1990, which confirms our conclusion that nuclear weaponry had already been withdrawn from the region by 1990.

4. Conclusion

The withdrawal of short and medium-range weaponry implies the withdrawal of nuclear warheads (combat components) as well as the removal of the delivery systems. In this regard, it is possible to make concrete assessments on the basis of a review of the missile systems stationed in Georgia. There is a minor discrepancy between the information of a Georgian source published in the Arsenali magazine and a report by Russian scientist Aleksandr Pikayev. The former says that the 119th missile brigade was withdrawn from Gombori during 1992[97] and the latter explains that nuclear weapons (warheads and carriers) were withdrawn to Russian territory before the disintegration of the Soviet

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[94] http://www.nuclearno/text.asp?1474., Герц Б. Россия снизила порог использования ядерного оружия, NuclearNo.ru. 2001. 11 января.

[95] http://www.interfax.ru/txt.asp?id=230110, Дальнейшее ядерное разоружение вряд ли возможно в формате только России и США, Директор Департамента по вопросам безопасности и разоружения МИД РФ Михаил Ульянов рассказывает «Интерфаксу» о ядерной безопасности в мире.

[96] Ядерное распространение: новые технологии, вооружения и договоры / под ред. А. Арбатова, В. Дворкина ; Моск.Центр Карнеги. — М. : Российская политическая энциклопедия (РОССПЭН), 2009. p 272.

[97] Journal Arsenal N14(161) 6-19 July 2012. Launched From Gombori the Nadiradze's missiles had to destroy Tehran, Baghdad and Ankara. Irakli Aladashvili, p 52.

Union, i.e. before December 1991.[98] The second source can be regarded as more reliable, as it is supported by data from Yegor Gaydar's archive. According to the report dated October 1991, all tactical weapons had been withdrawn from the Baltic countries, Transcaucasus republics, and Moldova.[99] As Soviet Marshal Yevgeniy Shaposhnikov (aviation marshal in 1990 and Soviet defence minister in 1991) stated, the incorrect information was deliberately disseminated in the Transcaucasus that tactical nuclear weapons would be withdrawn by rail, in reality however, they were effectively withdrawn by air.[100]

Thus, it can be concluded that the withdrawal of nuclear weapons and their delivery systems stationed in the Transcaucasus Military District started the latest by 1988 and ended by the end of 1990.[101] Since we know about the presence of TEMP systems stationed in Georgia, it is quite possible that the aforementioned process started as early as by the end of 1987, which is also confirmed by the interview with Gen Nikoleishvili.[102] He even suggests to date the end of withdrawal process by the year of 1989. On the basis of all sources, the process can be described as a one which began back in the Soviet period as a the result of obligations assumed under international agreements, speeded up later by political tensions and conflicts in Transcaucasus, and completed by 1990.

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Nuclear Nonproliferation Policy Development in Independent Georgia

Chabashvili M., Japaridze G. I., Lortkipanidze Sh., Nabakhtiani G., Pataraia T., Rostomashvili Z.

It took years after Georgia gained independence for nuclear nonproliferation and radioactive safety and security to gain a significant place in the country's foreign policy agenda. Georgia's statehood was challenged in the early 1990s by political instability, sustained economic crises and two internal conflicts in the aftermath of the dissolution of the Soviet Union. Dealing with these challenges proved especially difficult for the newly established political system, with its underdeveloped state institutions, ineffective bureaucracy, absence of the rule of law and inexperience with free markets.

In 1994, Georgia joined the Nuclear Nonproliferation Treaty (NPT) and since then, it has sought to become more integrated into global nuclear regimes. Cooperation with the International Atomic Energy Agency (IAEA) has contributed much towards the fulfilment of this goal. This has included taking measures for the improvement of nuclear safety in the country, enhancing the security and physical protection of high-activity radiation sources, abiding by agency nonproliferation safeguards, and responding to nuclear emergencies.

In 2003, Georgia ratified an IAEA comprehensive Safeguards Agreement, as well as an additional protocol to the safeguards agreement. Such protocols provide the agency with greater authority and technical capability to ensure that a non-nuclear-weapon-state is not operating undeclared nuclear facilities. In addition, Georgia officially announced its wish to abide by the principles of the IAEA-developed Code of Conduct for the Safety and Security of Radioactive Sources, and the regulations for import and export of radioactive substances and nuclear materials. In 2012, Georgia sent official letters to the IAEA to express agreement with the principles stated in these two documents.

In the same decade, Tbilisi also stepped up its cooperation with the International community in the fight against nuclear terrorism. In particular, in 2006, it joined the Convention for the Physical Protection of Nuclear Materials (CPPNM) and later ratified an important amendment to it from 2005 while in 2010, it joined the International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT). It has supported UN Security Council Resolution 1540 and its extensions, which called on states to ensure they have a sufficient legal and regulatory regime against the proliferation of weapons of mass destruction and their means of delivery, in order to deny the access of non-state actors to them. Georgia has also taken part in Nuclear Security Summits in 2010 and 2012 and the Global Initiative to Combat Nuclear Terrorism.

In addition, direct unilateral assistance provided by some Western states contributed significantly to the neutralization of nuclear and radiation threats in Georgia, the development of the National Registry of radiation sources (RASOD – Radiation Source Database, in cooperation with the US Nuclear Regulatory Commission) and the establishment of a radioactive waste temporary storage facility which began operating in 2007. In this regard, Georgia's effective cooperation with the IAEA, USA and EU and numerous European state agencies are worth mentioning. Georgia also joined two important conventions: Convention on the Physical Protection of Nuclear Materials (CPPNM) and Convention on Early Notification of Nuclear Incidents in 2006.

This chapter describes independent Georgia's participation in international nuclear regimes and reviews the challenges that faced the young state. These challenges were largely related to ensuring nuclear and radiation safety, combating illegal trafficking and addressing issues of radioactive waste management.

The chapter has three sections. The first describes the initial years of independence and how the challenges to state institution-building in 1992-1996 affected nuclear and radiological safety and security. It outlines the difficulties that led to nuclear and radiation threats originating in academic research laboratories, as well as another set of problems relating to proliferation, illegal trafficking and waste-management of orphaned radioactive sources.

The second section details the establishment of national instruments for promoting non-proliferation, radiation safety and security, and their limits and challenges. The third section focuses in detail on transnational threats such as illicit nuclear trafficking, the steps Georgia has taken with support from the international community to respond to those concerns, and the need for Georgia to cope with an emerging set of challenges.

1. Political Context and State-Building (1992-1996)

Until 1991, Georgia was part of the Soviet Union, and accordingly, the military and academic nuclear research infrastructure fell under the Soviet Union's centralized management system. The situation changed in 1991 when Georgia declared its independence from the Soviet Union and removed itself from central subordination. A year later, after the formal break-up of the Soviet Union, the international community recognized Georgia's independence and global international organizations opened the door to Georgia for cooperation. In summer 1992, Georgia became a member of the UN; a number of foreign countries, such as Germany, the USA and the UK, began establishing diplomatic ties with Georgia and opened embassies in the country. However, the intensity of cooperation with the West was low; the country was isolated and rife with political turmoil and internal conflicts for years.

In 1993, hoping to maintain stability and resolve its conflicts peacefully, Georgia joined the Commonwealth of Independent States (CIS)[1], a political-economic union led by Russia and consisting of former Soviet republics. During the same year, Georgia became a signatory to a security agreement defining a ceiling for military weapons to be transferred from the former Soviet military infrastructure – the so-called Tashkent Collective Security Treaty. With these decisions, Georgia entered a new legal framework of cooperation with other former Soviet Republics and Russia. In response, Russia contributed to easing Georgia's internal conflicts and mediating relevant ceasefire agreements, which strengthened opportunities for Georgia to start state institution-building and cooperate with global security institutions.

In 1994, Georgia acceded to the Non-Proliferation Treaty (NPT), allowing state officials to pay more attention to the challenges facing Georgia in terms of nuclear and radiation safety. In the early years of independence, Georgia, as a young state and a legal successor of the nuclear Soviet Union, turned to Russia for help in dealing with nuclear threats. However, this cooperation did not always prove fruitful. More systemic efforts to boost Georgia's institutional capacity began only after other international actors started to play a greater role in enhancing nuclear and radiation safety in Georgia. [2]

1.1. Nuclear and Radiation Threats

Nuclear research institutes: The first significant nuclear threat apparently emerged in the early 1990s after the nuclear reactor managed by the Institute of Physics shut down. As indicated in the chapter 'Nuclear Research in Soviet

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[1] In 1992, Georgia refused to join the CIS, citing the unacceptability of the Russian policy of military assistance to its separatist regions. Tbilisi's resistance eventually wore thin, however, and it joined the alliance in 1993.

[2] Under the Tashkent agreement (initiated in 1992), Georgia, like other republics, received as a legacy the military equipment stationed in its territory.

Georgia', on 30 March 1990 the academic board of the institute and the presidium of Georgia's Academy of Science issued a decree (Decree N 83 of 30 March 1990) to cease operations, dismantle the reactor, and return the remaining unused or already irradiated nuclear fuel to appropriate institutions. The last step was particularly important from a nuclear security point of view, since the reactor was fuelled by highly enriched uranium (HEU), which could have fuelled nuclear weapons.

Unfortunately, however, fresh HEU and lightly irradiated spent nuclear fuel remained on the site under inadequate protection, representing a serious security threat.[3]

The Georgian side informed the Soviet Academy of Science, the Soviet State Committee for the Use of Atomic Energy, the Kurchatov Institute and other relevant organizations of its decree.[4] However, the responses received during five years of attempts at communication prompted the Georgian scientists to realize that clearly the issue of closing nuclear facilities had not been experienced, professionally discussed, or even researched in the Soviet times and that the Institute of Physics had to handle the task independently. On 16 March 1995, the presidium of the Georgian Academy of Science approved a plan developed by the institute which met the requirements of radiation, environmental and seismological safety. In particular, permission was given to decommission the reactor by filling the lower radioactive section of the reactor's tank and its equipment with concrete.

In addition, at the initiative of the Institute of Physics of the Uzbek Academy of Science in 1995, Seventeen IRT-2M fuel assemblies (containing HEU with 90% enrichment of U235, 170g of U-235, 220g of uranium[5]) were exported from Georgia to Uzbekistan's Institute of Nuclear Physics. The shipment was made with the consent of the Presidium of the Russian Academy of Science, its institutes and several government agencies. The remaining 4.3 kg of fresh HEU and some 800 g. of spent nuclear fuel should have been protected according to international norms but Georgia at the time did not have the capacity to ensure such protection.

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[3] During the conflicts, state protection of the facility, formerly implemented by the Interior Ministry, was abolished.

[4] During the Soviet era, Russia managed and was responsible for both supplying the reactor with fuel and taking back spent fuel.

[5] The composition of IRT-2M fuel assemblies IRT-2M was given in Pavel Podvig's IPMF Blog, "Transfer of Georgian HEU spent fuel from Dounreay to Savannah River Site", published on 30 August 30, 2013; http://fissilematerials.org/blog/2013/08/shipment_of_heu_spent_fue.html, accessed on 15 October 2013.

Georgian scientists were also concerned about the safety of the substances kept at the Institute of Physics and Technology in Sokhumi. In September 1993, some 200 staff members of the institute fled the escalation of the conflict in Abkhazia and moved from Sokhumi to Tbilisi.[6] They became the core staff for the Sokhumi Institute of Physics and Technology based in Tbilisi. A particular cause for the concern was the fact that the director of the institute, Revaz Salukvadze, carried out an inventory before fleeing Sokhumi in September 1993 which counted 244 types of radiation sources, including 655 grams of HEU (enriched up to 90%) in the form of dioxide tablets . Salukvadze said in 1998 that the HEU had been kept at the institute since 1987 and did not rule out the possibility of the institute storing significantly more uranium than that total.[7] What accounted for this lack of certainty was the fact that the Institute, along with other Soviet research institutes, had taken part in many classified research projects and in many cases, the administration did not have full knowledge as to what substances were kept in the institute's laboratories.

Threats from radiation sources. Another new threat in post-Soviet Georgia was related to radiation safety. In 1995, warehouse inspections by employees of the ministries for environment protection and natural resources and the state security ascertained that radiation was quite high in places where some household lamps from Iran were stored in sizeable quantities. According to a former minister of environment protection and natural resources, the inspection revealed that each lamp contained a small amount of radioactive materials. Stored in bigger quantities, they increased the background radiation in the warehouse.[8]

During the same period, there were occasions when orphaned radioactive sources were found in several places in Georgia. Passers by at a railway station in Georgia's second largest city, Kutaisi, opened a container bearing a substance that proved to be caesium. It transpired that the caesium had been used at the Oncology Hospital in Tbilisi in the 90s and the disused source had been stored at the railroad station under the assumption that it would be returned to Moscow. In response to such cases, the government, with the help of scientists, neutralized threats to the extent possible – the radioactive substances were placed in special containers and stored at temporary repositories. However, these were only temporary measures.

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[6] During the same period, some 250,000 ethnic Georgians living in Abkhazia were expelled from the region.

[7] Interview with the director of Sokhumi Institute of Physics, Valter Kashia, summer 2001; Missing Uranium, By Charles J. Hanley, Associate Press, Wednesday, June 26, 2002.

[8] Interview with former Minister of Environment Protection and Natural Resources, Nino Chkhobadze, August 2012.

In addition, during the 1990s, Soviet and later Russian military units stationed in Georgia occupied a number of military facilities which utilized radioactive substances for various military purposes.[9] Due to the use of such unsealed sources, there were multiple incidents of radioactive contamination on the premises after the bases were closed. There were also attempts to smuggle nuclear and radioactive sources from the bases. The situation demonstrated the need for and expedited the process of the establishment of a state regulatory system of nuclear and radiation safety.

Transit/Illicit trafficking. After the breakup of the Soviet Union, patterns of illicit trafficking of nuclear and radioactive materials developed in some of the post-Soviet states. The South Caucasus region was attractive for illicit trafficking due to the widespread corruption in the region in the 1990s. This was further aggravated by political tensions among the region's countries and with their neighbours (between Armenia and Azerbaijan, Georgia and Russia, Armenia and Turkey) as well as the existence of the conflict regions within the states, the so-called territories beyond the control of the central authorities. All of these further hampered cooperation in border protection between the countries, which possessed weak border controls to begin with. Against this background, Georgia's research institutions still stored nuclear and radioactive substances over which they did not have total control.

In general, illicit trafficking of nuclear and other radioactive materials is an attractive business for international criminal groups already engaged in smuggling arms and other banned products. In the 1990s, the weak state institutions (such as weak and corrupt border and customs agencies and the police) and the existence of uncontrolled territories attracted criminals and increased the potential risk of illicit trafficking. Furthermore, Georgia at that time did not have a proper system of controls and licensing on imports, exports, and radiological sources.

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[9] Most commonly spread substances were two different assemblies of ^{137}Cs radionuclides, which were used for calibration of radiation measuring equipment. The first container included two ^{137}Cs radioactive sources, each of them with the activity of 10 mk. The second, larger container contained one ^{137}Cs radioactive source with activity of 3 Ci. In addition, liquid ^{90}Sr/^{90}Y sources were used to find chemical weapons reagents. Also commonly used in the military field were ^{226}Ra radionuclides due to their luminescent nature as they radiate at night easily observable blue light. Therefore, Kalashnikov rifle's night vision pointers contained open sources of this radionuclide (mainly two types of night vision pointers were used. Gamma radiation at the pointers was 3mkSv/hr). For the same reason, ^{226}Ra radionuclide was used to cover faces of certain equipment, switch tumblers (especially for flying devices). Military units also stored powders containing such radionuclides, which was used for charging batteries of certain equipment.

As a result, there were attempts to smuggle nuclear and radioactive materials into Georgia and beyond its borders. Interestingly, such cases have been publicized only since 1999, after Russian military border guard units left Georgia and the Georgian border units took responsibility for the control of the total perimeter of the Georgian border (though Georgia is not able to control the Abkhazia and South Ossetia sections of its border with Russia and maintains control over the administrative borderlines separating these regions from Georgian-controlled territory).

Repositories/Waste. Before 2006, Georgia did not have a centralized repository for storing radioactive waste and disused radioactive sources in particular. The need for such a facility became obvious when disused radiological sources (caesium-137 and cobalt-60) were found in Georgia. These were buried initially in a primitive, Radon-type near-surface disposal facility near Tbilisi. The Soviet-era facility was closed in 1988 and re-opened soon after to bury the newly found radioactive sources and then continued functioning under Georgian authority until 1995.

Thus, in the early 1990s the Georgian authorities faced for the first time the necessity of establishing a nuclear and radiation security and safety system. In the given situation, the government acknowledged that with limited capabilities it was hard to establish a solid system for material protection control and accounting (MPC&A), an effective export and import regime and powerful mechanisms ensuring its implementation, which would make it possible to curb the proliferation of nuclear materials and technologies and facilitate international cooperation with the global nuclear nonproliferation regime.

2. Creating Legal Foundations for Nuclear and Radiation Safety

Since 1996, given the challenges facing Georgia, international institutions and the USA and EU states have become more proactive in ensuring nuclear and radiation safety in Georgia and provided considerable support to Georgia in this area. In 1996, Georgia became a member state of the IAEA. Following Georgia’s accession, it committed to cooperating with that and other international institutions in the fight against the proliferation of WMD and to establish strict controls on export and import of arms and dual-use goods. During the following years the international community supported Georgia’s effort to establish a national export and import control system over WMD components and dual-use goods and a related enforcement regime, as well as appropriate means to implement international sanctions.

Some other factors also increased Western interest in speeding up the integration of this small and newly established state into the international non-proliferation regime. Georgia's new geopolitical role, which the country acquired in the 1990s as a regional hub for transport, energy resources and telecommunications for the West, played an important role in this process. In those years, the USA and the EU's leading governments supported the creation of a transport corridor between Europe and Asia, through Georgia and the South Caucasus region, and the development of the region's capacity in ensuring the transportation of energy resources and telecommunications. In order to respond to the new geopolitical role and new challenges of the late 1990s, the Georgian authorities, with the support of the international community, put on their agenda the creation of legal foundations for the establishment of a national system of export and import control and an institutional base for its implementation.

2.1. Creation of legal foundations for a national export and import control system in the area of nuclear and radiation security

After joining the IAEA, Georgia developed ties with the Western developed countries in the area of nuclear and radiation security. On 17 July 1997, the US and Georgian presidents signed an agreement (which came into force on 10 November 1997), enabling Georgia to participate in the US government's Cooperative Threat Reduction (Nunn-Lugar) Programme. This increased US support for Georgia to develop its legislative base of export and import controls, and improve the infrastructure and workforce capabilities of the country's border, customs and other enforcement state agencies.

Moreover, in 1997, a number of documents were adopted which laid the groundwork for the establishment of the import-export control regime for sensitive materials and dual-use goods in Georgia. On 5 October 1997, the Georgian president issued a decree on the formation of an interagency commission on military-technical issues under the National Security Council. Its remit was to provide recommendations to the executive government defining conditions for the export and import of military and dual-use goods and meeting Georgia's international commitments in this area. The body was the first coordinating agency whose responsibility was to establish a system dealing with nuclear and radiation threats.

Under the same presidential decree, the Ministry of Justice became responsible for issuing licences for the export and import of dual-use goods and the conditions of servicing, while the Ministry of Environment and Natural Resources Protection was tasked with developing regulations pertinent to the licensing of radioactive and related substances.[10] The Environment Ministry also became responsible for developing regulations for the creation of the state inventory of nuclear materials and radioactive waste, and the conditions of servicing.

Georgia took another important step in building its national export-import control regime on 1 September 1998, when the parliament passed a new law on the export and import control of arms, military equipment and dual-use goods. The law defined procedures and rules for the export/import of arms, military equipment and technology, and scientific and technological information. Under the law, export, re-export and transit of all goods that fell under the export control goods category was to be carried out according to the rules set by Georgian law and international conventions and agreements on non-proliferation of weapons and technologies of mass destruction.

Nonetheless, the legislative framework did not fully meet international obligations. In particular, the law did not ensure full control over the end users or continuous updates of the list of sensitive materials.

Later, in 2003, as well as in 2005, the laws regulating export and import of dual-use goods were further modified. However, the amendments did not address the loopholes earlier identified by experts, but rather raised additional concerns. The 2003 amendments to the law increased the role of the president in the decision-making process, while in 2005 the new edition of the law transferred control of the interagency commission for military and technical issues to the Defence Ministry and thus lost its inter-agency status. In addition, the system of licensing and issuing permits changed. In the past, the Justice Ministry had been responsible for issuing such licences while under the new law, the Ministry of Economy and Sustainable Development became the licence-issuing body. In addition, the law on Licences and Permits (passed on 24 June 2005) cancelled the need for government agencies to obtain a licence for export and import of arms and dual-use goods, which further weakened the control system.

The second major set of legislative developments pertained to radiation safety. The legislative base for the radiation safety system in Georgia is the Law on Nuclear and Radiation Safety. The initial version of the law was passed by parliament on 30 October 1998 and the law came into force on 1 January 1999. The law laid the legal foundation for the establishment of a national radiation safety agency in Georgia. Since then, multiple changes have been made to the law.

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[10] Regulations on licensing radioactive materials and related activities.

The law banned the export, re-export, transit and ownership of arms, explosives, radioactive waste, as well as their testing. The law banned the functioning of nuclear facilities of greater than 5MW capacity on Georgian territory. Also banned was the import of radioactive waste for use, storage and other purposes. Setting such limits in the law was linked to the stance of scientists and experts who had experience of working with the nuclear reactor and who understood full well that, against the background of Georgia's limited resources and weak administrative capabilities, the maintenance of safe nuclear facilities would prove extremely difficult.[11]

Paragraph 41 of the law, which banned the export, import, transit and re-export of radioactive waste, created a hindrance for returning spent radioactive sources to their producers. There was also the factor of the spent nuclear fuel accumulating in Armenia, which posed a certain threat to Georgia. In view of the safety of Georgia's population, experts deemed it reasonable that the fuel only be transported under strict control. EU experts expressed concerns about the law. They believed that the 1999 law did not define measures ensuring its implementation and did not adhere to the basic requirements of IAEA safeguards, as at that time Georgia had not yet signed its NPT Safeguards Agreement.

The latter problem was addressed when Georgia ratified IAEA Safeguards Agreement and voluntary additional protocol on 24 April 2003 under decrees No 2111- IIs and 2112 -IIs. Accordingly, Georgia started working on the amendments to the law on Nuclear and Radiation Safety. Parliament adopted the final version on 20 March 2012. The law removed bans on the export of radioactive waste and limitations set out in the previous version of the law on the power of nuclear facilities. The new law defined the Ministry of Environment and Natural Resources as responsible for issuing permits for the export, import, and transit of nuclear and radiation facilities, materials, waste and minerals and nuclear technologies.[12] According to the law, licences for such transactions are one-off and are issued for an indefinite period. The validity of the licence is limited to one year – activities should be carried out within one year of the issuance of the licence. Licences are issued for single transactions such as:

- Purchase and transfer of radioactive materials

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[11] Interview with a nuclear physicist working at the Institute of Physics, summer 1999.

[12] The system of authorization of nuclear and radiation safety started operating in Georgia on 14 January 2001, when, by decree of the minister of environment and natural resources, a relevant instruction came into force. Later on, when the law on licences and permits was passed, the instruction was cancelled and relevant provisions were transferred to the framework law on nuclear and radiation safety.

- Export, import and transit of radioactive substances, raw materials which can be used for the production of nuclear materials, equipment which contains radioactive substances, and nuclear technologies or expertise.
- Export of radioactive waste

Under the new law, a party who imports a radioactive source into Georgia should abide by the provisions of two laws. It must have two licences – one from the Ministry of Energy and Natural Resources for importing a radioactive source and the other from the Ministry of Economy and Sustainable Development for importing dual-use goods. The Ministry of Environment and Natural Resources in turn can only issue a permit if it gets approval from a special board of the Defence Ministry.

However, the system of issuing permits and licences for the export and import of arms is weakly developed and imperfect in Georgia. At present, state agencies no longer require licences when conducting import/export transactions of arms and dual-use goods, as was required of them before 2005. Under the Law on Licences and Permits of 24 June 2005, state agencies are eligible to import/export arms and dual-use goods without a licence. Such a practice contravenes the common approach applied in Western countries, which implies establishing a system of tight interagency control over the import/export of arms. This Western system rules out transfers through exporting countries to any other countries on which international sanctions have been imposed, or which face the threat of the resumption of conflicts. The EU Code of Conduct on Arms Export ensures the compliance with these commitments and in 2007 Georgia pledged to meet EU standards and requirements on arms transfers in the framework of the EU-Georgia cooperation agenda.

In addition, there are no legislative and regulatory mechanisms in place in Georgia that would ensure the regular revision of the lists of products and states on which the international community has imposed embargos or sanctions. Under current legislation, such lists are drawn up by the president, who for his part is guided by the recommendations from the parliament and the interagency commission. Under the current circumstances, wherein the commission is effectively not functioning as an interagency unit, there are no legal mechanisms for upgrading the lists. It is expedient that changes be made to the law which would bring Georgian law into line with European law and strengthen the arms control system in Georgia.

On 27 September 2013, the US Embassy in Georgia, in coordination with the European Union, hosted a government outreach symposium. During the event it was announced that, with support from the United States, EU and the Federal Agency for Export Control of Germany, with the involvement of Georgian members of parliament and committee chairs, the draft of a newly revised export control law was elaborated. According to the western donors supporting the development of the law, the draft export control legislation is to be adopted by the parliament in October 2013, and this must happen on an interagency basis in order to help move Georgia towards meeting international standards of nonproliferation legislation, thereby supporting Georgia's movement toward NATO and EU integration.

Normative acts regulating nuclear and radiation safety

1. Law on nuclear and radiation safety Parliament passed the law on 30 October 1998, and it entered into force on 1 January 1999. Parliament announced the old law out of force and passed a new edition on 20 March 2012. Some of its paragraphs came into force on 1 May 2012.
2. Georgian government decree N 397 of 24 December 2010 on the establishment of uniform rules for alarm in case of discovery of nuclear and radioactive substances at Georgia's border points, airports, ports and marine territories.
3. Presidential decree N 415 of 26 August 2008 on approval of the plan of national response to emergency situations of natural and technogenic nature.
4. Legislative acts issued by the Ministry of Labour, Health and Social Welfare:
    a. Decree N 151/o of 15 January 2000 on radiation safety limits

    b. Decree N 10/n of 13 January 2004 on norms and sanitary rules for the arrangement of radioisotope laboratories and the use of radio-pharmacological drugs in medicine

    c. Decree N41/n of 4 January of 2003 on sanitary norms for ensuring radiation safety in the process of medical X-ray and radiology diagnostic procedures and treatment

    d. Decree N 42/n of 4 March 2003 on basic sanitary rules to be applied during work with radioactive substances and other sources of ionizing radiation

   e. Decree N 8/n of 14 January 2004 on methodological instructions for organizing sanitary and hygienic and preventive medical measures during large-scale radiation disasters

5. Georgian law on protection of population and territories during emergencies of natural and technogenic nature (49922-Ib)

6. Regime developed and passed by the Transport Administration on transportation of goods by land vehicles

3. International Cooperation and Nuclear and Radiation Safety

The Georgian government began to address nuclear and radiation safety once it was able to access international aid, particularly from the USA, in the 1990s.[13] Before that, however, independent Georgia faced many challenges.

3.1. Nuclear safety and security

In 1990-1994, nuclear and radiological research laboratories in Georgia continued working in an unsafe physical environment and with limited economic resources, which on many occasions prompted the suspension of research activities.

The Andronikashvili Institute of Physics managed a nuclear reactor situated in 20 km from Tbilisi. The reactor, with a 5MW capacity, was operational until 1988 and utilized HEU fuel enriched up to 90%.

By 1996, the nuclear reactor stored 4.3 kg of fresh HEU rods and 800 grams of HEU- and LEU-based spent fuel, which raised security concerns as the institute lacked ability to sufficiently protect the material.[14] In 1996, the IAEA became involved in the process of improving physical protection systems at the institute. The current administration confirms that in 1996, IAEA helped the institute carry out an inventory of nuclear material; a special storage facility was set up for its safe storage, and an alarm system was installed. In addition, these measures resulted in improved protection of the stored fuel and nuclear materials. Still, they proved insufficient according to international norms for the protection of some materials, in particular, uranium enriched up to 90%. (Picture. 1)

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[13] Interview with Minister of Environment in 1995-2004 Nino Chkhobadze, July 12, 2012.

[14] Interview with S. Abramidze, summer 1999.

Picture 1. Reactor of the Institute of Physics

The institute managed to remove fuel from the reactor within the framework of the Nunn-Lugar programme, which started on the basis of the July 1997 US-Georgian bilateral agreement.[15] In April 1998, with support from the governments of the USA and the UK, operation Auburn Endeavour was carried out, under which 800 g. of HEU- and LEU- based spent fuel from the reactor was transported to the Dounreay nuclear Complex in Scotland and 4.3 kg fresh fuel – most of which was HEU enriched to 90% – to the US. In addition to the existing and already irradiated fuel, all other substances which posed threats to nuclear security were removed (Picture 2).[16] According to the British government and US official sources, additional spent fuel (5.8 kg of LEU fresh fuel and 3.7 kg of LEU spent fuel) was removed from the site during the same operation.[17]

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[15] The agreement between Georgia and USA on nonproliferation of WMD and Developing defence and military cooperation was signed in Washington DC on 17.07.97 by Eduard Shevardnadze, ratified by Georgian parliament's Decree N 856-RS of 17.09.97, enforced on 10.11.97. The agreement was extended until 10.11.2010 (nota N11–14485, 17.05.2002), further extended until 10.11.2016 under note N 6/4562–14, 13.10.09 http://www.mfa.gov.ge/index.php?sec_id=268&lang_id=GEO.

[16] M. Gordon. 21 April, 1998, "US, Britain relocate Nuclear Material from Volatile Georgia", NY Times.

[17] Philipp C. Bleek, 2004, Global Cleanout, "An Emerging Approach to the Civil Nuclear Material Threat", Belfer Center for Science and International Affairs, John Kennedy School of Government , Harvard University; NTI, "Georgia: Operation Auburn Endeavor.",

The joint UK-US operation was managed by the US National Security Council and was carried out with the participation of the US Departments of Energy and Defence. The enriched uranium was transported on two US Air Force C-5B Galaxy cargo planes.[18] The decommissioning of the reactor started following the removal of the fuel. Nevertheless, attention from the authorities and the international community was still required to guarantee the security of the spent fuel storage facility located on its premises.

On 16 July 1997, IAEA Director General Hans Blix visited the Institute of Physics. Lacking the technology and site to safely dismantle the reactor and store its component parts offsite, institute officials suggested that the IAEA help them decommission the reactor by pouring concrete in the lower, most radioactive, third of the tank. That would allow them to continue to use the upper-two thirds of the reactor tank for either a low power reactor or a critical assembly. Scientists saw this possibility as offering important benefits for Georgia such as education and training of specialists in the field of reactor physics and atomic energy[19]. In addition, operation of a critical assembly or low-power reactor will allow Georgia scientists to carry out neutron activation analysis and neutron radiography, irradiation of various samples and production of medical isotopes. But the opportunity to install a low power experimental nuclear facility has never been put on the agenda of the government or the institute since the reactor was decommissioned.

Blix approved the plan and in July 1998, IAEA experts visited Georgia to study the reactor.[20] On 8 September 1998, the agency's technical department supported the project[21] (1999-2000) which envisaged the decommissioning of the reactor and a feasibility study. In accordance with IAEA procedures, the agency sent a letter on 6 September 2000 to the Ministry of Environment and Natural Resources requesting permission to close the reactor by filling the tank with concrete. By

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[18] The fuel was transported by two US Air force cargo aircraft C-5B and the USA reportedly paid Georgia $125,000 for the material; Georgia: Nuclear research Facilities: according to the official administration of Andronikashvili Institute of Physics, Tbilisi.; Philipp C. Bleek, 2004, Global Cleanout, "An Emerging Approach to the Civil Nuclear Material Threat", Belfer Center for Science and International Affairs, John Kennedy School of Government , Harvard University; NTI, "Georgia: Operation Auburn Endeavor."

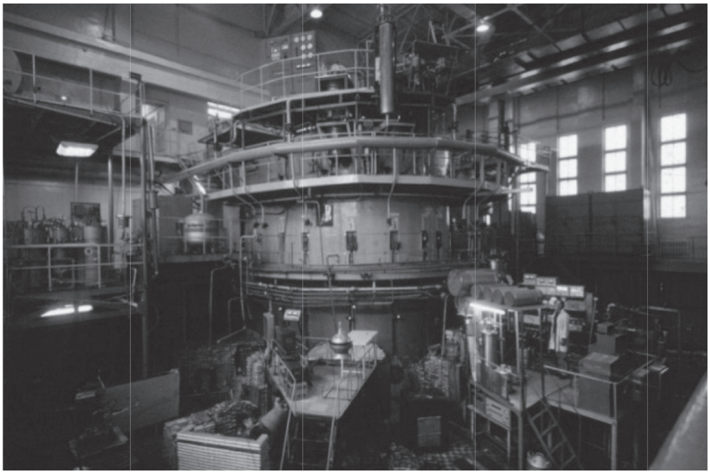
[19] IAEA-TecDoc 1124 On-site disposal as a decommissioning strategy http://www-pub.iaea.org/MTCD/publications/PDF/te_1124_prn.pdf.

[20] IAEA-TecDoc 1124 On-site disposal as a decommissioning strategy http://www-pub.iaea.org/MTCD/publications/PDF/te_1124_prn.pdf**.**

[21] Department of Technical Co-operation) GEO/4/002: Conversion of Research Reactor into a Low Power Facility.

10 August 2002, all activities envisaged at the first stage of the project were successfully completed.

In 2005, IAEA reviewed and approved a new project for the Institute of Physics.[22] The main task under the project was to dismantle the primary and secondary coolant circuits, cryogenic and other auxiliary systems of the reactor, whose surface had been contaminated by the radioisotope Cobalt-60. All radioactive waste generated during the dismantling activity was safely moved to special storage built on the reactor site. All activities under the new project were carried out successfully in 2006-2007. This prompted IAEA to approve a third project to dismantle the pipes connecting the reactor to the cryogenic station.[23]



Picture 2: Physical part of the Reactor

The Sokhumi Institute of Physics and Technology attracted international attention in 1996, when the Georgian government revealed the fact that it had no control over radioactive substances stored there. According to informal sources, in 1997, a group of Russian scientists from Obninsk visited Sokhumi Institute to conduct an inventory at the request of the international community. They said afterwards that hazardous radiation sources were not found, though the results were not formally publicized.

IAEA experts did not manage to visit the institute until 2001. However, at that time, the Georgian parliament had not yet ratified a safeguards agreement with

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[22] GEO/3/002: Decommissioning of the IRT-M Research Reactor at the Andronikashvili Institute of physics, Tbilisi (2005-2006).

[23] Within IAEA TC project GEO /3/004 the pipes connecting the reactor building to the cryogenic station were dismantled. The big pipes were used as containers for small pipes.

the IAEA, meaning that access for inspectors to the facility was limited. The Georgian party was represented by the Head of the Nuclear and Radiation Safety Service, under the Ministry of Environment and Natural Resources Protection. According to the information he provided, the inspection group was not allowed to inspect the infrastructure of the institute. Despite this, 10 to 20 grams of uranium (information provided without additional uranium specifications) were found at the institute.[24] Currently, de facto Abkhaz officials claim that neither HEU nor any other radioactive substance that can be hazardous to the environment are stored at the Sokhumi Institute.[25]

3.2 Radiation Safety

Concerns about radiation safety received attention from Tbilisi amid the closure of Russian bases on Georgian territory and helped prompt the establishment of a state regulatory system for nuclear and radiation safety. The Soviet military had utilized radioactive sources for various purposes[26]. As a result, after Russia withdrew its military bases in Georgia, some of these areas had been left contaminated with radianuclides and there were several attempts made to smuggle nuclear and radioactive materials from them. According to Georgian officials, many of these materials (137Cs, 60Co, 90Sr and some others) were sold on black market and some of them were found and recovered (total number 263) by security services. In addition, some Georgian officials believe that during the withdrawal Russian servicemen intentionally abandoned radioactive materials in order to avoid transportation costs, which sometimes were as high as the costs of the material itself.

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[24] Hanley Charles J., Missing Uranium, Associated Press, Wednesday, June 26 2002; Nuclear research Facilities' NIS Nuclear Profiles Database, CNS, Monterey Institute of Non-proliferation Studies, Monterey, CA, 2003.

[25] Georgia: Nuclear research Facilities: NIS Nuclear Profiles Database, CNS, Monterey Institute of Nonproliferation Studies, Monterey, CA, 2003.

[26] Most commonly spread substances were two different assemblies of ^{137}Cs radionuclides, which were used for calibration of radiation measuring equipment. The first container included two ^{137}Cs radioactive sources, each of them with the activity of 10 mci. The second, larger container contained one ^{137}Cs radioactive source with activity of 3 Ci . In addition, liquid ^{90}Sr/^{90}Y sources were used to find chemical weapons reagents. Also commonly used were in the military field ^{226}Ra radionuclides due to their luminescent nature as they radiate at night easily observable blue light. Therefore, the Kalashnikov rifle's night vision pointers contained open sources of this radionuclide (mainly two types of night vision pointers were used. Gamma radiation at the pointers was 3mkSv/hr . For the same reason, ^{226}Ra radionuclide was used to cover faces of certain equipment, switch tumblers (especially for flying devices). Military units also stored powders containing such radionuclides, which was used for charging batteries of certain equipment.

A well-known large-scale incident took place in Georgia in 1997, when 11 young Georgian servicemen suffered serious health problems at the Lilo Training Centre premises near Tbilisi because of exposure to caesium-137 radioactive sources.[27] In addition to those radioactive materials, smaller amounts of ^{60}Co and ^{226}Ra were also detected. In that case the IAEA provided large-scale assistance including radiation monitoring equipment and treatment for several of the affected servicemen in leading European clinics. During the monitoring mission at Lilo base, Cobalt-60 and Radium-226 radioactive sources were also found in addition to ^{137}Cs.

Another serious incident took place in August 1998 when powerful sources of ^{137}Cs and ^{60}Co radionuclides were found near the village of Matkhoji, in Georgia's western region of Samegrelo. Regrettably, there have been multiple instances of similar incidents in Georgia ever since, including some contamination by Radium-226 and caesium-137 on former Soviet military bases. One of the latest incidents came in 2009 when four orphaned caesium-137 radioactive sources were found and recovered near the village of Ianeti (the activity of each was 10^{-3}Ci[28]). The latest orphaned radioactive source was found in a load of scrap metal, which was due to leave the port of Poti in March 2012. Initial examination identified caesium-137 sources.

Another source of radiation threats in Georgia was the lack of control over thermoelectric generators (RTGs) (Picture 3). Each RTG source contains ^{90}Sr/^{90}Y radionuclide with initial activity of 1290 tBq (35,000 Ci). According to technical specifications, radiation at a 1 metre distance from the source is 1Sv/hr[29]. Six such sources were found and neutralized in Georgia. The sources were meant to generate electric power. The sources, due to a halt of Beta radiation in strontium titanate, generate intense heat. They were placed in couples in special containers which were installed in the ground. The difference of temperature between the source and its surroundings generated voltage, which was used for the electric

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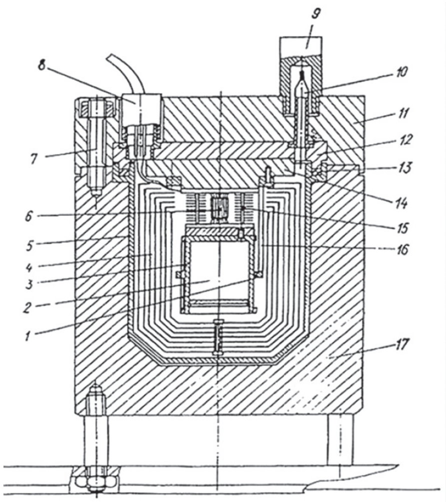
[27] "The Radiological Accident in Lilo, Georgia", IAEA, Vienna 2000.

[28] The units of measure for radioactivity are the curie (Ci) and Becquerel (Bq), a measure given in Ci or Bq tells the radioactivity of a substance. 1 Bq represents a rate of radioactive decay equal to 1 disintegration per second and 37 billion (3.7×10^{10}) Bq equals 1 curie (Ci). Source: US Nuclear Regulatory Commission website.

[29] Units for dose equivalent (the energy imparted by ionizing radiation per unit mass of irradiated material) are the roentgen equivalent man (rem) and sievert (Sv), and biological dose equivalents are commonly measured in 1/1000th of a rem (known as a millirem or mrem). It is generally believed that humans exposed to about 500 rem of radiation (5 mSv) all at once will likely die without medical treatment. Similarly, a single dose of 100 rem (1 mSv) may cause a person to experience nausea or skin reddening (although recovery is likely). However, if these doses are spread out over time, instead of being delivered all at once, their effects tend to be less severe. Source: US Nuclear Regulatory Commission website.

feed of a corresponding aerial. Such appliances in the Soviet era were located along the Enguri river gorge for military purposes. During Soviet times, the RTG devices were known to serve as a radio communication source for military aircraft. After the breakup of the Soviet Union, local residents who found the orphaned devices hid them to use them for heating purposes. As a result some of them were seriously irradiated and one died.[30]



Picture 3. RTG circuit

Russia has claimed to the IAEA that it has no information about the presence of RTG sources in Georgia. However, the RTG manufacturer Platov has provided some information on the number of generators (which were produced in Narva, Estonia) said to be present in Georgia[31]. According to Platov, eight to 12 such appliances were exported to Georgia. In order to identify the sites of RTG appliances across Georgia, a number of search operations have been conducted with the support from IAEA and with the participation of the Agency for Radiation Safety[32] (Picture 4).

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[30] "The Radiological Accident in Lia, Georgia", IAEA, Vienna (to be published). The latest accident related to RTGs took place in late 2001, when near the village of Lia, in the mountains, three local residents found an RTG, dismantled it and tried to transport the radioactive sources. They began to feel ill on the way, hid the sources behind a big stone and returned to the village. Two of them were seriously irradiated and were sent to Russia and France for treatment. Regrettably, the person who was sent to Russia did not survive.

[31] RTG constructor Platov orally shared this information with the Georgian official representing the Agency for Radiation Safety, Georgian Ministry of Environment Protection and Natural Resources.

[32] A large-scale operation whose purpose was to ensure radiation safety was carried out in Georgia, near the village of Lia, in early February 2002. The plan of the operation was

Picture 4. Two RTGs found near the village of Lia

All told, in the past years, more than 300 orphaned radioactive sources have been found and neutralized in Georgia (this does not include sources with relatively low activity such as the night vision device for Kalashnikov automatic guns). The Nuclear and Radiation Safety Service initiated a number of operations to recover and account for the sources, including physical searches (by air and on land) and inventory maintenance.

An air search operation in 2000, for example, was used to locate and safely dispose of several strontium-90 RTGs. With support from the IAEA, French and Georgian experts employed air-based gamma detectors in western Georgia and near Tbilisi to find the sources. Search operations carried out by car and on foot were supported by the IAEA and the governments of the USA, France, India and Turkey in 2002, 2003 and 2005.

Initial measures carried out by the Georgian agencies aimed to recover already identified but missing radioactive sources. However, later on, the agencies created a registry of ionizing radiation sources in order to prevent the appearance of new orphan sources and to lay the groundwork for the establishment of a national radioactive waste management system.

The Georgian Radiation Safety Agency created the registry with the assistance of the US Nuclear Regulatory Commission. For this purpose all potential users and owners of radiation sources were informed about the establishment of this

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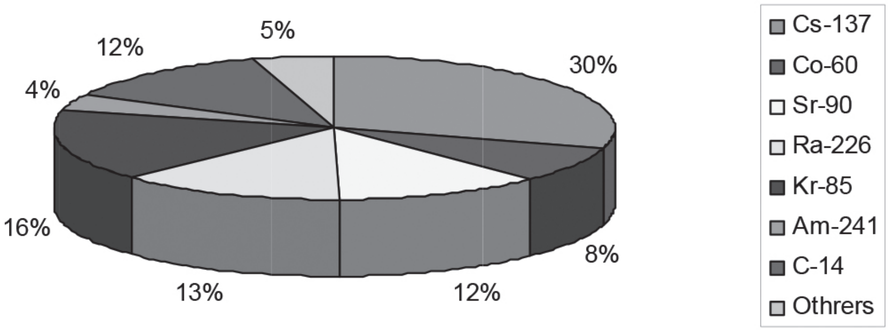
developed by the Nuclear and Radiation Safety Agency and was agreed with other relevant agencies. Rescuers were trained in advance and tools and activities were tested. The operation was successful – in the process the rescuers were irradiated to the lowest extent possible (0.1 – 1.16 mSv). The sources were placed in a special container (whose leaden protection was 23 cm thick) and were moved to a safe storage facility.

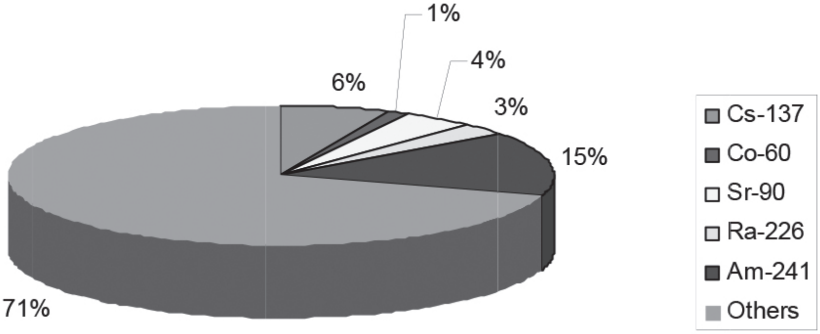
registry. During the next stage, the agency conducted an inventory of materials in order to 1) collect information about existing ionizing sources [33]; 2) identify information about potential users and owners of other ionizing sources; 3) consult with owners about the need to obtain licences and give them advice as to how to prepare a licence request.

The inventory identified 1,537 closed and 762 open radioactive sources the majority of which (1,132) were no longer needed and were placed in an appropriate storage facility. Sources typically found in Georgia were those used in drilling equipment carotages (^{137}Cs, ^{226}Ra, Pu-Be, ^{241}Am-Be), industrial radiography (^{192}Ir) and other industrial uses (^{90}Sr, ^{60}Co) and, medical (^{99m}Tc, ^{125}I, ^{14}C) and other uses.

Pictures 5 and 6 show the distribution of radioactive sources by radionuclides.



Picture 5: Distribution of closed radioactive sources against radionuclides



Picture 6: Distribution of open radioactive sources against radionuclides

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[33] Ionizing radiation sources covers radiation sources (open and closed) as well as ionizing radiation generators.

Overall, radioactive sources (used in research or production) present in Georgia and covered by government regulations can be grouped as follows:

1. Nuclear research reactor IRT-M (decommissioned)

2. Institutions which use radioactive sources for radiography, research, carotage, etc. (mainly ^{137}Cs, ^{60}Co and ^{192}Ir)

3. RTG sources: irradiators type Gube-400, Stebel and Kolos (^{137}Cs with activity of 280tBq). medical irradiators Rokus (^{60}Co with activity of 50-75 tBq), Teragama with activitiy of 232tBq

4. Neutron sources for logging ^{ing} (^{241}Am-Be, ^{210}Po-Be, ^{239}Pu-Be, ^{252}Cf)

5. Nuclear materials intercepted during illicit trafficking; nuclear materials used in research or as protective measures

6. Medical and research open sources

7. Disposal of radioactive waste

8. Three RHM (Reil High Measurement System) devices

9. X-ray devices used mainly for medical and also for research purposes

10. Special devices containing radioactive sources with activity less than 5mCi (smoke alarm devices and others)

So-called gamma relays (GR-6, GR-7), need to be singled out. These were used to measure density in substances and gases. These gamma relays were installed in all petrol and gas stations as well as in factories. The relays were used as ^{137}Cs sources with activity 10-15 gBq.

^{192}Ir sources were also widely used in industrial radiography in Georgia. Most of them entered Georgia temporarily and were removed. (Under Georgian law, one of the provisions for importing was that the goods be re-exported after the expiry date of the product.)

However, Georgia still has redundant sources that were exported in the Soviet time, but they are not a serious hazard considering their quality of half life in Troxler in a relatively short time – 74 days. So-called one-stop testing equipment, called “Troxler” (Troxler-3440 and Troxler-3430) has also been widely used until recently in Georgia. These devices contain ^{137}Cs with activity of 0.3 gBq and ^{241}Am-Be with activity of 1.48 gBq.

In medical radiation equipment, depleted uranium is often used as a protection against radiation. For example, Agat and Rocus cobins contain such uranium with a mass of 390-500 kg. In addition, ^{99m}Tc and ^{131}I are much used in medicine and gaining popularity (nuclear medicine).

3.3. Illicit trafficking

Since the late 1990s, there have been a number of cases of smuggling of nuclear and radioactive materials across Georgian territory. Two factors may account for these cases. One is the insecure borders between Georgia and Russia, in particular, those involving contested Georgian territories occupied by Russian forces, as well as the two countries' generally troubled relations. [34] The other is Georgia's economic growth, which has fuelled the transportation of both legitimate and illegitimate goods across Georgia.

Of the cases of illegal trafficking of nuclear and radioactive materials, the following have been most publicized:[35]

1. 20/September/1999 – 219 capsules containing 16% enriched uranium, total mass 1000.7grams
2. 19/April/2000 – 920 grams. 30% HEU, four suspects arrested and HEU were seized
3. 2000 – Tbilisi, 400 g plutonium and 800 grams low-enriched uranium, one individual arrested for possession
4. 21/April/2001 – 920 grams of 3%-enriched uranium
5. June 2003 – Georgian-Armenian border, 170 grams of 90%-enriched uranium

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[34] According to interviews with Georgian officials published by the Associated Press, the radioactive material in the five new cases in 2012 all transited through Abkhazia, which borders on Russia and has Russian troops stationed on its territory. AP Exclusive: Georgia investigations detail stream of radioactive materials on black market, Associated Press, Updated: Sunday, 9 December 2012, 7:36 PM; http://www.washingtonpost.com/national/georgian-investigations-suggest-a-steady-stream-of-radioactive-materials-hitting-black-market/2012/12/09/2e644bcc-4216-11e2-8c8f-fbebf7ccab4e_story.html , acceeded on 15 July 2013

[35] Illicit Trafficking in Nuclear and Radioactive Materials in the Caucasus: the Case of Georgia, Elena Sokova, CNS, INMM Workshop "Reducing the Risk from Radioactive and Nuclear Materials", Albuquerque, NM, 10-11 March 2009. Organized Crime and the Trafficking of Radiological Materials, The Case of Georgia, Alexander Kupatadze, Nonproliferation Review, Vol. 17, No. 2, July 2010. Some other references were provided by the Georgian Agency on Nuclear and Radiation Safety, August 2012.

6. 1/February/2006 – 110 grams of 89.5%-uranium
7. 9/June/2007 – 14 grams of low-enriched uranium
8. 2/November/2007 – 84-pound lead vessel contained radioactive cesium-137, Zugdidi Georgia
9. 11/March/2010 – 17 grams of highly enriched uranium. Police arrested two Armenian citizens with the material transported in a pack of cigarettes.
10. February 2011 – Kutaisi, stolen radioactive substance from an abandoned Soviet helicopter factory, iridium-192 and europium-152
11. 18/July/2011– 1581 grams of 5%-enriched uranium , Armenian-Georgian border
12. 6/January/2012 – Tbilisi, 36 vials with cesium-135
13. March 2012 – a lead cylinder holding cesium-137, found in the scrap metal, which was leaving the Port of Batumi
14. 2/April/2012 – 2 pounds of (1 kg) Caesium 135, Ankara, Turkey, three men entered from Georgia
15. 5/April/2012 – three glass containers with about 2.2 pounds (1 kilogram) of yellowcake uranium seized from a group of five in Samtredia, Georgia
16. 10/April/2012 – caesium-137 and strontium-90[36], two Turkish nationals and one Georgian were convicted
17. June 2012 – 9 vials of caesium 135, five Georgian men were convicted, materials same as seized in January 2012 and April 2012 (in Turkey)

Of the cases identified in 1999-2012, ten were intercepted at the border; six criminals were detained as part of a special operation, and two were detained during random checks.[37]

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[36] The four latest cases were first reported by following source: AP Exclusive: Georgia investigations detail stream of radioactive materials on black market, Associated Press, Updated: Sunday, December 9, 2012, http://www.washingtonpost.com/national/georgian-investigations-suggest-a-steady-stream-of-radioactive-materials-hitting-black-market/2012/12/09/2e644bcc-4216-11e2-8c8f-fbebf7ccab4e_story.html, acceeded on 15 July 2013

[37] Illicit Trafficking in Nuclear and Radioactive Materials in the Caucasus: the Case of Georgia, Elena Sokova, CNS, INMM Workshop “Reducing the Risk from Radioactive and Nuclear Materials”, Albuquerque, NM, 10-11 March, 2009.

Multiple cases of illegal border crossing with highly enriched uranium and other radiation sources, as well as examples of seizure by police forces of nuclear materials smuggled from Georgia in Turkey in 2012, demonstrates that Georgia has become an attractive transit country for the nuclear black market. Most smugglers detained in Georgia are foreign nationals without links to international crime groups and looking for opportunities to sell stolen radioactive sources. They mostly enter Georgia from Armenia, or cross the Georgia-Russia border either through the legal checkpoints or illegally from Abkhazia or South Ossetia. It is also clear that sometimes smugglers crossed borders undetected and that the scale of black market presence to Georgia is still unknown.[38] In addition, many of the detained smugglers appeared to be targeting Western markets by transferring radioactive materials into Turkey.

Several assistance programmes to Georgia's Ministry of Internal Affairs have been aimed at curbing trafficking.[39] For example, the US State Department has provided assistance to Georgia's Border Guard Agency. In particular, the Georgian Border Security and Law Enforcement (BSLE) Assistance Programme started in 1999 and under the programme, Georgia received radio equipment, vehicles and boats, while customs and border guard staff were trained in WMD non-proliferation issues.

Currently, with the assistance of the US government, Georgia operates SLD (Second Line Defence) system (state border nuclear and radiation security system), enhancing the security level and physical protection infrastructure for high activity radiation sources in the framework of GTRI (Global Threat Reduction Initiative) and works to build the capacity of the relevant Georgian agencies.
In recent years, Georgia has carried out the following activities with support from the US government:

- Installed portal monitors at border checkpoints, while green borders (the external land borders outside border checkpoint areas) are equipped with mobile portable monitors)
- Distributed portable detectors and spectrometers to the Patrol Police and the Ministry of Economy and Sustainable Development (to locate, register and identify a radioactive source)

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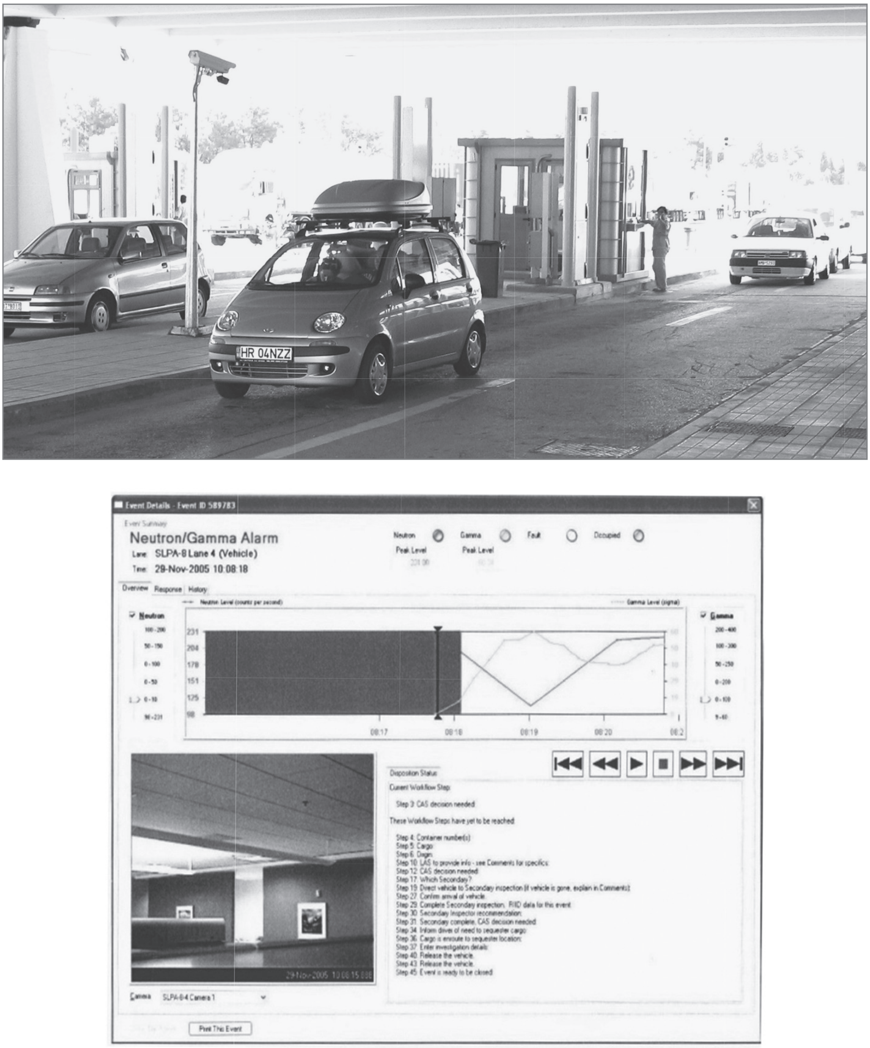
[38] AP Exclusive: Georgia investigations detail stream of radioactive materials on black market, Associated Press, Updated: Sunday, December 9, 2012, 7:36 PM; http://www.washingtonpost.com/national/georgian-investigations-suggest-a-steady-stream-of-radioactive-materials-hitting-black-market/2012/12/09/2e644bcc-4216-11e2-8c8f-fbebf7ccab4e_story.html

[39] Organized Crime and the Trafficking of Radiological Materials, The Case of Georgia, Kupatadze Alexander, 15 July 2013, Nonproliferation Review, Vol. 17, No. 2, July 2010.

- Established a response and notification system

Portal radiation monitors detect increased volumes of gamma and neutron radiation being smuggled through green borders (Picture 7). The equipment checks the received signal against portable detectors and a report is generated by special computer software.



Event Details - Event ID 589783

Event Summary

Neutron/Gamma Alarm

Lane: SLPA-8 Lane 4 (Vehicle)

Time: 29-Nov-2005 10:08:18

Disposition Status

Current Workflow Step:

Step 3: CAS decision needed

These Workflow Steps have yet to be reached:

Step 4: Container number(s)
Step 5: Cargo
Step 6: Origin
Step 10: LAS to provide info - see Comments for specifics
Step 12: CAS decision needed
Step 17: Which Secondary?
Step 19: Direct vehicle to Secondary inspection (if vehicle is gone, explain in Comments)
Step 27: Confirm arrival of vehicle
Step 29: Complete Secondary inspection. RIID data for this event
Step 30: Secondary Inspector recommendation
Step 31: Secondary complete, CAS decision needed
Step 34: Inform driver of need to sequester cargo
Step 36: Cargo is enroute to sequester location
Step 37: Enter investigation details
Step 40: Release the vehicle
Step 43: Release the vehicle
Step 45: Event is ready to be closed

Camera: SLPA-8-4 Camera 1

Picture 7. Portal monitor and a screenshot of report

This equipment has already helped detect several illegal shipments of radiological and nuclear material, for instance, in March 2012 when caesium-137 was found in scrap metal, which was leaving the Port of Batumi (Picture 8).

Picture 8. ^{137}Cs radioactive source found in scrap metal

Moreover, the international nonproliferation community offers Georgia cooperation with the IAEA's ITDB (Illicit Trafficking Data Base) by providing relevant information. Since 2005 Georgia has actively participated in ITWG (International Technical Working Group) activities aimed at combating illicit trafficking of nuclear and radioactive material. Most importantly, in 2012 Georgia concluded a political agreement with the EU to establish the Regional Secretariat in Tbilisi within the framework of the Chemical Biological, Radiological and Nuclear (CBRN) 'Centres of Excellence' (CoE) Initiative[40].

3.4. Treatment of radioactive waste

Before 2005, Georgia did not possess a centralized storage facility for radioactive waste. Such a facility was constructed with support from the US government on the premises of the applied research centre of the Institute of Physics. The site was chosen because of the following factors:[41]

- The staff of the applied research centre had relevant knowledge and practical experience to manage radioactive waste
- There were buildings on the premises that could be modified for the purposes of storage and management of radioactive waste

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[40] National Progress Report by Georgia, Nuclear Security Summit, Seoul, South Korea, 26-27 March, 2012.

[41] "Storage of Radioactive Waste", IAEA Safety Guide, WS-G-6.1, Vienna 2006.

- Constructing a facility did not require an additional geological study
- Waste generated in the process of decommissioning the reactor could be placed in the storage with no need for long-distance transportation
- The public would not be opposed to using the premises of the existing nuclear facility as a storage facility

The constructed facility is a two-story building which has eight modules. A radiation monitoring system was installed in the building with support from the IAEA. With the US government's support, the drainage system of the storage facility was improved and the floors were covered with a special smooth cover. The facility is equipped with a special security system, which includes thermal detectors that register movement and a series of video cameras. Currently, the waste generated as a result of decommissioning the reactor, as well as the majority of the confiscated sources, are stored in the facility with the remaining sources to be moved into the building soon.

In addition to the storage facility, Georgia possesses a Radon-type near surface disposal, which was intended to be closed in 1988. The last time a radioactive source was buried there was in 1995. Regrettably, there are no records about the radioactive waste stored there. During a study undertaken together with a Swedish partner, the presence of liquid substances was identified (liquid ^{226}Ra nuclide). Currently, the IAEA and the British government plan to implement a project aimed at improving the physical protection of the repository, and an EU-supported project is to study the repository in detail and assess its safety.

3.5. International Assistance and International Relations

Georgia has been cooperating closely with various countries and international institutions in the area of nuclear and radiation safety. Cooperation with the IAEA should be singled out in this regard. Since 1996, Georgia has received considerable assistance from the agency, which included providing technology such as dosimetric and other equipment, technical assistance, and the training of Georgian specialists. Georgia actively participates in many regional projects across the Europe, Georgian specialists attend training sessions and consultations, and implement national projects. In 2009 -2012 the following projects were implemented:

1. GEO/3/004 “Decommissioning of the reactor site by Andronikashvili Institute of Physics”. The project envisaged dismantling of the pipes connecting the reactor building with the Cryogenic station. The project

was a logical extension of the previous GEO/3/002 project and was successfully completed**.**

2. GEO/0/003 “Support for the creation of national infrastructure for the potential use of nuclear energy”. The project envisages studying Georgia’s energy potential and assessing future likelihood of the use of nuclear energy.

3. GEO/6/007 “Improvement of disease diagnostics and cancer treatment with the help of nuclear medicine technologies”. The project aims to improve the quality of treatment for oncology patients.

4. GEO/8/004 “Development of a radiation forensics laboratory”. The project was a logical continuation of the previous project by IAEA. Regrettably, the project was not implemented due to the restructuring of the existing forensics laboratory.

5. GEO/9/009 “Developing the capacity of radiation monitoring stations”. The project aims to revamp technologically environment radiation monitoring stations and to train specialists. Five new stations will be established under the project.

One project GEO/8/004 “Development of a Radiation forensics laboratory” was a logical continuation of the previous project by IAEA. Regrettably, the project was not implemented due to the restructuring of the existing forensics laboratory.

The following projects are to be implemented in 2012-2013 in cooperation with IAEA:

- GEO/6/008 “Improving brachitherapeutic services at the national oncology centre”

- GEO/7/001 “Support to environmental studies through isotopic methods for underground water management”

- GEO/9/010 “Strengthening nuclear and radiation safety through improving the system of inspection and coercive measures”

- GEO/9/011 “Establishment of treatment of radioactive waste through simple conditioning and processing (including redundant radioactive sources

As noted earlier, the US government has provided substantial support to Georgia. As part of the assistance, the US Energy Department provided equipment to the Georgian border checkpoints, and organized training sessions. The staff of the Argonne National Laboratory organized regular training sessions on identification of dual-use goods. The US Nuclear Regulatory Commission (NRC) purchased a building for the Nuclear and Radiation Safety Department in the city of Poti, which was equipped by the US Energy Department with dosimetric equipment and three vehicles. The Pacific Northwest National Laboratory has financed nuclear security projects in Georgia under which various pieces of equipment containing radioactive sources are being dismantled and moved to appropriate storage facilities. The laboratory also supports a project at the Institute of Physics, which aims to train Georgian specialists on locating and studying nuclear materials. Sandia National Laboratory initiated training in Georgia on locating orphaned radioactive sources and provided dosimetric equipment. Similar training is planned for the current year. The NRC also supported the creation of a registry of ionizing radiation and the development of a number of legislative acts.

Since 2007, cooperation with the EU has also expanded. Within the framework of the EU Neighbourhood Policy, the EU-Georgia cooperation envisages a joint response to threats and risks, in particular: meeting commitments relating to non-proliferation of WMD and means of their delivery, establishment of a national export control system, strengthening controls over export and transit of WMD and related materials and dual-use goods, eradication of illicit trafficking of dual-use goods, identification of end-users and effective implementation of international sanctions.

Two projects (GE/RA/01 and GE/RA/02) can be singled out which have been implemented within the framework of cooperation between the EU and Georgia’s radiation safety regulatory body. The project has helped develop a number of draft laws and regulatory acts. Of these, most important is the development of a country strategy on radioactive waste treatment. The projects provided Georgia with state-of-the-art dosimetric equipment and two vehicles. The EU has approved a new 1 million Euro project (G4.01.08), to carry out a strategic study and assessment of the proposed Saakadze radioactive waste repository and the storage facility of the Institute of Physics. A competition for bids was announced in December 2011. The project was officially approved in 2008 and it is to be completed in 2013[42]. The Georgian side has urged the EU to include in the project training of Georgian specialists in leading centres of Europe and has received written consent from the donor.

With support from the UK government, Georgia carried out a study titled "Management of radioactive sources in Georgia", which analyzed all issues related to the treatment of radioactive sources and developed 22 project proposals, which were then presented at a UK government-supported donor conference. The international donors from the USA and EU pledged to support some of these proposals. The UK government and IAEA are also supporting a project on the improvement of physical protection of the repository.

Sweden's Radiation Safety Administration has played a significant role in international support to Georgia in the area of nuclear and radiation safety. A number of efforts supported by Sweden can be singled out:

1. Nuclear non-proliferation: Financial support during 33 months to the regional office in Poti of the Nuclear and Radiation Safety Agency

2. Physical protection: Improvement of physical protection of the nuclear subcritical facility at the Institute of Physics.

3. Medical radiation: Organizing two working meetings in Tbilisi and one visit to Sweden where prospects for medical radiation treatment in Georgia were discussed

4. Treatment of radioactive waste: a joint study by Sweden and Georgian specialists for a radioactive waste repository. Soil and water samples were tested and the presence of liquid waste was identified. Results were highly important for the assessment of the safety of the repository. The next plan is to test leakage from the container in the repository.

In sum, with the help of international organizations and Western governments, the Georgian state agencies have taken steps to improve border control, radiological security and nuclear waste management. However, most of the time these issues have been brought to the government's attention by foreign donors, and Georgia has addressed only those areas where it received foreign assistance. In the meantime, the government has focused less on other elements of nuclear nonproliferation and has not been able to respond in a timely manner to

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[42] EU Projects on Disused Sealed Sources in Former Soviet Union Countries, presentation on CEG Workshop, IAEA, http://www.iaea.org/OurWork/ST/NE/NEFW/Technical_Areas/WTS/CEG/documents/CEG-Workshop-Vienna-2013/English/3.5_EC_Presentation_Eng.pdf

ongoing international challenges. Overall, it can be argued that in the context of increasing international assistance, Georgia still has paid insufficient attention to the developments of its foreign and security policy priorities despite the fact that current nonproliferation dynamics in international arena requires that Georgia ensure the review of its foreign and security policy priorities continuously.

For example, it would be useful for Georgia to pay more attention to nuclear policy developments of its strong regional neighbours, Russia, Turkey, Iran, and take into account their performance in the international nonproliferation regime while defining Georgia's foreign policy priorities. Until now Georgia's foreign and security policy have not considered the regional context in terms of its neighbours' nuclear interests.

To illustrate this point, one could observe several developments indicating lack in consistency of Georgia's foreign policy which is reflected in decisions taken by the Georgian government between 2009 and 2012. One example of this is a controversial decision to increase economic and political cooperation with Iran, which raised serious concerns among Georgia's international partners. In 2009, the Georgian government invited Iranian investments into its hydropower sector. Since 2010, Iranian businessmen have intensified their activities in Georgia – established businesses, entered the banking sector, opened a bank, and founded an Iranian airline company[43]. In addition, Iran and Georgia agreed to take their cooperation even further and established a visa-free movement between the two countries, which placed Georgia among three countries in Europe and the broader Middle East that grant Iranians easy access.[44] Rapid expansion of Georgia-Iran relations raised concerns in the USA and the EU. According to official statements made in the USA and the EU, such developments run counter to the recent efforts by the international community to impose a "fourth round" of sanctions on Iran in order to strike at Iran's capacity to finance its nuclear programme and deepen its isolation[45]

At the same time Georgia has made no modifications in its foreign and security policy in response to the initiatives of its close regional neighbours, Turkey,

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[43] As Sanctions Bite, Iranians Invest Big in Georgia, Benoit Faucon, Jay Solomon and Farnaz Fassihi, WSJ, 20/June/2013, http://online.wsj.com/article/SB10001424127887323864304578320754133982778.html accessed on August 20, 2013

[44] Ibid.

[45] The UN Security Council resolution #1929 imposes tighter restrictions on financial transactions with Iranian banks and an expanded arms embargo. On 1 July 2010 President Obama signed into law US unilateral sanctions against Iran, which aim to cut-off Iran's imports of refined petroleum products such as gasoline and jet fuel as well as limit Iran's access to the international banking system, impose sanctions against foreign companies that trade with Iran.

Armenia, Azerbaijan, related to the development of the peaceful nuclear industry. Turkey is developing the necessary legal and practical infrastructure for its current and future nuclear facilities, particularly, in the context of the Akkuyu Nuclear Power Plant project.[46] Armenia owns a nuclear power plant from the Soviet times and its government formally agreed to close it after several years of pressure from the USA and the EU for safety reasons. It is currently discussing with Russia the issue of constructing a new nuclear power plant and decommissioning the old one. Azerbaijan has plans for the construction and application of an experimental nuclear reactor. Accordingly, Georgia should develop its foreign and security policy based on the premise that its neighbours are going to operate peaceful nuclear facilities. Georgia needs to be more prepared to adequately respond to nuclear security and safety challenges that may arise close to its borders and ensure implementation of its international responsibilities on implementation of export controls and sanctions. In its National Progress Report, submitted during the 2012 Nuclear Security Summit in Seoul, South Korea in March 2012, Georgia pledged to implement nonproliferation objectives and their components on the national level, and provide sufficient commitments to the international instruments. Among the most important political decisions made by Georgia recently have been joining the Convention for the Suppression of Acts of Nuclear terrorism (2010), the Global Initiative to Combat Nuclear Terrorism) and UN Security Council Resolution 1540 on prevention of nonstate actors from obtaining weapons of mass destruction, their means of delivery and related materials as well as extension of its mandate.

The current research did not envisage an analysis of Georgia’s foreign/security policy developments and accordingly, these issues have not been discussed in the chapter in more detail but it does seem urgent for Georgia’s foreign and national security policy to reconsider its approaches and take into account regional dynamics in the nonproliferation field in the future.

<u>International conventions and treaties to which Georgia has acceded</u>

- On 7 March 1994, Georgia joined the Nuclear Non-Proliferation Treaty as a non-nuclear state.
- On 24 April 2003, the Georgian parliament under decree 211-IIs ratified an agreement with IAEA on using the Nuclear Non-Proliferation

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[46] National Progress Report of Turkey to the Nuclear Security Summit on the Implementation of the Washington Work Plan, (Seoul, 26-27 March 2012).

Treaty-related Safeguard Agreement (main protocol). The same day an additional protocol was ratified by decree 2112-IIs.

- In October 2004, Georgia presented its first report in accordance with UN resolution 1540.
- On 7 October 2007, the Convention on Physical Protection of Nuclear Materials came into force in Georgia
- On 20 October 2009, the Joint Convention on Safe Managing of Spent Nuclear Fuel and Waste Management came into force in Georgia. Georgia presented its first national report in accordance with this convention in 2011.
- On 5 November 2010, Convention on Early Notification of Nuclear Disaster came into force in Georgia
- In 2012, Georgia expressed its political will to abide by rules defined by the Code of Safety and Security of Radioactive Sources and its additional directives.

4. Conclusions

Georgia's experience participating in the international nonproliferation regime following independence demonstrates how a new and small state with a nuclear legacy has attempted to cope with this issue. It has become clear that that deep and comprehensive international cooperation is essential to such a country's integration into the nonproliferation regime.

Over the past twenty years, Georgia has signed up to key international legal commitments and participated in relevant nuclear forums. Tbilisi has pledged to be actively involved in international cooperation, improve its nuclear safety and security, prevent non-state actors from obtaining WMD and combat nuclear terrorism, and not tolerate illicit trafficking of nuclear and radioactive sources and related materials. And it has made considerable strides in this direction. Yet, much remains for it to do on a policy, institutional and infrastructural level.

First of all, Georgia's current national security strategy documents (including the National Security Concept, Foreign Policy Strategy, Military Strategy) only loosely address the ways of achieving nonrpoliferation and nuclear security objectives. Georgia needs to take current international dynamics into account and review its foreign and security policy priorities on a permanent basis in the area of nonproliferation. Tbilisi needs to develop export control law that meet US and EU standards and pay closer heed to the nuclear developments of its strong regional neighbours, Russia, Turkey, Iran, as well as Armenia and Azerbaijan.

One area that may hamper Georgia's nonproliferation efforts is connected with the Russian factor. In 2008, Russia militarily occupied part of its territory and exacerbated its security risks. Georgia does not control the international borders that divide its occupied regions – Abkhazia and South Ossetia – from Russia. This fact might allow the unrestricted and unidentified flow of people, as well as movement of potentially dangerous stuff from Russia into the breakaway regions. The Georgian government, with support from the international community, has to address these issues and adjust its foreign/domestic policies accordingly.

Another issue to be addressed by the Georgian government from the point of view of nonproliferation objectives relates to the underdeveloped system for export control of arms and dual-use materials and technologies. No interagency mechanisms exist to control and guide the government's export-import policy, although such control mechanisms are required by international law. Currently Georgia needs to develop a stringent control system that meets the standards of the European Union's Code of Conduct on the Export of Arms, improves the arms-related decision-making process, and ensures efficient measures against arms trafficking and international terrorism.

And finally, there is a danger that the issue of nuclear and radiation safety may remain beyond the political and social discourse taking place in Georgia[47] unless the taboo on the subject is overcome. Politicians, experts, media and society have usually shunned the topic so far. No leading politicians had mentioned nuclear and radiation safety in their pre-election manifestos in recent years. The media have only taken interest in individual cases of illicit trafficking. The cases which are publicized by the state agencies are presented by the media without in-depth analysis of the process or consideration of the international context[48]. Environmental specialists have not demonstrated interest in the issue despite the fact that radiation safety is part of everyday life and its importance

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[47] While working on the given research, soviet high rank officials and Communist Party leaders, in particular, Eduard Shevardnadze, refused to comment and share his knowledge over state of affairs of nuclear and radiation security during the Soviet period in Georgia (August 2012)

[48] Georgia investigations detail stream of radioactive materials on black market, Associated Press, Updated: Sunday, December 9, 2012; http://www.washingtonpost.com/national/georgian-investigations-suggest-a-steady-stream-of-radioactive-materials-hitting-black-market/2012/12/09/2e644bcc-4216-11e2-8c8f-fbebf7ccab4e_story.html; Missing Uranium, By Charles J. Hanley Associated Press, Wednesday, June 26 2002; , acceeded on 15 July 2013

is growing, as introducing treatments with radioactive substances in medicine is becoming more common. This prompts a need for higher public awareness, which currently is very low.

Accordingly, training of specialists in the field is vital for Georgia and the government has to focus on this. As this paper has demonstrated, Georgia, with the help of IAEA, participates in assessing possibilities of future use of nuclear energy, in particular, opportunity to install a low power experimental nuclear facility on the upper-two thirds of the decommissioned reactor which will allow Georgian scientists to carry out neutron activation analysis and neutron radiography, irradiation of various samples and production of medical isotopes. In addition, Georgian experts participate in finding ways to improve disease diagnostics and cancer treatment with the help of nuclear technologies, Georgia has conducted several national trainings and workshops on nuclear security and physical protection and on specialized related subjects. [49] However, these steps are not sufficient. The country has to direct its own human and material resources towards the development of the human dimension of nuclear security, develop relevant strategies and prepare highly qualified technical experts, which can contribute to improving security culture in the country. Today there is practically no interest towards the relevant spheres of physics/radiology among Georgian young people, these academic disciplines are not in demand and the relevant university faculties face problems of attracting students. Scientists have expressed concerns over these trends as they already anticipate the lack of future specialists in radiation safety, nuclear medicine and other relevant and related sectors.

This part of the book describes independent Georgia's nuclear nonproliferation policy in the context of Soviet Georgia's nuclear legacy and is dedicated to analysing ongoing trends in the field since the 1990s. The research suggests that Georgia's policy, institutional and human capacity is still weak. There is a need to broaden not only the discourse, but also policy vision, for Georgia to become a proactive member of the nonproliferation regime that will not only consume security but will also contribute to the process of building security in Georgia and around the world.

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[49] National Progress Report by Georgia, Nuclear Security Summit, Seoul, South Korea, 26-27 March, 2012.

About Authors

Akubardia Teona has over 10 years experience as analyst on various government, media and civil society positions on defense and security issues in Georgia. She is PhD student at Tbilisi State University. She is cofounder and board member of Civil Council on Defense and Security. She is one of the founders of Defense Consulting. Her spheres of professional interest are: defense and security policy and reform, democratic oversight over the security sector, the role of media in democratization process. Ms. Akubardia is author and anchor of several radio and TV programmes.

Chabashvili Mariam worked in Tbilisi State University as a teacher and expert in computer sciences and information technologies. Starting from 2005 she is a program manager of Nuclear and WMD nonproliferation programs carried out in Andronikashvili Institute of Physics in close cooperation with the international organizations (IAEA) as well as the USA and EU member states' institutions (SSM, US DOE/NNSA and PNNL and ANL). She is an expert on Export Control of Nuclear WMD and Dual use Commodities, a member of Technical Experts Workgroup and participates in all events of TEWG, prepares manuals for Georgian Customs and border guard Departments. She is an expert on call in nuclear dual use technologies for Georgian Revenue Service Customs Department.

Dzebisashvili Shalva received EU-Commission doctoral fellowship (GEM) in September 2012 and currently is a PhD-researcher at the Institute for European Studies (IEE-ULB). He is member of the Civil Council on Defence and Security (CCDS). Shalva Dzebisashvili is a former MOD-Official. He graduated from the Catholic University of Eichstaett (Germany) in the field of International Relations and Law in 2003, he entered the government service in a position of senior specialist of the Defence Policy and Planning Department. In 2008-2009 he successfully completed Masters of Art-course in Strategic Security Studies at the NDU (Washington D.C.) and consequently took over the position of Senior Civilian Representative of Geo-MOD (Defense Advisor) to the Georgian Mission to NATO.

Japaridze George I., PhD., Professor of Theoretical Condensed Matter Physics at the Ilia state University, Tbilisi, Georgia; Principal Researcher at the Andronikashvili Institute of Physics. Works in the theory of low-dimensional strongly correlated systems. Author of the more then 60 publications in the fields of spintronics, theory of metal-insulator transitions, low-dimensional magnetism, exactly solvable low-dimensional systems. Member of the Georgian National Academy of Sciences

Nabakhtiani Giorgi, Ph.D. Professor at Georgia Technical University, **t**he Head of Divison of Deparetment for Nuclear and Radiation Safety of Georgian Ministry of Environment and Natural Resorces Protection. He is an author of 41 scientific articles (including IAEA books). Prof. G.Nabakhtiani is an initiator, manager and counterpart of number projects on radiation safety with EU, USA, IAEA, UK and Sweden. He is an author of Georgian license system for nuclear and radiation safety and Georgian laws and regulations. He took part as a leader in every serious searching and recovery operation for orphan radioactive sources conducted in Georgia. G.Nabakhtiani works for upgrading the nuclear security system in Georgia (border control) and establishing for education system for nuclear and radiation safety

Lortkipanidze Shorena, has MA in International Relations, since 2000 works in civil society sector as analyst and practitioner. She is co-founder and board member of Civil Council on Defense and Security (CCDS); Programme manager on civil society development at Tbilisi based International Center on Conflict and Negotiations. She had lectured at Tbilisi State University, worked at MFA Georgia as senior specialist at foreign policy research and Analysis Center; She has working experience as a senior analyst at Parliamentary Committee on Defense and Security. Her spheres of professional interest are: defense and security policy, conflict and peace studies, minority issues, cold war history.

Mchedlishvili Erekle (Irakli) is a co-founder and Board member of the Civil Council on Defense and Security . He has working experience as a visiting specialist at the Committee on Foreign Relations of the Parliament of Georgia, chaired Tbilisi based nongovernmental organization - the Center for Peace and International Relations Studies. In 2001 – 2003 he was a Co-Chairman of the Regional Stability in Southern Caucasus Study Group of the NATO PfP Consortium of Defense Academies and Security Studies Institutes based in Garmisch-Partenkichen, Germany. Currently he is a member of the Combating Terrorism Working Group of the PfP Consortium.

Pataraia Tamara is a head European and Euro-Atlantic Cooperation Programme at the Caucasian Institute for Peace, Democracy and Development, author of number of research surveys and policy reports. Her spheres of professional interest are: democratic transition, foreign relations, international and national security. She is a member of the following professional bodies; Editorial Board Member of the Quarterly Journal CONNECTIONS, Partnership for Peace Consortium of Defence Academies and Security Studies Institutes, Board member of Civil Council on Defence and Security. She was a visiting fellow at the James Martin Centre for Nonproliferation Studies of the Monterey Institute for International Studies, and has been lecturing on the topics of global security and nonproliferation since 2005 at Ilia State university as an invited lecturer. She holds PHD degree in physics and mathematics from Tbilisi State University and lectured plasma physics at Tbilisi State University in 1998-2005.

Rostomashvili Zaza, holds PHD in Plasma Physics and Chemistry. Currently he is a Deputy Director of Andronikashvili Institute of Physics. He is an author of the more than 40 publications in Plasma Physics and Computational Physics. Since 2002 he has been participating in nuclear security and nuclear nonproliferation programs carried out in the Institute in close cooperation with the international organizations (IAEA), as well as USA and EU member states' governments (SSM, US DOE/NNSA and PNNL and ANL).