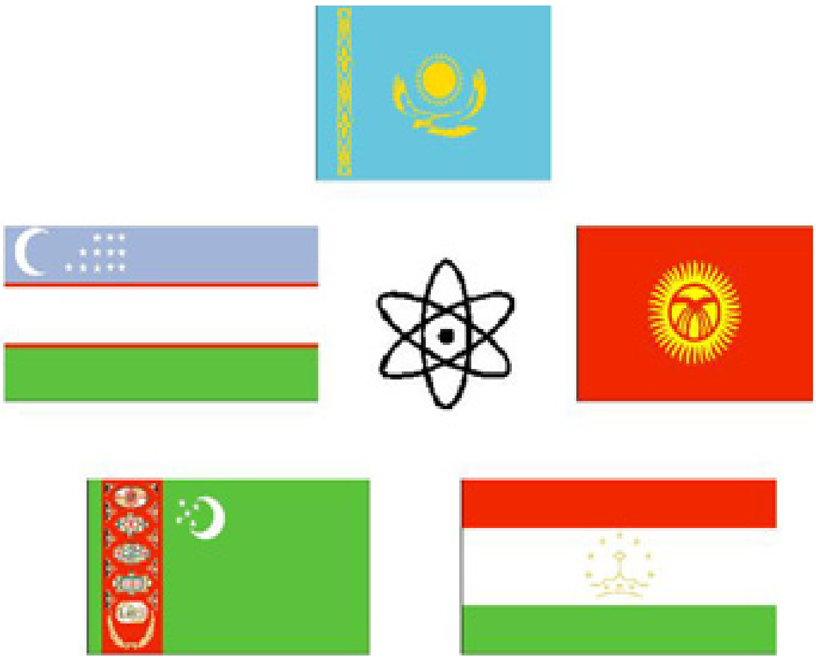
FOI
SWEDISH DEFENCE
RESEARCH AGENCY

FOI-R--1292--SE
July 2004
ISSN 1650-1942

User report

Björn Sandström

Nuclear Risk Assessment:
Central Asia after Independence



NBC Defence
SE-901 82 Umeå

SWEDISH DEFENCE RESEARCH AGENCY

NBC Defence
SE-901 82 Umeå

FOI-R--1292--SE

July 2004

ISSN 1650-1942

User report

Björn Sandström

Nuclear Risk Assessment:

Central Asia after Independence

<table>
<tr><td rowspan="5">Issuing organization
FOI – Swedish Defence Research Agency
NBC Defence
SE-901 82 Umeå</td><td>Report number, ISRN
FOI-R--1292--SE</td><td>Report type
User report</td></tr>
<tr><td colspan="2">Research area code
3. NBC Defence and other hazardous substances</td></tr>
<tr><td>Month year
July 2004</td><td>Project No.
A6131</td></tr>
<tr><td colspan="2">Customers code
2. NBC Defence Research</td></tr>
<tr><td colspan="2">Sub area code
31 N research</td></tr>
<tr><td rowspan="4">Author/s (editor/s)
Björn Sandström</td><td colspan="2">Project manager
Nils Olsson</td></tr>
<tr><td colspan="2">Approved by
Åke Sellström</td></tr>
<tr><td colspan="2">Sponsoring agency</td></tr>
<tr><td colspan="2">Scientifically and technically responsible
Nils Olsson</td></tr>
<tr><td colspan="3">Report title
Nuclear Risk Assessment: Central Asia after Independence</td></tr>
</table>

Abstract (not more than 200 words)

From a nuclear weapons policy point-of-view, the Central Asian states, which formerly were part of the USSR, has created a lot positive, such as declaring the region as a nuclear-weapons-free zone, in their first decade of independence. The nuclear risks are still considerable, but in general the situation has greatly improved compared to 1991. Concerns regarding nuclear weapons have been eliminated. In addition, only a limited amount of weapons-grade nuclear material remains. Today, highly-enriched uranium and spent nuclear fuel elements are probably of most concern. With efforts by international assistance programs, that material now seems reasonably well-guarded. Industrial and medical radiation sources are also on the list of nuclear, or rather radiological, concerns in the region. The national radiation authorities in Central Asia can still be regarded as weak due to lack of economical resources. They are suitable targets for Western assistance, operating on relatively small funds. Another matter of serious concern is diversion of nuclear expertise and material. It is therefore of great importance that critical Central Asian facilities receive grants from international assistance programs. Sabton Limited of Israel is one of the actors on the Central Asian uranium market. A former 15% minority owner of Sabton is accused of involvement in illegal arms trade. It is not reassuring that a company like Sabton can get access to the sensitive uranium market.

Keywords

Central Asia, Kazakhstan, Kyrgizstan, Tajikistan, Turkmenistan, Uzbekistan, nuclear weapons, nuclear risks, radiological risks, uranium

Further bibliographic information	**Language** English
ISSN 1650-1942	**Pages** 62 p.
	Price acc. to pricelist

Utgivare	Rapportnummer, ISRN	Klassificering
Totalförsvarets Forskningsinstitut - FOI NBC-skydd 901 82 Umeå	FOI-R--1292--SE	Användarrapport
	Forskningsområde 3. Skydd mot NBC och andra farliga ämnen	
	Månad, år Juli 2004	**Projektnummer** A6131
	Verksamhetsgren 2. NBC skyddsforskning	
	Delområde 31 N-forskning	
Författare/redaktör Björn Sandström	**Projektledare** Nils Olsson	
	Godkänd av Åke Sellström	
	Uppdragsgivare/kundbeteckning	
	Tekniskt och/eller vetenskapligt ansvarig Nils Olsson	

Rapportens titel (i översättning)

Nukleär riskbedömning: Centralasien efter självständigheten

Sammanfattning (högst 200 ord)

Ur kärnvapensynpunkt har de centralasiatiska stater, som tidigare ingick i Sovjetunionen, uppnått mycket positivt, som t.ex. att utropa hela regionen som kärnvapenfri zon, under det första årtiondet av självständighet. De nukleära riskerna är fortfarande betydande, men i allmänhet har situationen kraftigt förbättrats i jämförelse med 1991. Oron kring kärnvapnen har eliminerats. Dessutom finns endast en liten mängd klyvbart kärnvapenmaterial kvar. Det är troligen höganrikat uran och utbränt kärnbränsle som idag utgör de största riskerna. Med hjälp av internationell assistans verkar ändå dessa vara under godtagbar kontroll. Radioaktiva strålkällor avsedda för industriella och medicinska tillämpningar finns också på listan över nukleära, eller snarare radiologiska, risker. De nationella strålskyddsmyndigheterna i Centralasien kan ännu anses som svaga pga bristande ekonomiska resurser. De utgör lämpliga mål för biståndsåtgärder med begränsad finansiering. En annan allvarlig risk utgör risken att nukleära experter och materiel försvinner till oönskade arbetsgivare. För att motverka detta är det viktigt att de centralasiatiska forskningsanläggningarna ges anslag från de internationella stödprogrammen. En aktör på den centralasiatiska uranmarknaden är Sabton Limited från Israel. Företaget har genom en tidigare delägare kopplingar till illegal vapenförsäljning. Det måste anses oroande att detta företag lyckats komma in på den känsliga uranmarknaden.

Nyckelord

Centralasien, Kazakstan, Kirgisistan, Tadzjikistan, Turkmenistan, Uzbekistan, kärnvapen, nukleära risker, radiologiska risker, uran

Övriga bibliografiska uppgifter	Språk Engelska
ISSN 1650-1942	**Antal sidor:** 62 s.
Distribution enligt missiv	**Pris: Enligt prislista**

Contents

Executive Summary **7**

Introduction **9**

Central Asia **11**
History 11
Political Situation 12
Kazakhstan 13
Kyrgyz Republic 13
Tajikistan 13
Turkmenistan 13
Uzbekistan 13
Internal Conflicts 14
Regional Players 15

Review of Central Asian Nuclear Policies **19**
Nuclear Weapons Policy after Independence 19
Central Asian States and Non-Proliferation Regimes 21
Central Asian Nuclear-Weapon-Free Zone 22
IAEA Safeguards and the Additional Protocol 23

Nuclear Facilities in Central Asia **25**
Kazakhstan 25
Fissile Material Overview 25
Uranium Conversion 27
Power Reactor 29
Research Reactors 30
Radioactive Waste and Spent Fuel 31
Nuclear Test Sites 32
Dismantlement of the Nuclear Weapons Infrastructure 34
Uzbekistan 36
Uranium mining and milling 36
Research Reactors 37
Kyrgyzstan 38
The Kara-Balta Ore Mining Combine 38
Closed Uranium Mining Operations in Kyrgyzstan 38
Radioactive Waste Sites 39
Nuclear submarine rocket testing 39
Tajikistan 39
Vostokredmet in Chkalovsk 39
The Argus Nuclear Reactor in Dushanbe 39
Turkmenistan 39

Risks of Diversion of Nuclear Material, Equipment, and Expertise **41**
Illicit Nuclear Trafficking in Central Asia 41
The Ust-Kamenogorsk Gang 42
The Iranian Truck 43
Other incidents 44
Risk of Nuclear Material Diversion 44
Nuclear Material Diversion in Central Asia - A Decreasing Problem? 47
Risk of Diversion of Nuclear Equipment 47

Risk of Diversion of Nuclear Experts 48
International Assistance Programs to Support Former Weapons Scientists 49
How Does Central Asia Fare in Competition for Grants? 50
Is This Enough? 51
Nuclear Control & Ownership 51
Sabton Limited 52

Map of Central Asia 54

Acknowledgements 57

Appendix 1: The Evolution of IAEA Safeguards 59

Appendix 2: International Corporations that have Explored the Central Asian Uranium Market 61

Executive Summary

From a nuclear weapons policy point-of-view, the Central Asian republics, which formerly were part of the U.S.S.R., has accomplished a lot of positive in their first decade of independence. When this study was initiated Kyrgyzstan had not ratified the Comprehensive Test Ban Treaty and Kazakhstan had not signed and ratified the International Atomic Energy Agency Additional Safeguards Protocol. Since then, Kyrgyzstan has ratified the Comprehensive Test Ban Treaty (in October 2003) and Kazakhstan has signed the Additional Protocol (February 2004). In addition, the five republics together have done an impressive work towards declaring the region as a nuclear-weapons-free zone. At the time of writing, the endorsement of the zone is clearly in the hands of the nuclear weapon states and it is unlikely that they will want to act as long as the situation in the wider region (Afghanistan, Iraq, and Iran) is as unstable as it presently is.

There are still considerable nuclear risks associated with Central Asia, but in general the situation today has greatly improved compared to the situation at the time of independence in 1991. Fortunately, the greatest concerns, those associated with nuclear weapons, have been eliminated. All nuclear weapons, as well as most of the associated infrastructure, are since many years (1995) removed from Kazakhstan. Also, most of the weapons-grade uranium was removed in the US-sponsored Project Sapphire. Today, a limited amount of weapons-grade material remains and the nuclear material of most concern is probably highly-enriched uranium and spent nuclear fuel elements. That material now seems reasonably well guarded with the efforts by international assistance programs to help secure it.

Industrial and medical radiation sources may well be an equally important topic on the list of nuclear, or rather radiological, concerns in the region. Such radioactive sources have not been regarded as a great security problem in the past. Hence, security issues have not been a priority. The International Atomic Energy Agency recently started a program directed against the problem of orphaned sources to make sure that states take this problem seriously. ‘Cradle-to-grave control’ of radioactive sources is the term to ensure that the sources are appropriately regulated at all times. Earlier, emphasis was almost entirely placed on the safety of radioactive sources. Following the events of the latest years and the realisation that radioactive sources have a potential to be used for malicious purposes, the aspect of source security has grown equally urgent from a regulation point-of-view. Central Asia can still be regarded as a part of the world where national radiation authorities are lacking economical resources to effectively control radioactive sources. This is an area where Western assistance, operating on relatively small funds, might be able to accomplish quite a lot to improve security.

Another matter of serious concern is diversion of nuclear expertise and material. It is of great importance that the critical Central Asian facilities and personnel are getting enough grants from international assistance programs for support of former weapons scientists to keep them from leaving the region. High-profile scientists must be prevented to ‘disappear’ to shady enterprises in countries or organisations that leave little insight into their businesses. It seems reassuring that two major national nuclear institutes in Kazakhstan (the National Nuclear Center) and Uzbekistan (the Institute of Nuclear Physics of the Academy of Sciences) both have been comparatively successful in securing grants from the International Science & Technology Center and the Science & Technology Center of Ukraine, respectively. Domestic production of equipment for the

nuclear fuel cycle might also be of concern to be diverted. Export control regimes in force are therefore of great importance to minimise spreading of sensitive technology from Central Asia. This is an area where Sweden since the early 1990s has assisted Kazakhstan.

One of the international companies that have sought access to Central Asian uranium production is Sabton Limited. Sabton does not really fit in the picture with the other foreign actors on the Central Asian uranium market. A former 15% minority owner of Sabton is accused of involvement in illegal arms trade. It is not reassuring that a company like Sabton can get access to the sensitive uranium market.

Introduction

After World War II, Central Asia became an important part of the Soviet quest for nuclear weapons. It is claimed that uranium from Tajikistan was used to produce the first Soviet nuclear device,[1] which was exploded in 1949. The testing of it also took place in Central Asia, at the Semipalatinsk test site in Kazakhstan. Semipalatinsk later became one of two major nuclear test sites in the former Soviet Union.

The independence of the Central Asian republics in the autumn of 1991 was an event happening suddenly to the region. The political leaders were ill-prepared and their own desire for independence at the time has been questioned. With many of the Soviet Union's nuclear facilities remaining in Central Asia, particularly Kazakhstan, the situation could quickly have become critical if Kazakhstan had not opted for a non-nuclear position by making sure their nuclear weapons ended up in Russia a couple of years later.

This paper seeks to examine, from a proliferation standpoint, the nuclear situation in the Central Asian region of the former Soviet Union, i.e. the five republics: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. From a nuclear perspective, Kazakhstan by far outweighs the other four republics so emphasis has been given to the situation in Kazakhstan. After this introduction, the report tries to give the reader a short introduction to the current political situation in the five Central Asian republics. The third section contains the evolution of a nuclear weapons policy after independence, a summary of the participation of the Central Asian republics in international nuclear non-proliferation regimes, and the development towards a nuclear-weapon-free zone in Central Asia. The fourth section of the review is devoted to a comprehensive inventory of nuclear facilities. In the fifth and final section, a risk analysis for diversion of nuclear material, equipment, and expertise from Central Asia is presented. To be able to do that, incidents of illicit nuclear trafficking that have occurred in Central Asia, existing international programs to support former weapons scientists, and the ownership of nuclear facilities are discussed.

[1] Nuclear Threat Initiative website, Tajikistan: Vostochnyy Rare Metal Industrial Association (Vostokredmet). http://www.nti.org/db/nisprofs/tajikis/facils.htm

Central Asia

The Central Asian region of the former Soviet Union consisted of five republics: Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan. When the Soviet Union fell apart in 1991, the leadership of the Central Asian states somewhat reluctantly followed the other states of the union and declared their independence. Paradoxically, the Central Asian states had been somewhat unwilling members of the Soviet Union, yet they were very insistent to preserve cooperation with Russia after the break-up of the union. One important reason was naturally that economy was deeply dependent on inflow of cash from Moscow. Some years as much as three quarters of the total budget could come from this source.[2]

History

Most of the Central Asian region had come under Russian rule already in the 19th century. For a long time, and up until a few years after the 1917 revolution, Central Asia was known as Turkestan. In 1918, it became the Turkestan Autonomous Soviet Socialist Republic and was officially included in the Soviet Union in 1921.[3] After Stalin came to power in 1924, he also made sure that the map of Turkestan was redrawn and divided it into the five republics it consists of today. One of his ideas behind the division was to disrupt nationalistic tendencies, but in fact Central Asians had never been particularly caring for their respective nationalities.

The root to some of the trading problems seen today, particularly in the Ferghana Valley, stems from this land division. These problems are highlighted by the fact that residents in nearby villages of the same ethnicity cannot trade locally with each other as they did before and during the Soviet era because of the customs barrier that is now dividing them.

Despite the fact that Central Asia was for a long time under Russian rule, the Russian influence had only been limited until the 1920s. This changed under Stalin when the central authority began to exert itself in a way that was both ideologically and culturally alien to the inhabitants. Many Russians began to move in to take leading positions in corporations that were established during this time.

During World War II, Soviet production facilities were duplicated as far away as possible from the Western front. Thus, many new plants (under Russian management) came to be built in Central Asia. The trend to locate industries in Central Asia started to change around 1970. The Soviet Union leadership then started locating them more rationally where the expertise was to be found, i.e. near research institutions. This helps to explain why very little manufacture of radio electronics, computer hardware, cars, trucks or technical instruments was present in Central Asia at the time of the Soviet Union break-up. [2]

The percentage of Russians in the populations of the four southern republics reached a maximum around 1960 when there were 13-17% ethnic Russians in Uzbekistan, Tajikistan, and Turkmenistan. In Kyrgyzstan, there were as many as 30% Russians.[2]

---

[2] Alexei Vassiliev, Political and Economic Challenges in the Post-Soviet Era, Saqi Books (2001).
[3] The Times of Central Asia. Country guide, History, Tajikistan under Russian rule. http://www.times.kg/tajikistan/

Naturally, the Russian influence was and still is the greatest in Kazakhstan where Russians today number 30%.[4] The Russian presence is still quite notable in Kyrgyzstan where 18% of the population are Russians. In Tajikistan, Turkmenistan and Uzbekistan, the Russian minority now varies between 3.5 and 6.7%. Altogether, ethnic Russians make up nearly 8 millions of Central Asia's population of almost 60 millions. It is also worth noting that about half a million people of German origin reside in Central Asia, primarily Kazakhstan. They mainly trace back to the time of the forced migrations that took place under the Stalin leadership.

With the exception of Tajik, which is a Persian language, all Central Asian languages have Turkic roots. The majority of the population in all Central Asian countries are Muslims.[5] In Kazakhstan, however, the Russian Orthodoxs are nearly as many the Muslims.[6] Some other notable facts and figures can be found in Table 1.

Table 1. Central Asian countries: Some facts and figures[6]

Country	Area (1000 km^2)	Population	GDP* per capita (US$)	Life expectancy (yrs)
Kazakhstan	2,717,300	15,143,704	7,000	66.1
Kyrgyzstan	198,500	5,081,429	1,600	67.8
Tajikistan	143,100	7,011,556	1,000	64.5
Turkmenistan	488,100	4,863,169	5,700	61.3
Uzbekistan	447,400	26,410,416	1,700	64.1

*GDP = Gross Domestic Product

Major oil and gas findings in Kazakhstan and Turkmenistan are reflected in the column showing Gross Domestic Product per capita. Although Uzbekistan is seen as the military most powerful state in the region, it is still harmed by the so-called "cotton economy" and when it comes to comparing GDP per capita figures, Uzbekistan rather falls into the same category as Kyrgyzstan and Tajikistan.

Political Situation

When Russia in the 19th century and the Soviet Union in the 20th century colonised Central Asia, one of the main reasons was to get access to an area where cotton could be grown and harvested. It has been estimated that 60% of the Uzbek economy depended upon cotton when Uzbekistan became independent in 1991. Major irrigation schemes to increase cotton production are being blamed to have caused the Aral Sea ecological disaster. The Aral Sea, once considered as the fourth largest lake of the world, has shrunk considerably in the latest decades leaving sand dunes, stranded fishing boats, and a damaged fishing industry behind.

Central Asia seems to be a long way from democracy in the sense the Western World sees it. There are few signs that the situation will dramatically change in the next decade. Currently, the presidents of Central Asia rather appear as elected monarchs of their countries and even try to marry their children with each other as happened in

[4] The Times of Central Asia, Country guide, Facts at a Glance. http://www.times.kg/kazakhstan/
[5] The Times of Central Asia. Country guide, History, Tajikistan under Russian rule. http://www.times.kg/tajikistan/
[6] CIA, The World Factbook 2004.

Kazakhstan when President Nazarbayev's daughter married the son of Kyrgyzstan's President Akayev.

Kazakhstan

Nursultan Äbishuly Nazarbayev, 63, won the first Presidential election in December 1991 and has been President of Kazakhstan ever since. In the election in 1999 he received by Central Asian standards a meager 80% to prolong his presidency until 2006. Several opponents were allowed to participate and the main opponent Serikbolsyn Abdilin received 12% of the votes.[7] The most controversial decision of Nazarbayev has probably been to move the capital from southern Almaty to the more central Aqmola in 1997 and renaming it Astana in the following year.

Kyrgyz Republic

The former physicist Askar Akayevich Akayev, born 1944, remains in power until 2005 after winning the Presidential election in October 2000. He received 74% of the votes. His main rivals were outmanoeuvred before the election. A test in the Kyrgyz language was for example introduced for Presidential candidates.[8] In the early 1990s, there were hopes that Kyrgyzstan would become a new Switzerland in Central Asia. Such hopes have long since vanished.

Tajikistan

Imomali Rakhmonov, 51, became president in 1994 and started his presidential era by more or less banning all opposition. In the 1999 election he received 97% and his opponent Davlat Ismonov 2% of the votes. Nothing will prevent Rakhmonov from winning the next presidential election later this year.[9] The civil war that raged Tajikistan between 1992 and 1997 drove the already weak economy to the bottom. When the negotiated peace surprisingly lasted presumably because of tiredness of war on both sides, some sort of normality slowly returned to Tajikistan.

Turkmenistan

The 65-year old Saparmurat Nyyazov or Turkmenbashi (Father of Turkmen people) as he prefers to be called has now ruled Turkmenistan for more than a decade. In 1992, he was elected president for five years. In a referendum held in 1994, another five years was added to his presidential period. In 1999, he was declared president for life. The 'humble' Turkmenbashi has since on several occasions declared that he sees his presidential period ending in 2010.[10] The prime token of the personal cult around Turkmenbashi is the 22 metres high golden statue in the capital Ashkabad, which rotates so that the face of Turkmenbashi always faces the sun.

Uzbekistan

The 66-year old president Islam Abduganievich Karimov has been the president of Uzbekistan since independence. In the last presidential election, held in January 2000,

---

[7] Electionworld.org / Elections Around the World. http://www.electionworld.org/kazakhstan.htm
[8] Electionworld.org / Elections Around the World. http://www.electionworld.org/kyrgyzstan.htm
[9] Electionworld.org / Elections Around the World. http://www.electionworld.org/tajikistan.htm
[10] Electionworld.org / Elections Around the World. http://www.electionworld.org/turkmenistan.htm

he defeated his opponent Abulchafiz Dzjalalov, who astonishingly claimed that he voted for Karimov, with 92% vs. 4% to win another 5 years at the helm.[11] Karimov's Uzbekistan has been particularly under international criticism for its handling of Islamic worshippers. In the eyes of the regime, all radical muslims, whether they are from rather peaceful organisations such as Hisb-ut-Tahrir or not, are terrorists and should be imprisoned. The evident danger with such action is that also relatively low-key organisations may be forced to radicalise and take to arms in order to survive.

Internal Conflicts

At presently, there are no severe internal conflicts in Central Asia. There are, however, several unresolved issues between the states, which potentially even could lead to the rattling of guns. The borders between the countries are under dispute; in fact all of the states have outstanding matters with at least one of their neighbours.[12] Uzbekistan has unresolved disputes with all of their four neighbours. The incursions of the Uzbek army into both Kyrgyzstan and Tajikistan during 1998 and 1999 to chase guerrilla fighters of the Islamic Movement of Uzbekistan (IMU) have further marred the relationship between these countries. At that time, Uzbekistan also mined the border. The mines are still there despite protests from both Kyrgyzstan and Tajikistan and it is estimated that almost one hundred innocent people, mostly peasants, have died in the mine fields.[13] It is no question that Uzbekistan, as the military most powerful nation in Central Asia, has no regrets about reminding their military weaker neighbours of this situation now and then.

The story of the murder attempt on the president of Turkmenistan in November 2002 came to an unexpected turnabout when it was realised that the alleged perpetrators had received assistance from Uzbekistan. The Uzbekistan Ambassador to Turkmenistan, Abdurashid Kadyrov, was asked to leave the country within 24 hours when it was revealed that the alleged brain behind the attempted killing, the former Turkmen Foreign Minister Boris Shikhmuradov, who was thought to be in exile in Moscow, had received assistance to pass the border into Turkmenistan. Shikmuradov had also been given protection in the embassy after the unsuccessful assassination attempt. To make Uzbek – Turkmen relations even worse, the Uzbek minority living on the Turkmen border, by presidential decree, was ordered away from the area to be replaced by ethnic and 'more trustworthy' Turkmens.[14] Six months later, however, Turkmenbashi was ready to forget and praised relations with the neighbour.[15]

Then there are the oil & gas vs. water quarrels. Highland Kyrgyzstan and Tajikistan are rich in water, but poor in gas and oil, where the situation is reversed in lowland Kazakhstan, Turkmenistan, and Uzbekistan.[16] During the Soviet times all got a share of what they needed, but since their independence, Kyrgyzstan and Tajikistan have had to pay for gas and oil. Particularly Kyrgyzstan, but also Tajikistan, wants to maximise

[11] Electionworld.org / Elections Around the World. http://www.electionworld.org/uzbekistan.htm
[12] International Crisis Group, Central Asia: Border Disputes and Conflict Potential, ICG Asia Report No. 33, Osh/Brussels, 2002-04-04.
[13] At the time of completion of this report (June 2004), Uzbekistan made pledges stating that the mines will be removed.
[14] Bruce Pannier, Radio Free Europe/Radio Liberty, Turkmenistan: Government Forcibly Relocating Uzbeks Away From Border, 2003-01-15.
[15] Turkmen TV first channel, Turkmen Leader Puts Crisis in Relations with Uzbekistan behind Him, 2003-05-13. http://www.uzland.uz/2003/may/15/04.htm
[16] Eurasianet, Water Games Could Leave Central Asia High and Dry This Summer, 2001-03-30.

electricity outtake from their hydroelectricity power plants during winter, while Kazakhstan and Uzbekistan want to maximise water flow in spring and summer for irrigation of their croplands. Kyrgyzstan's Toktogul Reservoir controls the source of the Naryn River, one of the major sources of the Syr Darya River. In recent years, the states seem to have come to some kind of working agreement on the issue with Uzbekistan and Kazakhstan seeking to help Kyrgyzstan meet its energy demand during winter. In exchange, Kyrgyzstan has reduced water discharges during winter.

However, the situation has been described as 'all try to break the rules whenever they are to gain from it'. This was clearly demonstrated in early 2004 when the situation in the lowlands became severe. A combination of heavy rain followed by cold weather produced serious flooding in the lowlands of both the Syr Darya and Amu Darya Rivers. The cold weather produced ice in the rivers and prevented the natural flow of water which was already high because of the downfall. In the months to follow, accusations of violations of previous agreements were a common feature in Central Asian politics.

Regional Players

Apart from the obvious, the neighbouring nuclear powers China and Russia, two states have actively sought a role in the region in the last decade: Iran and Turkey. It may be surprising to find a Turkish interest in this region relatively far away from its usual sphere of interest, but at the time of the Soviet Union breakdown, Turkey actively began reviving historic pan-Turkic ideas. The vision was a Turkic commonwealth in which Azerbaijan was included along with the Turkic Central Asian states, which only excludes Tajikistan of the five.

Since 1992, seven Turkic summit meetings have been staged to keep this vision afloat. The latest summit was held in April 2001 and saw the group return to Istanbul, where the first meeting was held in 1992. There has been a lean interest from the Central Asian leaders for these pan-Turkic ideas and Turkey's 'big brother' mentality. For example, despite fierce Turkish lobbying the Central Asian states have not recognised the Turkish Republic of Northern Cyprus. It remains to be seen if Turkic summit meetings will be revived since more than three years has passed since the last summit.

It is possible that the Central Asian interest would have been greater if Turkey had managed to be economically more influential in the region than it is. Parenthetically, by the end of 1997 Turkey had invested only about 6 billion US$ in Central Asia compared to more than 100 billion US$ in Russia.[17] Consequently, Turkey can boast few results in Central Asia since 1991. Turkey has helped build a network of audio-visual and telecommunications in Central Asia, Turkish Avrasya TV is broadcast in the region, Turkic schools have been built and scholarships are offered to Turkish schools and universities. As a NATO member, Turkey was given the leading role in NATO relations with Central Asia and a Partnership for Peace Commandership of Education was opened in Ankara in 1998. This was not the start of military education for Central Asian cadets and officers in Turkey, as by then 2,300 Central Asians had already graduated from Turkey's military colleges and a further 1,700 were under training.

[17] G.M. Winrow, Turkey and Central Asia, *in* Central Asian Security: The New International Context, Eds: Roy Allison & Lena Jonson. Washington, D.C. and London: Brookings Institution Press and the Royal Institute of International Affairs, 2001. ISBN 0-8157-0105-5

The main game for Turkey, however, has revolved around the Central Asian gas and oil fields and here Turkey's interests clash with Iran's. Iran has sought a relationship with Russia to counterbalance the Turkey-American interest to build a pipeline through Azerbaijan – Georgia – Turkey. Such a pipeline would avoid both Russian and Iranian territory. Iran also has had some success in the relations with its neighbour in the north, Turkmenistan, and is now Turkmenistan's fourth largest trading partner. Turkmenistan is exporting natural gas to Iran through the 200 km long Korpezhe – Kurt-Kui pipeline, which was completed in 1997. It was the first pipeline from Central Asia to avoid Russian territory. Iranian companies are presently building terminals for liquid gas storage, railway stations, and a dam for a hydroelectric power plant.[18]

The Central Asian leadership at one time feared Iran would try to export its Islamic revolution to Central Asia, but Iran has shown more interest in economy than religion in its dealings with the region. The language links with Tajikistan has meant less than perhaps could be expected and Iran's trade with Tajikistan is only about 10% of its trade with Turkmenistan.[19]

Presently, also India and Pakistan are looking for a role in the region. As a supporter of the Taliban in Afghanistan, it was previously impossible for Pakistan to find influence in Central Asia. With the Taliban removed from power, and everyone on the same side against terrorism, new coalitions can be built. During 2002, Pakistan officially met bilaterally with all Central Asian republics except Uzbekistan. Relations between the two states have stayed frozen and have not been helped by Uzbekistan claims that Pakistan has hidden al-Qaida members of Uzbek origin.[20]

India is naturally seeking to counter any Pakistan influence and may be helped to win this in the region because of its strong ties with Russia. India has offered assistance to Tajikistan in upgrading the Aini Military air field outside Dushanbe,[21] which at least in Pakistani media has been described as India now establishing an air base in Tajikistan.

The Shanghai Cooperation Organisation (SCO) is a chance for the leaders of Central Asia to regularly meet with their powerful neighbours Russia and China. The erratic Turkmen President Saparmurat Niyazov has refrained from joining SCO. SCO was formed in 1996 as the Shanghai Five, but since Uzbekistan joined the organisation in 2001 it holds its present name. SCO has widened its perspective since 1996, when solving border disputes was the top priority of the organisation. Today, facilitating trade and economic co-operation in the region has become more vital for SCO. After the summit meeting in St. Petersburg in June 2002, Russian President Putin said he wanted SCO to grow and become a forum to strengthen stability from the Baltic to the Pacific.[22]

Despite some encouraging trends over the last few years, Central Asia still is a long way from democracy in the sense the Western World recognises it. There are few signs that the situation will dramatically change in the next years. All presidents in Central

[18] Turkmenistan.ru, In 2002 Trade Turnover Between Turkmenistan and Iran Reached USD 436 Million, 2003-01-31.
[19] Islamic Republic News Agency (IRNA), Iran-Tajik Trade Transactions Stood at Dollars 40million in 2002, 2003-01-15.
[20] Timofei Zhukov (AP), Uzbekistan Accuses Pakistan of Harboring Uzbek Al-Qaida Members, 2002-04-05.
[21] Interfax, India to Help Tajikistan Reconstruct Aini Military Airfield, 2002-02-06.
[22] Yulia Orlova (RIA Novosti), Shanghai Six Leaders Met in St. Petersburg, 2002-06-13.

Asia act as maintaining power and gaining personal wealth are their top priorities. It is difficult to see that if power was to be shifted in any of the republics, the successor would have a significantly different agenda.

Some observations from the time of independence are evident. Ever since 1991, Uzbekistan and Turkmenistan have been the two states striving hardest to stay out of Russian influence. Judged in relation to its enormous potential for natural gas production, Uzbekistan economy is the great underachiever in the region. Based on GDP per capita figures, it is in the same class as its poor cousins of Central Asia, Tajikistan and Kyrgyzstan, when it really should be in the same class as Kazakhstan and Turkmenistan. The distribution of the newly found wealth in these former communist republics is a long way from the ideal proclaimed during the Soviet Union era. Oil and gas revenues reach the pockets of the nomenclature and stay there if they do not go towards purchases to underline their wealth. Unfortunately, while a few already wealthy are gaining enormous fortunes in Central Asia, the poor and elder see little prospect of improvement.

Review of Central Asian Nuclear Policies

Nuclear Weapons Policy after Independence

When the Central Asian republics became independent in 1991, significant parts of what previously had been Soviet nuclear weapons and nuclear energy infrastructure was found in four of the five republics. Only Turkmenistan was entirely without any kind of nuclear enterprise. Kazakhstan, on the other hand, held significant nuclear assets. It inherited about 1,400 strategic nuclear weapons and an unknown number of tactical nuclear weapons when the Soviet Union collapsed. No other country in Central Asia had nuclear weapons on its soil. In fact, in the period between 1991 and 1994, Kazakhstan had the third largest nuclear arsenal in the world and as large as the one you would have got from the combined efforts of China, France, and the United Kingdom. From a non-proliferation view, Kazakhstan then acted very responsibly and by May 1995, all of its nuclear weapons had been turned over to Russia.

Also in Kazakhstan, there were no less than 104 nuclear silos for launching of Inter-Continental Ballistic Missiles (ICBM). They were all destroyed by September 1996, which meant that almost exactly five years after its independence, Kazakhstan had completely removed the most significant parts of its former nuclear arsenal. In retrospect, this looks like an example of one of the greatest non-proliferation achievements in history by Kazakhstan and its elected president, Nursultan Nazarbayev.

The process of becoming a stern believer in nuclear non-proliferation was not immediate, however. It took Nazarbayev about 9 months to abandon the thought of a nuclear arsenal in Kazakhstan. His immediate reaction was to keep strategic nuclear weapons as long as Russia had strategic nuclear weapons. At the time, he used the term ‘temporary nuclear state’ to describe his view of Kazakhstan’s position.

Ordinary people in Kazakhstan had strong antinuclear feelings. They had lived for such a long time in, or around, a nuclear test zone and had seen it create both environmental and health problems. This probably did not affect Nazarbayev that much. It is more likely that pressure from Russia and assurances from the U.S. to finance an elimination of the strategic nuclear weapons made Nazarbayev rethink. So far, nothing in Kazakhstan’s security situation suggests he did not make the right choice.

The Central Asian republics were important for the Soviet Union’s nuclear program. Uranium was mined in Tajikistan, Uzbekistan, and Kazakhstan and it was milled in Kyrgyzstan. In addition, the early nuclear weapon tests were all performed in Kazakhstan, but the importance of Central Asia in a nuclear context should perhaps not be exaggerated. The core of the nuclear industry was always inside Russia and Central Asia presented perhaps to the central government in Moscow little more than a convenient outpost in the empire where the dirty testing could be conducted. In return, some of the least vital nuclear facilities from a security point-of-view were located there.

However, Kazakhstan President Nazarbayev does not agree on such a view. On the official website of Kazakhstan, the President suggests that ‘Kazakhstan [in the early 1990s] had almost all the necessary scientific research, mining, and even production infrastructure for the creation of its own nuclear weapon program'.[23] He claims that Kazakhstan had 'the entire scientific research base needed to create and modernise nuclear weapons' and that the Institute of Nuclear Physics in Almaty had a large number of 'highly qualified and talented nuclear scientists'. He notes that Kazakhstan did not have plants to make weapons-grade uranium,[24] but states that if Kazakhstan hypothetically had wanted 'to remain a nuclear [weapon] state with the appropriate technology, it would have taken only a few years for the Ulba Plant to manufacture its own highly enriched uranium'.

To underline his strong commitment to nuclear non-proliferation, he proudly states that 'we already had enough enriched uranium that could have been used for the production of atom bombs' referring to the nearly 600 kilograms of highly-enriched uranium (HEU)[25] at Ulba that was removed under the joint US – Kazakhstan Project Sapphire (see page 28). Experts have questioned the quality of this HEU, though. However, there can be no question that what President Nazarbayev and the Republic of Kazakhstan did after their independence was extremely important for international non-proliferation and was a role model to follow for the present nuclear weapon and threshold states.

[23] Official Kazakhstan website, Nursultan Nazarbayev, Epicenter of Peace. http://www.president.kz/articles/state/state_container.asp?lng=en&art=Epicenter

[24] All Soviet Union production facilities for weapons-grade uranium were located in Russia.

[25] Somewhat simplified, natural uranium consist of two isotopes: 99.3% U-238, which does not easily undergo fission; and 0.7% U-235, which can be used in nuclear weapons, but only after the percentage of U-235 has been increased to 90%. This product is called weapons-grade uranium and it is produced in a process called enrichment. Uranium enriched to 20% or more is defined as HEU. Uranium enriched to less than 20% U-235 is called low-enriched uranium (LEU).

Central Asian States and Non-Proliferation Regimes

The status of the Central Asian states adherence to different nuclear non-proliferation regimes is outlined in Table 2.

Table 2. Central Asian states: Participation in non-proliferation regimes

Country	Acceded NPT[26]	Signed / Ratified CTBT[27]	IAEA membership[26]	Safeguards (INFCIRC 153)[26]	Additional Protocol (INFCIRC 540)[28]
Kazakhstan	14-02-1994	s: 30-09-1996 r: 28-11-2001	14-02-1994	s: 26-07-1994 eif: 11-08-1995	s: 06-02-2004
Kyrgyzstan	05-07-1994	s: 08-10-1996 r: 02-10-2003	16-09-2002	s: 18-03-1998	
Tajikistan	17-01-1995	s: 07-10-1996 r: 10-06-1998	22-09-2000	s: 07-07-2003	s: 07-07-2003
Turkmenistan	29-09-1994	s: 24-09-1996 r: 20-02-1998	***		
Uzbekistan	02-05-1992	s: 03-10-1997 r: 29-05-1997	26-01-1994	s: 05-04-1994 eif: 08-10-1994	s: 22-09-1998 eif: 21-12-1998

s (signed; date of signature, the state then indicates it will accept the agreement and commit itself to follow the purpose of the agreement, pending formal ratification); **r** (ratified; date of formal approval by parliament or legislative body); **eif** (entry into force; date when the agreement becomes legally binding for the state)

*** Turkmenistan does not have any nuclear facilities.

The Central Asian states soon after their independence all acceded to the Nuclear Non-Proliferation Treaty (NPT). Tajikistan was the last of the countries to do so in January 1995. It did so despite the fact a civil war was raging in the country at the time. Kyrgyzstan ratified the Comprehensive Test Ban Treaty (CTBT) in October 2003, having signed it already in 1996. That means that among the former Soviet republics, only Moldova remains not to have signed or ratified the CTBT.[26]

Kyrgyzstan recently gained IAEA membership,[29] which means that Turkmenistan now stands alone in not having sought IAEA membership. This is perhaps not that surprising since Turkmenistan seems to be entirely without nuclear facilities. Finally, when it comes to accepting IAEA safeguards, the two countries with major nuclear facilities, Kazakhstan and Uzbekistan are currently the only two to have applied a Safeguards regime. Both Kyrgyzstan and Tajikistan have signed comprehensive Safeguards agreements, but these are still waiting to enter into force.

In 2002, Kazakhstan became the 40th member of the Nuclear Suppliers' Group (NSG). NSG is the major nuclear export control regime in the world and is working to control the export of products that are especially designed or prepared for nuclear use, or technology associated with such products.

---

26 Nuclear Threat Initiative website, International Organization and Treaty Tables, Membership in Nuclear Nonproliferation Treaties. http://www.nti.org/db/nisprofs/shared/intorgs/nnptreat.htm

27 CTBTO - Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organisation website. http://www.ctbto.org/

28 IAEA website, Strengthened Safeguards System: Status of Additional Protocols. http://www.iaea.org/OurWork/SV/Safeguards/sg_protocol.html

29 Radio Free Europe/Radio Liberty Kyrgyz News, Kyrgyzstan Becomes Members of IAEA, 2002-09-16.

Central Asian Nuclear-Weapon-Free Zone

Perhaps the most interesting aspect of Central Asian nuclear non-proliferation work is their initiative to declare the five states as a nuclear-weapon-free zone. Central Asia has ever since May 1995, when Kazakhstan handed over to Russia the last Soviet nuclear weapons left on its soil, been a region free from nuclear weapons. At the 48th UN General Assembly in 1993, Uzbekistan President Islam Karimov appears to have been the first to formally propose Central Asia as a nuclear-weapon-free zone.[30] However, on the official website of Kazakhstan, President Nursultan Nazarbayev claims that he was 'the first president among [the] newly independent former Soviet states to call for the elimination of nuclear weapons and the creation of a nuclear-free zone in the Central Asian region'.[31] The proposal of Karimov later moved into a concrete initiative that was launched through the Almaty Declaration of 28 February 1997.[32] Following expert meetings in Geneva, Bishkek, Tashkent, and Sapporo during the next three years, the work had seemingly come to a halt by mid-2000. Little progress was made in the next two years and there was a general concern that all parties would not endorse the nuclear-weapon-free zone. Apparently, one of the major obstacles was that Kazakhstan, Tajikistan, and Kyrgyzstan wanted to leave open a possibility to exclude from the negotiated zone Russian nuclear weapons brought in for their own security.[30]

The background to this was to be found in the 1992 Commonwealth of Independent States (CIS) Collective Security Treaty, what popularly became known as the 'Tashkent Treaty' since it was signed at a summit meeting in the capital of Uzbekistan. Turkmenistan, Moldova, and Ukraine refrained from signing the treaty, in which the states made promises to assist each other in case they were militarily attacked. Thus, only nine of the twelve CIS states originally became members.[33] When the treaty expired in May 1999, Uzbekistan, Azerbaijan and Georgia decided to leave the defence pact. The six now remaining states are Kazakhstan, Kyrgyzstan, Tajikistan, Russia, Belarus, and Armenia. It seems clear that the three Central Asian states still under the Russian umbrella had to carefully revise the text of the Nuclear-Weapon-Free Zone Treaty to get Russian endorsement. At a meeting in Samarkand (Uzbekistan) on September 27, 2002, the five Central Asian states could finally agree on the text of the treaty. They were prepared to sign the treaty already the following month when UN General Secretary Kofi Annan visited Central Asia and agreed that the best site to finish the Central Asian nuclear legacy was Semipalatinsk.

Next, the document according to the NPT regulations had to be presented to the five nuclear weapon states for them to endorse the treaty, but they then asked for more time to review. At the time it was assumed that it was primarily Russia who demanded more time. However, this appears not to be the case as it seems that the treaty text not explicably prevented transfer of nuclear weapons through Central Asia.[34] Instead, it was

---

[30] Scott Parrish, Central Asian States Achieve Breakthrough on Nuclear Weapon-Free Zone Treaty, 2002-09-30. http://cns.miis.edu/pubs/week/020930.htm#fn8

[31] Official Kazakhstan website, Head of State, Dossier. http://www.president.kz/main/mainframe.asp?lng=en

[32] United Nations Regional Centre for Peace and Disarmament in Asia and the Pacific website, Central Asian Nuclear-Weapon-Free Zone (CANWFZ). http://disarmament.un.org/rcpd/centasia.htm

[33] The CIS Collective Security Treaty was signed on May 15, 1992 by Armenia, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, and Uzbekistan. Azerbaijan joined the Treaty on September 24, 1993, Georgia on December 9, 1993 and Belarus on December 31, 1993.

[34] Mike Nartker, Global Security Newswire, Iraq Crisis Derails Central Asian Treaty Talks, 2003-03-11.

France, the U.K., and the U.S. that expressed concerns with several provisions of the treaty. In addition to nuclear weapons transfer, they were not happy with the text concerning a possible further expansion of the zone, and how the treaty related to other regional agreements.

Thus, currently the future of the Central Asian Nuclear-Weapons-Free Zone Treaty clearly lies in the hands of the nuclear powers. At the end of 2002, it was reported from Central Asia that the treaty would be signed at Semipalatinsk early in 2003,[35] but the 2003 Iraq crisis shifted the attention of the nuclear powers away from Central Asia. It still might take considerable time before the treaty negotiations are concluded.

IAEA Safeguards and the Additional Protocol

The most important international nuclear non-proliferation tool is probably IAEA Safeguards. A review of the evolution of Safeguards leading to the development of the Additional Protocol during the 1990s can be found in Appendix 1.

At the time of their independence, Russia apparently demanded from the Central Asian states that they signed a side agreement with Russia, probably as part of a bilateral treaty. In this side agreement, the Central Asian states were to promise not to reveal anything about the USSR nuclear legacy. Reportedly, at least some of the countries did sign such side agreements.[36] Thus, these states will have apparent difficulties fulfilling the declaration concerning past nuclear-related activities. Despite this, Uzbekistan was one of the first states[37] that had an Additional Protocol agreement with the IAEA entering into force. This suggests that either Uzbekistan never signed or never had to sign such an overruling agreement with Russia. A third, but more unlikely, option would be that Uzbekistan decided to break the agreement.

The existence of such an overruling bilateral agreement will no doubt have had most effect on Kazakhstan and it may be the reason why it took such a long time for Kazakhstan to sign the Additional Protocol. As an outside viewer, it is hard to imagine that any of the other four states could jeopardise Russian, or their own, security by revealing something from the Soviet Union’s past. In the future we may someday get satisfactory answers regarding the existence and content of side agreements, but at presently much is left to speculation.

---

[35] Interfax-Kazakhstan 2002-12-04, Treaty for Nuclear-Free Zone in Central Asia May be Signed in Early 2003. http://www.times.kg/news/1066481.html

[36] This information comes from a source with insight into IAEA matters. It has not been officially confirmed.

[37] Uzbekistan was only preceded by Australia, Jordan, New Zealand, and the Holy See in signing the Additional Protocol.

Nuclear Facilities in Central Asia

Kazakhstan

The ministries and ministers that predominantly deal with nuclear issues in Kazakhstan are:[38]

- The Ministry of Defence (Mukhtar Tuleubekovich Altynbayev)
- The Ministry of Education and Science (Zhaksybek Abdrahmetovich Kulekeev)
- The Ministry of Energy and Mineral Resources (Vladimir Sergeyevich Shkolnik)
- The Ministry of Natural Resources and Environment Protection (Aitkul Baigaziyevna Samakova)

Timur Miftakhuly Zhantikin chairs the Committee on Atomic Energy, which is an agency subordinate to the Ministry of Education and Science.

KazAtomProm, created in 1997, is a closed joint stock company with the Government of Kazakhstan as its sole shareholder. It shall represent the interest of the Republic of Kazakhstan on the world nuclear fuel cycle and rare metals markets. KazAtomProm is the only company with exclusive rights to market uranium from Kazakhstan.[39]

Before the creation of KazAtomProm, the Kazakhstan State Corporation for Atomic Power and Industry (KATEP) was responsible for Kazakhstan's entire nuclear industry. KATEP today is subordinate to KazAtomProm and responsible only for commercial nuclear power reactors, i.e. the shutdown BN-350 reactor (see page 29) and the proposed project of the South Kazakhstan Nuclear Power Plant at Lake Balkhash.[40]

Kazakhstan was by far the most important of the five Central Asian states for the Soviet Union nuclear complex. A detailed survey of nuclear-related facilities in Kazakhstan follows.

<u>Fissile Material Overview</u>

Uranium Mining and Milling

Uranium has been mined in Kazakhstan since 1948. Kazakhstan holds the second largest uranium reserve in the world (Australia has the largest). The total uranium reserve has been estimated to about 630,000 metric tons.[41] It is estimated that about 50% of Kazakhstan uranium can be extracted at a competitive price of less than US$ 40 per kg uranium. In 2003, uranium production in Kazakhstan rose to a record-high 3,300 tons showing a steady increase in the last years. The corresponding figures for 1998, 2001 and 2002 were 1,270 tons, 2,050 tons, and 2,800 tons. Production had fallen in the mid-90s from a previous annual production level of around 2,000 tons. Kazakhstan uranium production was the third largest in the world in 2003, next only to Canada

[38] Official Kazakhstan website. http://www.president.kz/main/mainframe.asp?lng=en
[39] KazAtomProm website. http://www.kazatomprom.kz/eng/profile/
[40] Interfax-Kazakhstan, Kazakhstan plans to build nuclear power plant on Lake Balkhash, 2002-09-17.
[41] World Information Service on Energy & Nuclear Information and Resource Service website. NIRS/WISE, World uranium resources. http://www.antenna.nl/wise/uranium/umaps.html

(10,457 tons) and Australia (7,596 tons), and reached almost 10% of the total world production (35,824 tons).

The state-owned joint stock company KazAtomProm controls the uranium industry in Kazakhstan and was the 4th largest uranium producing company in the world in 2002. Its share of world production was almost 8% in 2002.[42] KazAtomProm and Kazakhstan have ambitious plans to expand uranium production in the future. KazAtomProm president Mukhtar Dzhakishev has revealed plans to increase uranium production to 15,000 tons by 2028[43] and the country's energy and mineral resources minister, Vladimir Shkolnik, was recently cited as saying 'We have very aggressive, ambitious plans to provide the world energy industry with uranium'.[44]

Large deposits of uranium are found in northern and central Kazakhstan and on the Mangyshlak Peninsula in the west. The discoveries were primarily made in the 1950s and led to the creation of:

- Tselinny Gorno-Khimicheskii Kombinat (TGK; Tselinnyy Mining and Chemical Combine) at Stepnogorsk. Production at the Tselinnyy uranium mines ceased during the 1990s. In 1996, World Wide Minerals of Canada took over the facility, but after a dispute concerning uranium deliveries to the facility, the Kazakhstani government soon cancelled the contract. The Israeli company Sabton then bought the bankrupt TGK in 1999 (see page 52). Uranium slurry from *in situ* leaching operations in southern Kazakhstan is now processed at TGK.[45]

- The Prikaspiyskiy Mining and Metallurgy Combine at Aktau. However, Prikaspiyskiy has changed name to Kaskor JSC and is no longer involved in uranium mining or milling.

These two facilities were the core of the Soviet uranium production industry together with the Navoi Mining and Metallurgy Combine in Uzbekistan. Table 3 illustrates the current situation in the Kazakhstan uranium market.

Since independence in 1991, all uranium exploration, production, processing, and marketing activities were managed by KATEP. In 1997, KazAtomProm took over the reponsibility for these activities. KazAtomProm itself, or in joint ventures with foreign companies, is the only domestic actor in Kazakhstan on the uranium import-export market. The state still owns all mineral resources and license producers.[46]

The uranium is processed and packaged at KazSabton and the Kara Balta Ore Mining Combine in Kyrgyzstan. KazAtomProm oversees sales of uranium products to foreign customers, who include the US-German NUKEM Inc., Cameco of Canada, and Energy Resources of Australia.

---

42 World Uranium Mining, Nuclear Issues Briefing Paper 41, June 2003. http://www.uic.com.au/nip41.htm

43 TopAz, Kazatomprom May Become Largest Uranium Producer by 2028, 2002-07-14.

44 Interfax-Kazkhstan, Kazakhstan Plans to Raise Uranium Supplies to World Markets*,* 2002-12-09

45 In situ leach mining is a technique to regain uranium from the soil without traditional mining. A solution is pumped through the deposit to dissolve uranium. The uranium-containing slurry that is formed in this process is later recovered at the soil surface. Milling is not required with this form of mining and the slurry can be sent directly to the fuel plant.

46 Nuclear Threat Initiative website**,** Kazakhstan: Uranium Mining and Milling, http://www.nti.org/db/nisprofs/kazakst/fissmat/minemill.htm

Table 3. Uranium Mining and Milling Enterprises in Kazakhstan[46]

Enterprise	Activity	Uranium Deposits	Location	Owner/Operator
Stepnoye Mining Directorate	mining	Akdala Mynkuduk Uvanas Zhalpak	Stepnoye, Shymkent Oblast	KazAtomProm Subsidiary
Tsentralnoye Mining Directorate	mining	Kainor Kanzhugan Moinkum	Taukent, Shymkent Oblast	KazAtomProm Subsidiary
No. 6 Mining Directorate	mining	Irkol N. Karamurun S. Karamurun Kharasan	Chiili, Kzyl-Orda Oblast	KazAtomProm Subsidiary
Joint Venture Inkai	mining	Inkay (Inkai) Mynkuduk	Stepnoye, Shymkent Oblast	Cameco, Canada and KazAtomProm
KATCO Joint Venture	mining	Moinkum (Muyunkum)	Tsentralnoye, Shymkent Oblast	Cogema, France and KazAtomProm
KazSabton (previously Tselinny Mining and Chemical Combine)	milling	Grachevskoye Kamyshovoye Shokpak Vostok Zaozernoye Zvezdnoye	Astana Oblast	Sabton, Inc., Israel
Kaskor JSC (previously Prikaspiyskiy Mining and Metallurgy Combine)	closed	Melovoye Tomyak	Aktau, Mangystau Oblast	Kaskor JSC

Uranium Conversion

The Ulba Metallurgy Plant

The Ulba Metallurgy Plant near Ust-Kamenogorsk is owned by KazAtomProm. It was established in 1949 and was known as Mailbox 10 during the early Soviet era. Uranium concentrate and by-products of uranium mining are the principal sources of hard currency for KazAtomProm. The Ulba Metallurgy Plant is refining uranium from *in situ* leaching operations in the South. After enrichment at Russian facilities, Ulba produces low-enriched uranium[25] (LEU) fuel pellets.

In recent years fuel pellet production has been somewhat reduced and the plant has also been converting uranium hexafluoride (UF_6)[47] to uranium dioxide powder for use at Western fuel fabrication facilities. Ulba also produces beryllium and tantalum products, superconducting niobium-titanium alloys, and zirconium materials. Ulba is reportedly able to process any type of uranium-containing materials, including fuel assembly by-products. During the Soviet era, Ulba produced HEU fuel for the secret Alfa submarine program and participated in the development of fuel for nuclear-powered satellites. The plant reportedly halted HEU-related activities in the 1980s.

[47] Uranium hexafluoride: It is a powder at room temperature, a gas when heated and crystallised when cooled. Crystallised UF_6 is the form shipped to enrichment plants and used as feed for the enrichment process.

The Ulba Plant receives LEU from two Russian enterprises: the Angarsk Electrolytic Chemical Combine and the Electrochemical Plant in Zelenogorsk. Production stages include treatment of the supplied enriched uranium material, transformation of UF_6 into UO_2, and manufacture of UO_2 pellets.[48] U-235 content in the pellets ranges between 1.6% and 4.4%. The UO_2 pellets are sent to fabrication facilities in Elektrostal in the Moscow Oblast and Novosibirsk, where they are made into fuel rods and assemblies.[48]

As of January 2000, KazAtomProm managed 90% of the shares in the Ulba Metallurgy Plant. In order to solidify its relationship with Russian companies, KazAtomProm then made an agreement with the Russian joint stock company TVEL[49] to exchange 34% of its shares in Ulba for shares in three Russian companies: Priargunsky Mining and Chemical Association Joint Stock Company, the Novosibirsk Chemical Concentrate Plant, and the Chepetsk Mechanical Plant. In response to concerns of MINATOM, Ulba had to change its bylaws to allow so-called 'golden shares', which would give TVEL the possibility to veto major policy changes. [48]

According to IAEA declarations, the Ulba Plant is a so-called material balance area (MBA), divided into seven sub-areas: two fuel processing lines, for the VVER and RBMK reactors, one laboratory, two storage areas, and a quality control area. U-235 enriched to 4% is stored in all these sub-areas. In addition, the seventh sub-area at Ulba is devoted to thorium storage. [48]

Materials Protection, Control and Accounting System (MPC&A)

The Ulba Plant participates in the MPC&A program headed by the US Department of Energy. Also Sweden has been actively assisting Ulba to develop its safeguards accounting system.[50] Apparently, the introduction of IAEA safeguards at the site complicated material accounting. The U.S. has installed scales, non-destructive assay systems, analytical chemistry equipment, an experimental bar-coding system, and computers and software for inventory accounting. Physical protection has also been modernised. Portals and access points have been hardened to now include metal and nuclear material detectors and alarm and communications systems have been installed.[48]

Project Sapphire

In what US Defense Secretary William Perry described as a unique project, the so-called Project Sapphire, 581 kilograms of HEU were transferred from Ulba to the Y-12 Plant at the Oak Ridge National Laboratory in Tennessee via Dover, Delaware on 21 November 1994.[51] Reports claim that President Nazarbayev personally initiated the transfer in order to prevent the possibility of the material being diverted by terrorists, or by any of the nuclear threshold states in the vicinity of Kazakhstan. Reports that Iran was interested in LEU from Ulba, with the hidden intent to also get access to HEU, circulated at the time. The US Ambassador to Kazakhstan, William H. Courtney, led the

[48] Nuclear Threat Initiative website, Kazakhstan: Ulba Metallurgy Plant. http://www.nti.org/db/nisprofs/kazakst/fissmat/ulba.htm

[49] TVEL is apparently not an acronym.

[50] Stig Rolandson, Ulba – modern bränslefabrik i gamla Sovjet (in Swedish, title translates: Ulba – modern fuel plant in old Soviet), Nucleus 1/2002, pp. 20-27, (2002).

[51] Nuclear Threat Initiative website, Kazakhstan: Project Sapphire. http://www.nti.org/db/nisprofs/kazakst/fissmat/sapphire.htm

secret negotiations between the Government of Kazakhstan and the US Departments of Defense and Energy. Apparently, Russia had full insight into the US-Kazakhstan project although the Russians were not directly involved.

The uranium had been stored at Ulba in facilities that were neither secure nor safeguarded. Electronic means of accounting were missing; quantities were simply recorded by hand into books. The opinions of analysts diverged regarding the number of nuclear weapons that could be produced from the Ulba HEU. The estimates were between 20 and 50. However, according to Kazakhstan experts, only about 5% of the HEU was pure enough to be used for weapons, while the rest would have required further processing.[51] If this estimate was correct, only 1-2 nuclear weapons could have been produced without further processing of the material.

During the operation itself, 31 US technicians repackaged the uranium into 1,300 steel canisters for air shipment to Dover (Delaware). Kazakhstan was compensated for the nuclear material with an estimated US$ 10 to 20 million, in both cash and in-kind assistance. The compensation package, delivered by August 1997, included: 20 Nikon 35-mm cameras, lenses, flash assemblies, and cases; 102 computers, 80 printers, 10 scanners, assorted software, and 10 photo copiers; eight pursuit vehicles with radios and patrol lights, five mini-vans, eight light pick-up trucks, four buses (all with radios); and medical supplies.[52]

Power Reactor

MAEK[53] (BN-350) in Aktau (formerly Shevchenko) in Mangyshlak, Mangystau Oblast, was a Liquid Metal Cooled Fast Breeder Reactor with an average electrical effect of 135 MW. The reactor was shut down on April 22, 1999. It was designed to use uranium fuel enriched to 20-25 percent, but could also run on MOX fuel (23.19% Pu).

The reactor served two purposes: to breed plutonium and to operate as a source of electricity, district heating, and water desalinisation for the city of Aktau. The BN-350 reactor was the only power reactor in the world used for industrial scale-desalinisation with a capacity of up to 100,000 tons per day. An accidental exposure is said to have occurred at MAEK in 1974.[54]

After cooling on site at MAEK, irradiated fuel assemblies were sent to Mayak in Russia for reprocessing. Further shipments of spent fuel were stopped when the Soviet Union collapsed. Apparently, some of the fuel assemblies irradiated over nearly 26 years of operation remain in the facility's cooling pool. Under the so-called Kazakhstan Spent Fuel Initiative, the U.S. secured the spent fuel at the site. According to the US Department of Energy, there was three tons of weapons-grade plutonium in approximately 300 metric tons of spent fuel at the site. The spent fuel was packaged for long-term storage in steel canisters. The project was completed in June 2001.[55] In a second phase, the canisters will be removed from Aktau and shipped to a more secure

[52] Defense Threat Reduction Agency, Project Sapphire [Completed]. http://www.dtra.mil/ctr/project/projkaz/sapphire.html
[53] Mangyshlakskiy Atomny Energokombinat (Mangyshlak Atomic Energy Combine).
[54] Viktor Kiyanskiy, West Kazakhstan NGO Exposes Human Costs of Soviet Nuclear Program. http://www.isar.org/isar/archive/GT/GT11kiyanskiy.html
[55] Nuclear Threat Initiative website, Kazakhstan: Mangyshlak Atomic Energy Combine (MAEK). http://www.nti.org/db/nisprofs/kazakst/reactors/powerrea.htm

site at Semipalatinsk.[56] A US-funded US$ 3 million plant designed to reprocess 1,300 tons of liquid sodium from MAEK into alkali is expected to be launched by May 2005. The US government is also planning to fund a second plant to process the alkali into a solid material for further safe storage.[57]

MAEK employed about 4,000 people and produced products and services worth 5.7 billion Tenge, equal to US$ 37 million, in 2001. However, MAEK has run into financial difficulties and is presently more or less bankrupt and the Kazakhstan government will sell the power plant if it can find a buyer.[58]

Research Reactors

There have been four research reactors in Kazakhstan. One, the **RA** reactor, is now fully decommissioned. It was an experimental reactor converted from a nuclear rocket engine prototype into a research reactor. The zirconium-moderated RA reactor had an effect of 0.5 MW and was run on 8.3 kg 90% HEU.[59] It went critical in 1989 and was located in the Baykal-1 Complex at the Semipalatinsk Test Site. It was dismantled and then shipped to Russia in 1998.[60] The three still operable reactors are:

- The **VVR-K** research reactor is situated at the Institute of Nuclear Physics in Alatau outside Almaty (previously known as Alma Ata). This fully operational reactor is a light water reactor that became operable in 1967.[61] It has a thermal power of 6 MW and operates on 5.4 kilograms 36% HEU. [62]

- The **IGR** (Impulse Graphite Reactor) is now one of the two remaining reactors in Kurchatov at the Semipalatinsk Test Site. The reactor is located underground in the middle of the IGR Complex at the Institute of Atomic Energy. It is a pulsed light water reactor, became operational in 1961, and has a thermal power of 10 MW. The reactor contains 10 kilograms 90% HEU. Both fresh fuel (7 kilograms) and spent fuel (7 kilograms) is stored on the site. [60]

- The **IVG-1M** reactor[63] is also located in Kurchatov at the Semipalatinsk Test Site, but in the Baykal-1 Complex. It is a 60 MW water-cooled pulsed reactor that became operational in 1972. The core contains 4.6 kilograms 90% HEU. In addition, 600 g fresh 90% HEU is stored at the site.

---

[56] Russian American Nuclear Security Advisory Council (RANSAC) website, Russian Nuclear Security and the Clinton Administration’s Fiscal Year 2000 Expanded Threat Reduction Initiative: A Summary of Congressional Action. http://www.ransac.org/new-web-site/related/congress/status/etri-2.html

[57] Associated Press, 2004-03-04.

[58] Interfax, Kazakhstan's Only Nuclear Power Plant May Go Bankrupt, 2003-01-10.

[59] Information on Nuclear Technology in The Republic of Kazakstan. http://www.insc.anl.gov/tempdb/d_sql_interface_view=spec_country_status_qvar=id_qval=58.php, 2004-05-05.

[60] Nuclear Threat Initiative website**,** Kazakhstan: Institute of Atomic Energy. http://www.nti.org/db/nisprofs/kazakst/reactors/iae.htm

[61] IAEA website, Research Reactor Details - WWR-K Alma Ata. http://www.iaea.org/worldatom/rrdb/

[62] Nuclear Threat Initiative website, Kazakhstan: Fissile Material Table. http://www.nti.org/db/nisprofs/kazakst/tables/kzfistab.htm

[63] In the IAEA Research Reactor Database, this reactor is called EWG 1. http://www.iaea.org/worldatom/rrdb

Weapons-grade fissile material is now only located at the three reactor sites:

- The Mangyshlak Atomic Energy Combine (MAEK) in Aktau, plutonium
- The Institute of Atomic Energy in Kurchatov, HEU
- The Institute of Nuclear Physics in Alatau, HEU

Radioactive Waste and Spent Fuel

Under the 31 December 1992 decree of the Kazakhstan Cabinet of Ministers *On Urgent Measures To Improve the Radiation Situation in the Republic of Kazakhstan*, a program was adopted to create a state system for collecting, processing, transporting, and disposing of radioactive waste. The program helped set up a registry of 528 locations in Kazakhstan where radioactive waste was stored or deposited. There is more than 230 million tons of radioactive waste in the country, the majority of which originates from nuclear weapons testing. The total activity of the waste has been estimated to around 500 PBq.

The main sources of radioactive waste in Kazakhstan are:

- remains at test sites of nuclear explosions (12 million tons, 480 PBq)[64]
- uranium mining, milling, and processing facilities and nuclear reactors (218-225 million tons of low-activity waste; 8.5 PBq and 1.17 million tons of medium-activity waste; 2.2 PBq)
- industries using radioactive isotopes, of which 3 PBq should be disposed.

Table 4. Facilities where radioactive waste is stored in Kazakhstan

Type of facility	Number
Locations of past nuclear explosions	16
Nuclear accidents or explosions outside Kazakhstan*	3
Nuclear facilities	5
Plants using sealed radiation sources	301
Uranium mining and processing	127
Uranium ore milling and processing	76
Total	**528**

* Chernobyl and Kyshtym (Mayak) nuclear accidents, Chinese nuclear testing at Lop Nor.

The national Kazakhstan waste site for radioactive material is located at Semipalatinsk at the Baykal-1 reactor complex. The storage facility was built to contain high-activity waste and is of international standard. It has been reconstructed to allow accommodation of sealed radioactive sources. Previously, spent radioactive sources were sent to Russia for storage, but a change of the Russian Constitution to forbid import of foreign radioactive waste meant that Kazakhstan itself had to take care of the problem. Spent fuel is also stored near the reactors as described previously (page 30). In Ust-Kamenogorsk (Oskemen in Kazakh) in East Kazakhstan, the Ulba Metallurgical Plant has a storage facility for low activity waste located near the city.

[64] PBq (Petabecquerel) = 10^{15} Bq. As a comparison, it has been estimated that 1,760 PBq of I-131 and 85 PBq of Cs-137 were released in the Chernobyl accident.

Nuclear Test Sites

Semipalatinsk Test Site

Semipalatinsk Test Site, also known as 'The Polygon', is a 19,000 km^2 large area in the far east of Kazakhstan. In the nuclear testing period from 1949 to 1989, 456 (87 air, 26 surface, and 343 underground tests) were conducted there. Five tests were unsuccessful and created no nuclear explosion. Instead, plutonium was dispersed on the ground.[65] The only inhabitants on-site during the testing era lived in the town of Kurchatov, known as 'Semipalatinsk-21' or 'Moscow-400' during those days to confuse. The first Soviet fission bomb (Joe 1) was exploded at Semipalatinsk on August 29,1949. In 1953, also the first Soviet hydrogen bomb (fusion) detonation took place there. The test site was officially closed on August 29, 1991; exactly 42 years after the first explosion took place there.

Under a five-year US-sponsored contract that ran between 1995 and 2000, nuclear weapons-related infrastructure, including tunnels, wells, and silos for intercontinental ballistic missiles was destroyed. Under this project, a series of calibration explosions with a yield of 5 to 25 tons of TNT were carried out. The explosions were used by the International System of Monitoring Nuclear Tests in support of the Comprehensive Nuclear Test Ban Treaty to calibrate seismic signals and to help experts differentiate between earthquakes and nuclear or chemical explosions.

The National Nuclear Center of the Republic of Kazakhstan was formed in 1992. It took over the Semipalatinsk Test Site infrastructure and other relevant nuclear research facilities in Kazakhstan. The missions of the centre were specified in a governmental resolution in 1993:[66]

- Elimination of the consequences of nuclear weapon testing in Kazakhstan
- Provision of scientific, technical, and training basis for nuclear power development in Kazakhstan
- Conversion of the former Semipalatinsk Test Site infrastructure to use its scientific and technical potential for peaceful purposes
- Monitoring of nuclear weapon tests worldwide.

Semipalatinsk's Degelen Mountain nuclear test facility (located at test site G, in the southern part of the test site), was the largest underground nuclear test site in the world, consisting of 186 separate tunnels in natural mountain formations. Between October 11, 1961 and October 10, 1989, 224 tests were conducted there.[67] Underground tests were also conducted at Balapan. The last nuclear test conducted at the Semipalatinsk Test Site took place at Balapan in November 1989.

Under the US Cooperative Threat Reduction program, the Degelen Mountain Test Tunnel Complex and Balapan altogether consisting of nearly 200 nuclear test tunnels and shafts were sealed.[68] There are no fences that prevent people from entering into

---

[65] Peter Stegnar & Tony Wrixon, Semipalatinsk Revisited: Radiological Evaluation of the Former Nuclear Test Site, *IAEA Bulletin* 40/4, 1998.

[66] Official website of the National Nuclear Center of the Republic of Kazakhstan. http://www.nnc.kz/e_index.php

[67] Nuclear Threat Initiative website, Kazakhstan: Semipalatinsk Test Site. http://www.nti.org/db/nisprofs/kazakst/weafacil/semipala.htm

[68] Senator Richard G. Lugar, Nunn-Lugar: The Past as a Guide to the Future, 1999-12-13. http://lugar.senate.gov/991213.htm

Semipalatinsk, but both reactor complexes on the area (Baykal-1 and IGR) are behind fences.[67]

Sites of Peaceful Nuclear Explosions

Within the framework of the Soviet nuclear program, 124 so-called 'peaceful nuclear explosions' (PNEs) were carried out with the stated purpose to support oil, gas, and mineral industries and to create water reservoirs.[69] It is unclear whether these reservoirs ever were used for the intended purpose. Reports from elsewhere in the former Soviet Union suggest that the fear of remaining radioactivity was too strong for them to be taken in use.[70] Seven PNEs were conducted at technical areas in the southwestern part of Semipalatinsk Test Site between 1965 and 1974 with energy yields between 0.23 and 140 kt. The largest test was the excavation explosion 'Chagan', which produced a lake about 500 m in diameter and 100 m deep, called 'Lake Balapan' or 'Atomic Lake'.

In addition, the following Soviet PNEs were also conducted in Kazakhstan:

- 17 PNEs at Azgyr
  Azgyr is a place in western Kazakhstan close to the Caspian Sea. Between 1966 and 1976, 24 underground nuclear explosions were conducted here. The purpose of the explosions was to create underground cavities in salt domes for the large oil and natural gas deposits in the Caspian Depression. The Southern Seismological Station, which managed the nuclear explosions, closed in 1994 and the Russian guards left the site in March 1996. The total activity at the Azgyr site has been estimated to 10 PBq. Soil contamination was found to be up to 320 kBq per m². [71] As a comparison, locations near Gävle in Sweden received around 200 kBq per m² from Chernobyl, the highest levels of radioactive contamination detected outside of the U.S.S.R. from the accident.

- 6 PNEs at Lira
  The Lira test site is located in northwestern Kazakhstan, 140 km east of the town of Uralsk. Starting in 1983, six underground PNEs were conducted at Lira, creating an underground storage volume of about 60,000 m^3 in cavities in salt domes. The cavities were created with the intention to store condensed gas extracted from the Karachaganak gas field.

- 3 PNEs at Say-Utes
  The Say-Utes test site is located about 100 km south of the village of Say-Utes on the east side of the Caspian Sea. Three peaceful nuclear explosions were conducted at Say-Utes in 1969-1970.

In addition to these tests, seven tests for seismic purposes have been conducted in Kazakhstan. In 1972, under the Region program, three tests were conducted in the

---

[69] Ministry of the Russian Federation for Atomic Energy and Ministry of Defense of the Russian Federation, USSR Nuclear Weapon Tests and Peaceful Nuclear Explosions; 1949 Through 1990, 1996. http://npc.sarov.ru/english/issues/peaceful/peaceful_e.pdf

[70] Bellona Report No. 1 1994, Sources to Radioactive Contamination in Russian Counties of Murmansk and Arkhangelsk, Chapter 7.5.1 Civil Nuclear Explosions. http://www.bellona.no/en/international/russia/report_1-1994/7568.html

[71] Claus Bunnenberg, Environmental Performance Review of Kyrgyzstan 1999/2000: Management of Radioactively Contaminated Territories. http://sun1.rrzn-user.uni-hannover.de/zsr/radio08.htm

Western Kazakhstan and Kostanav Oblasts. The following year, another three tests were performed under the Meridian program in the oblasts of Kzyl-Orda, Zhezkazgan, Karaganda, and Kostanay. The last seismic test took place in 1987 under the Batolit program in Aktyubinsk Oblast.

Dismantlement of the Nuclear Weapons Infrastructure

ICBM Force

The Intercontinental Ballistic Missile (ICBM) Force of the Soviet Union that was deployed in Kazakhstan consisted of 104 SS-18 ICBMs tipped with 1,040 warheads, deployed at two missile bases.

- Zhangiz-Tobe (also known as Solnechnyy), Semipalatinsk Oblast
- Derzhavinsk, Turgay Oblast

At four sites, a total of 148 silos and other structures, including 104 SS-18 launch silos, 16 launch control centres, two SS-18 training silos, and 26 other silo structures, were located.

- Zhangiz-Tobe missile base
- Derzhavinsk missile base
- Leninsk test range, Kzyl-Orda Oblast
- Balapan test range, Semipalatinsk Test Site

All 148 missile silos and silo structures were dismantled and destroyed in a two-phase program that was completed in 1999. Previously, all of the 1,040 nuclear warheads associated with the 104 SS-18 ICBMs and the ICBMs themselves had been transferred to Russia. The transfer of the warheads had been completed by April 25, 1995.

Heavy Bombers and Air-Launched Cruise Missiles Force

A squadron of 40 Tu-95[72] heavy bombers equipped with Kh-55 Air-Launched Cruise Missiles (ALCM)[73], tipped with 370 warheads, was stationed at Shagan Aerodrome in Semipalatinsk. During February 1994 Russia removed the 40 Tu-95 bombers and ALCMs. All of the 370 warheads had been removed by 25 April 1995. Russia left behind a number of outdated 1955-vintage bombers. These had been dismantled by August 1997 under the US Cooperative Threat Reduction program.

Non-Nuclear Facilities in Kazakhstan Leased by Russia

When Kazakhstan declared its independence in 1990, the declaration of sovereignty included a ban on further nuclear testing. In 1992, Kazakhstan declared state ownership over all former Soviet military facilities. However, on January 20, 1995 Russia and Kazakhstan agreed on terms for the Russian leasing of a number of facilities in Kazakhstan.[74] The agreement was ratified by the Kazakhstan Parliament five years later. The facilities leased by Russia were:

---

[72] NATO Designation 'Bear'
[73] NATO Designation AS-1 5A 'Kent'
[74] Marat Kenzhetayev, Military and Technical Cooperation of Kazakhstan: Prospects and Structure. http://www.armscontrol.ru/atmtc/kazakhstan/article_mtc_kazakhstan.htm

1. The area of the Russian Kapustin Yar Test Site (4th State Central Test Range) that is located inside Kazakhstan. About 15,000 km^2 of the test site, which was created in the Soviet times when there was no border between Russia and Kazakhstan, is located in the Oblast of Western Kazakhstan. Kapustin Yar is one of Russia's five rocket launch sites, (but two of them, Sary-Shagan and Baikonur, are completely located within Kazakhstan). In 1999, after an 11-year break in orbital launches from Kapustin Yar, one German and one Italian satellite were launched from there.[75] The site has also been used for testing of ballistic missiles.

   The first Soviet surface nuclear explosion with missile launch was performed at Kapustin Yar on February 2, 1956[76] and resulted in an accidental surface explosion near Aralsk. Ten more nuclear tests followed in the next six years.[77] As of January 2001, Russia was leasing the site from Kazakhstan in exchange for annual in-kind payments of military equipment and training, worth US$ 25.5 million.[78]

2. Three missile ranges
   - Emba
     The Emba Test Site is a tactical anti-aircraft defence and anti-missile defence systems test site located in the Oblast of Aktyubinsk in central Kazakhstan. The site, which covers an area of 7,000 km^2, was created in 1960. In 1995, Kazakhstan and Russia agreed on terms under which Russia could lease Emba during 10 years. By November 1999, Russia had moved its entire infrastructure at Emba to Kapustin Yar and terminated the leasing contract.

   - Sary-Shagan
     The Sary-Shagan Test Site, situated near Lake Balkhash in southeastern Kazakhstan, conducts work on strategic anti-aircraft defence, anti-ballistic missile defence, and anti-satellite systems. Sary-Shagan was established in 1956 and is the only site where Russian tests of ABM systems are allowed under the 1972 Anti-Ballistic Missile (ABM) Treaty. The site has a length of 480 km, which allows long-range testing. The agreement also includes 'ensuring of activities of Priozersk town', which is located nearby.[74]

   - 929th State Flight Center
     The area of the 929th State Flight Testing Center at Vladimirovka that is located within Kazakhstan. The centre is comprised of three sections situated in the Atyrau, Mangystau, and Western Kazakhstan Oblasts. The territory is used to test aviation technology and various types of weapons for all branches of the military.

---

[75] Russian Spaceweb website, 4th State Central Test Range at Kapustin Yar. http://www.russianspaceweb.com/kapyar.html

[76] V.N.Mikhailov (ed), USSR Nuclear Tests. Hydronuclear Experiments. Plutonium Inventory, 1998. http://npc.sarov.ru/english/issues/plutonium/section1.html

[77] U.N. Environmental Performance Review of Kazakhstan, Chapter 6, Management of Radioactively Contaminated Territories, pp. 77-96, 2000.

[78] Nuclear Threat Initiative website, Kazakhstan: Other Test Sites. http://www.nti.org/db/nisprofs/kazakst/weafacil/othermil.htm

3. Baikonur Cosmodrome
   The size of Baikonur is about 10,000 km^2. It is located in central Kazakhstan east of the Aral Sea. It is the largest and oldest working space facility in the world. The agreement between Russia and Kazakstan for lease of Baikonur Cosmodrome was signed on August 29, 1994. The original contract was for 20 years with an annual rent equivalent to US$ 115 million. However, by mutual consent, Russia started to actually pay the rent in 1999.[79] Russia and Kazakhstan recently extended Moscow's lease of the Baikonur satellite launch site until 2050.[80]

Uzbekistan

The nuclear authority in Uzbekistan is the State Committee on Safety in Industry and Mining. The Academy of Sciences of Uzbekistan under the Ministry of Higher and Secondary Specialised Education also plays an important role in domestic nuclear research and the Institute of Nuclear Physics is subordinate to the Academy. Uzbekistan is clearly the second most important country in Central Asia regarding present and former nuclear facilities. This is a description of the most important nuclear-related facilities in Uzbekistan.

Uranium mining and milling

The uranium reserves of Uzbekistan are much smaller than those in Kazakhstan, but still impressive. The uranium reserves of Uzbekistan are estimated at 137,000 metric tons, of which about two thirds could be extracted at a cost of less than US$ 40 per kg uranium.[81] Uranium production in Uzbekistan is entirely run by the Navoi Mining and Metallurgy Combine (NMMC) in Navoi between Bukhara and Samarkand in central Uzbekistan. It is now limited to *in situ* leaching operations in Uchkuduk, Zafarabad, and Nurabad.

There are still seven uranium mines operating in Uzbekistan. The Uchkuduk and Kendykijube mines belong to the Northern Mining Division in Uchkuduk. The Southern Mining Division in Zafarabad includes the two mines in Sabyrsaj and Ketmenchi and Mining Division No. 5 in Nurabad oversees the North Bukinai, South Bukinai and Beshkak mines and the Navoi mill. Finally, the Sugraly deposit, which is not mined at the moment, is situated in the Eastern Mining Division.[82] COGEMA of France was in 1998 reported to join NMMC to develop the Sugraly deposit, but recent reports suggest that COGEMA has withdrawn from the project.[83] The Meylisai, Bakhaly, and Altyntau mines are now closed. Underground operations at the Uchkuduk and Kendykijube mines are also closed.

In 2003, NMMC produced 1,770 metric tons representing 4.9% of the total world output. Production at NMMC has steadily fallen since 1999, when 2,159 tons were produced.[41]

---

[79] Baikonur (Interfax), Kazakhstan to Extend Baikonur Lease 10 Years, 2000-11-16.

[80] Erin E. Arvedlund (New York Times), Kazakhstan: Russia Extends Lease On Space Gateway, 2004-01-10.

[81] World Information Service on Energy & Nuclear Information and Resource Service website. NIRS/WISE, World uranium resources. http://www.antenna.nl/wise/uranium/umaps.html

[82] World Information Service on Energy & Nuclear Information and Resource Service website. NIRS/WISE, Uranium mine ownership: Asia. http://www.antenna.nl/wise/uranium/uoasi.html

[83] World Information Service on Energy & Nuclear Information and Resource Service website. NIRS/WISE, New Uranium mining projects – Other countries. http://www.antenna.nl/wise/uranium/uproj.html

All uranium production in Uzbekistan is the property of the government of Uzbekistan and subsequently NMMC is part of an Uzbekistan State holding company: Kyzylkumredmetzoloto. All uranium mined and milled in Uzbekistan was shipped to Russia before independence. Since 1992, all uranium is exported, mainly to the United States, through NUKEM Inc. Previously, the U.S. limited imports of uranium from Uzbekistan. The roof was gradually increased until it was completely abolished in July 2000.[84]

During the Soviet era, Uzbekistan was the main provider of uranium for military purposes. The towns Uchkuduk, Zarafshan, Zafarabad, Nurabad, and Navoi were all built for the purpose of supporting uranium production. Altogether, they had a population of 500,000 and provided NMMC with a stable and highly skilled work force. Senior positions in Uzbekistan's uranium industry, however, were and still are held by ethnic Russians.[85]

During the Soviet era, NMMC relied on Russian-produced materials, instruments, machine tools, and reagents. After independence, Uzbekistan has developed its own industry and NMMC is now able to find more of the necessary equipment on the domestic market.

Research Reactors

There have been two research reactors in Uzbekistan, but only one of them remains in operation. Today, the only operational reactor is WWR-CM (VVR-SM) at the Institute of Nuclear Physics in Ulugbek, a suburb of Tashkent. It is a light-water reactor with an effect of 10 MW. Since February 1999, it runs on 5.5 kilograms 36% HEU.[86]

The reactor, which was started in 1959, initially ran on uranium enriched to 10%. During the years between 1971 and 1979, the reactor was modernised. The rebuilding resulted in a reactor that used 90% HEU fuel. In a process lasting just six months, from August 1998 to February 1999, the reactor was converted under the Russian Reduced Enrichment for Research and Test Reactors (RERTR) program to use 36% HEU. The Institute of Nuclear Physics has declared that it is planning to further reduce the enrichment level to 19.7%.[86]

Less than 100 kilograms HEU is now stored on site. The spent HEU fuel (initially 90%) is stored in two cooling-ponds. On March 12, 2002, the U.S. and Uzbekistan signed an agreement to hand over the spent reactor fuel to Russia.[86]

The second research reactor, IIN-3M, at the Photon Radioelectrical Technical Plant in Tashkent is now closed. It was a liquid salt, pulsed reactor. The nuclear material from the reactor has been transferred to the Institute of Nuclear Physics.

[84] Nuclear Threat Initiative website, Uzbekistan: Uranium Mining and Milling. http://www.nti.org/db/nisprofs/uzbekis/mining.htm

[85] When the Soviet Union broke up, Uzbekistan opposed the Russian suggestion that ethnic Russians should be given dual citizenship.

[86] Nuclear Threat Initiative website, Uzbekistan: Institute of Nuclear Physics. http://www.nti.org/db/nisprofs/uzbekis/inp.htm

Kyrgyzstan

The president of Kyrgyzstan, Askar Akayevich Akayev, is a former nuclear physicist. However, the nuclear facilities he now has to oversee are quite limited.

The Kara-Balta Ore Mining Combine

Kara-Balta was a secret city during the Soviet era. It is located in the Chui Oblast in northern Kyrgyzstan about 70 km west of the Kyrgyz capital Bishkek. The Kara-Balta Ore Mining Combine processed uranium concentrate from mines in Kyrgyzstan and Kazakhstan for the Soviet Union's military and civilian nuclear industries. After independence in 1991, there were a couple of years when Kara-Balta was without raw material. In 1994, an agreement was reached with KazAtomProm to refine uranium ore concentrate from Kazakhstan into U_3O_8.[87] Today, Russian MINATOM is working to restore some of their previous relations with Kara-Balta that came to a halt in 1991.

Kara-Balta owns 10% of the Zarechnoye Joint Venture, which is planning to develop the Zarechnoye deposit in southern Kazakhstan.[88] The project was announced in October 2003 with Kazatomprom and TVEL as the major owners with stakes of 45% and 20%, respectively. The Russian companies Tekhsnabexport (15%) and Atomredmetzoloto (10%) have made up the remaining capital. Commercial mining is scheduled to begin in late 2005. The aim of the project is to produce 500 tons U_3O_8 annually.[89]

In December 2002, the Finnish government donated more than 3 million Euros for environmental work in Kyrgyzstan. One of the projects will aim to stabilise the Kara-Balta uranium mill tailings dump.[90]

Closed Uranium Mining Operations in Kyrgyzstan

Uranium mining in Kyrgyzstan itself has ceased. Six uranium mines have existed in Kyrgyzstan: Kyzyl-Kia in Kyzyl-Kia and Mayli-Suu, north of Osh in Jalalabad Oblast; Ak-Tyuz in Orlovka where thorium is still mined; both Min-Kush (also known as Kavak) in Min-Kush and Tonskiy Bay in Issyk-Kul are closed since long time, and Kadzhi-Say in Kadzhi-Say has been closed since the 1970s. Uranium mining has caused considerable environmental damage, particularly at Kyzyl-Kia and Mayli-Suu[87] and significant efforts have been made by the international community to aid the Kyrgyz Republic in restoring the sites.[91] In 2002, a huge landslide barricaded a river near Mayli-Suu threatening to flood the uranium dump site. Recently, Japan promised to fund a project to prepare detailed documentation of the issue. Once this documentation exists, The World Bank has pledged to help initiate practical work on the site.[92]

---

[87] Nuclear Threat Initiative website, Kyrgyzstan: Uranium Mining and Milling. http://www.nti.org/db/nisprofs/kyrgyz/mining.htm
[88] BBC/Interfax, 2001-10-10.
[89] Itar-TASS, 2003-10-02. Kazakhstan-Russia-Kyrgyzstan uranium venture to be created in Kazakhstan.
[90] AKIPress, 2002-12-04.
[91] World Information Service on Energy & Nuclear Information and Resource Service website. NIRS/WISE, Kyrgyzstan: Cleanup of Mailii Su uranium mill tailings. http://www.antenna.nl/wise/uranium/udec.html#KGTAIL
[92] Kyrgyzstan: World Bank to reduce uranium waste danger in Ferghana Valley. http://www.irinnews.org/report.asp?ReportID=38104&SelectRegion=Central_Asia&SelectCountry=KYRGYZSTAN

Radioactive Waste Sites

In 1999, there were 36 uranium tailings sites and 25 uranium-mining dump sites on the territory of Kyrgyzstan. Many of the sites are associated with the Mayli-Suu uranium processing facility. Other radioactive waste sites include Kara-Balta, Kadshi-Say, Khaidarkan, Min Kush, Samsar River, Shekaftar, and Terek-Say.[93]

Nuclear submarine rocket testing

The Russian navy still operates a long-distance communications centre, as well as a testing site on Lake Issyk-Kul. This facility is testing rockets for nuclear submarines. It is one of the few sites in Central Asia that Russian officials still claim to be of vital interest for Russian security.[94]

Tajikistan

One of the first Soviet uranium mines was situated in Tajikistan, but since then Tajikistan has lost most of its importance in the nuclear field. Few facilities still exist.

Vostokredmet in Chkalovsk

Uranium ore from deposits in Tajikistan, Uzbekistan, and Kazakhstan was refined into yellowcake[95] at the Vostochnyy Rare Metal Industrial Association (Vostokredmet), which previously was known as the Leninabad Mining and Chemical Combine. Apparently, Vostokredmet continues to process small amounts of uranium. However, today it is mainly processing gold, silver, and other precious metals. It is possible that a uranium enrichment plant once was situated at the Vostokredmet Plant,[96] but this is merely of historical interest today.

The Argus Nuclear Reactor in Dushanbe

A research reactor, designed to run on 21% enriched uranium, was completed in 1991, but it has never been loaded with fuel.[96]

Turkmenistan

There are no known nuclear facilities in Turkmenistan. Together with Azerbaijan and Moldova, it was one of only three Soviet republics to entirely lack nuclear infrastructure.[97]

---

[93] Nuclear Threat Initiative website, Kyrgyzstan: Radioactive Waste. http://www.nti.org/db/nisprofs/kyrgyz/waste.htm

[94] Alec Rasizade, Foreign Service Journal, The Specter of a New “Great Game” In Central Asia, November 2002.

[95] Yellowcake is the product of uranium extraction (milling); it results in a bright yellow compound, hence the name yellowcake. Yellowcake is commonly referred to as U_3O_8. This fine powder is sent to a plant that produces uranium hexafluoride (UF_6) as the next step in the production of nuclear fuel.

[96] Nuclear Threat Initiative website, Tajikistan: Overview. http://www.nti.org/db/nisprofs/tajikis/overview.htm

[97] Kenji Murakami, Experience in Building National Experience in Building National Nuclear Material Control Nuclear Material Control Capabilities, IAEA. http://www.iaea.or.at/worldatom/Press/Focus/Nuclear_Terrorism/murakami.pdf

Risks of Diversion of Nuclear Material, Equipment, and Expertise

Illicit Nuclear Trafficking in Central Asia

Central Asia has been, and still is, considered to be a source of diverted radioactive material. [98,99,100,101] The focus, however, has perhaps drifted during the decade of independence from weapons-grade material in quantities sufficient for the production of a nuclear weapon to more specifically HEU in quantities still to be highly concerned over, but perhaps not sufficient to directly produce a nuclear weapon from. However, a proliferator could combine several such sources to finally obtain enough material to produce a nuclear weapon. With the knowledge that borders in Central Asia are highly porous for drug trafficking, it is not comforting to know that some of the states of highest concern from a proliferation view are found close to Central Asia. We also know that the most feared individual terrorist organisation at the moment, al Qaeda, is claimed to have its base in, or at least close to, nearby Afghanistan.[102]

Primarily, the U.S., but also other countries have done much to improve safety and security of nuclear material in Central Asia and the concern has gradually drifted towards radioactive industrial sources that potentially could be used to produce a 'dirty bomb', i.e. a mix of explosives and radioactive substances. Radioactive sources are generally much less protected than HEU, or used nuclear fuel, since they often are found at industries and in hospitals. In May 2002, the FBI captured Jose Padilla, aka Abdullah Al Muhajir, and later accused Padilla of plotting to make such a 'dirty bomb'.[103] Particularly after that incident 'dirty bombs' are seen as plausible terrorist weapons. IAEA recently started a program directed against the problem of orphaned sources to make sure that states take this problem seriously. 'Cradle-to-grave control' of radioactive sources is the term to ensure that the sources are appropriately regulated at all times.[104]

Indeed, there have been a number of cases in the last decade of illicit trafficking of nuclear material that has involved the Central Asian republics. All Central Asian states except Turkmenistan have joined The IAEA Illicit Trafficking Database, which records incidents such as loss, theft, or unauthorised transfer, possession, or disposal of nuclear material (uranium or plutonium), or radioactive sources. Since the four states joined the system in December 1999, 25 incidents have been reported to occur in Central Asia in the years 1993-2002. Twenty of these have occurred in Kazakhstan, one in Uzbekistan, and two each in Kyrgyzstan and Tajikistan.

With the exception of the cases that are discussed here, most of them have involved only small amounts of radioactive material or cross-border transport of radioactively

[98] AFP (Moscow), Uzbeki held in Kirghizstan for trying to pass plutonium to UAE, 1999-05-14.
[99] Narodnaya gazeta (Dushanbe), Tajikistani Offical Notes Threat of Nuclear Smuggling, 2001-02-16.
[100] Charles J Hanley, Associated Press, Central Asia emerges as source of 'dirty bomb', 2002-06-15.
[101] Adam Tanner, Reuters, U.S. concerned about nuke smuggling in Central Asia, 2002-12-09.
[102] The World, Nightmare Taliban-Mafia Alliance a Possibility, 2000-12-28.
[103] BBC News, Profile: Jose Padilla, 2002-06-11. http://news.bbc.co.uk/1/hi/world/americas/2037444.stm
[104] IAEA, International Conference on Security of Radioactive Sources, Vienna, 2003-03-10--13.

contaminated scrap-metal.[105],[106] It can directly be said that none of the more serious cases of nuclear diversion in the former Soviet Union has occurred in any of the Central Asian republics.[107]

The Ust-Kamenogorsk Gang

One of the most widely extended nuclear trafficking cases, both in terms of goods stolen and people involved, occurred in 1995 around the Ulba Metallurgical Plant and the Lead-Zinc Combine in Ust-Kamenogorsk in Kazakhstan. This case was something like a chain letter in nature in that each new person, brought into the criminal ring, recruited another to help with acquiring the radioactive material. It started with two persons discussing the possibility of trading radioactive materials and ended with 18 people being sentenced to prison terms of between three and eight years. The five women in the group, however, received presidential amnesties.[108]

The brains behind the series of thefts were metal dealers, Viktor Krinitsyn, who originated from Ust-Kamenogorsk, and Evgeniy Zaikin, who was from Novosibirsk in Russia. Krinitsyn was responsible for locating sources of radioactive material and negotiating a price. Zaikin was responsible for analysing the material, finding buyers, and collecting money. The two men began by recruiting a customs official in the Novosibirsk region to help them ship the radioactive material to Russia or elsewhere. Then a department head of the foreign economic relations at the Ulba Plant was brought into the ring and so on.

In the summer of 1995, a welder at Ulba was recruited to help steal uranium. The welder in turn persuaded a storehouse foreman to remove five 6-L containers of uranium fuel tablets. Another branch of the ring stole tantalum and thorium. With the aid of some of the women previously mentioned, twenty boxes of thorium weighing about half a ton were stolen from the plant. By November 1995, the Kazakhstan Intelligence Service (KNB) had began noticing that material was regularly disappearing from the Ulba Plant. Their investigation led them to Krinitsyn and his group, but as they found that the network extended to Novosibirsk the Russian Federal Security Service (FSB) was informed and together they put the group under surveillance. Two minor transactions were allowed to take place before a sting operation was initiated. It involved the sale of four kilograms of uranium tablets for 800,000 dollars to an agent posing as a businessman from Vladivostok.

The subsequent search of apartments and houses revealed that the criminal group altogether had stolen 146.4 kilograms of uranium fuel pellets[109] and 438.7 kilograms of radioactive Thorium-232 from the Ulba Metallurgical Plant, as well as 58.3 kilograms and 19.9 kilograms of the rare metals of thallium and indium from the Lead-Zinc Combine.

---

[105] V. Brazhko, Times of Central Asia, Radiation for Export?, 2000-04-20. http://www.times.kg/news/1011925.html
[106] ITAR-Tass, Kazakhstan Seizes Two China-Bound Radioactive Containers, 2001-04-06,
[107] R.W. Lee III, Smuggling Armageddon – The Nuclear Black Market in the former Soviet Union and Europe, St. Martin's Press 1998.
[108] P.N. Woessner, Nuclear Trafficking Incidents Database 2001
[109] According to available reports, Uranium fuel pellets processed at Ulba contain between 1.6 and 4.4 % U-235.

The Iranian Truck

The case of a stopped radioactive transport between Kazakhstan and Uzbekistan turned into a diplomatic flurry with at least four nations giving official statements. On March 30, 2000, Uzbekistani customs officers seized an Iranian-registered truck on the Kazakh-Uzbek border on its way to Quetta in Pakistan. The Uzbekistani authorities claimed that it contained 'ten 70 x 40 x 25 cm lead containers with highly radioactive material'. The transport documents of the truck said it was carrying 23.2 tons of scrap metal from the Kazakhstani firm Aral to a Pakistani firm, Akhmadzhan Khadzhi Er Makhammad. There were essentially two problems with the cargo; the Kazakhstani customs had cleared the truck and issued a certificate saying it had passed radiation screening and the lead containers were not listed in the transport documents of the truck. Uzbekistani radiation experts determined that the level of gamma radiation emitted by the cargo was 5 roentgens (around 50 milliSv) per hour, at least 25 times over the acceptable level. The truck and its cargo were then forced to return to Kazakhstan.[110]

On April 3, Kazakhstani customs officials admitted that a radioactive cargo had been mistakenly allowed to cross over the border into Uzbekistan and launched an investigation. However, that same day, KNB sources denied the reports that containers of highly radioactive material had been in the truck. They claimed it was the scrap metal itself that was radioactive. Other Kazakhstani officials also quickly denied that the incident involved attempted smuggling of highly radioactive materials claiming among other things that the Uzbekistani authorities had mistaken 'the waste products of some technological production process' for being containers.

A US spokesman noted that the seizure represented a successful example of US efforts to halt international smuggling. The Uzbekistani customs officers involved had been trained and equipped by U.S. authorities. They also used US-supplied radiation detectors to check the truck thereby uncovering its high level of radiation.

On April 7, Kazakhstani specialists were ready with their analysis and concluded that at least part of the cargo had likely been salvaged from a uranium mine. They had come to the conclusion that pipe scraps in the cargo were coated with radioactive debris that emitted 3.6 milliroentgens (36 microSv) per hour; 1/1,400th of the radiation level the Uzbeks had reported. A Kazakhstani diplomat now claimed that the Uzbekistani authorities had misinformed journalists about the case. The Kazakhstani Ambassador to Uzbekistan showed journalists copies of dosimetric analyses of the cargo made by experts in both countries. The test results displayed at the press conference both reported that maximum radiation levels of 3.2 milliroentgens (32 microSv) per hour were coming from the cargo, which was a long way from the initially reported 5 roentgens per hour. At this time, the lead containers were not even mentioned.

On April 8, Pakistan denied any involvement in the case when a Pakistan Foreign Ministry spokesman said that 'Pakistan is not connected in any way with this shipment…..This is obviously an attempt to falsely implicate Pakistan, which we condemn.' A commentary in the Washington Times with the title 'The New Islamic Bomb' said that radioactive isotopes could be used to make radiological weapons (dirty bombs) and claimed that unspecified 'Middle Eastern terrorists' were likely to use such

[110] Nuclear Threat Initiative website, Uzbeks Seize Radioactive Material. http://www.nti.org/db/nistraff/2000/20000280.htm

weapons in the future. Indian media wrote that it showed that 'Pakistani terrorists now want nuclear arms besides traditional weapons'.

In a final statement released on April 25, the Kazakhstani government repeated its position that there were in fact no containers of radioactive material in the truck and that it carried only slightly radioactive scrap metal.[111]

Other incidents

In 1999, KNB officers in Semipalatinsk arrested two men in possession of one kilogram of uranium during an undercover operation.[108] One of the men, who was trying to make a living from selling sunflower oil at the local market, had met a worker from the Ulba Plant in Ust-Kamenogorsk at a dinner party. He was there offered to buy five kilograms of uranium for 4,500 dollars, but only bought one kilogram, as he was rightly unsure about the uranium market. Apparently, he was not getting anywhere trying to find prospective buyers so he confided in an Afghan war veteran and asked him to help find a buyer. The veteran found him a buyer who turned out to be a KNB agent. Both men received 18-month suspended sentences with a one-year probation.

In April 2000, six persons from the Leninabad Region in northern Tajikistan were sentenced to different terms of imprisonment for 'theft and contraband sale' of 1.5 kilograms of Cesium-137-contaminated uranium oxide. One of those arrested was on the staff of the Tajikistani uranium processing plant Vostokredmet.

In May 2000, after receiving a tip, Kazakhstani police intercepted a car carrying two containers with radium between Zyryanovsk and Ust-Kamenogorsk in East Kazakhstan and arrested the driver. The radium had probably been stolen in November 1998 from the storehouse of the Lazurit joint-stock company in Zyryanovsk.[112]

According to KNB reports, there have been at least two cases worth noting in 2002. In April, a radiation source was seized from a Kazakhstani national. The weight of the device was 18 kilograms and it had been stolen in 1998 from a company in Leninogorsk in East Kazakhstan. In July, KNB officers arrested a resident of Pavlodar in northern Kazakhstan when he was trying to sell 5 grams of Cesium-137, a highly radioactive material.[113]

Risk of Nuclear Material Diversion

There are many potentially dangerous events associated with nuclear material diversion. I have divided such events into three categories in this paper. The worst case is the diversion of a nuclear weapon or enough weapons-grade material to produce a nuclear weapon. An intermediate type of threat is diversion of material that can be converted to nuclear weapons material, but not without the necessary infrastructure.

[111] Nuclear Threat Initiative website, Uzbeks Seize Radioactive Material. http://www.nti.org/db/nistraff/2000/20000280.htm

[112] Nuclear Threat Initiative website, Police Seize Two Containers With Radium in East Kazakhstan. http://www.nti.org/db/nistraff/2000/20000320.htm

[113] Nuclear Threat Initiative website, Press Release of the Committee of National Security of the Republic of Kazakhstan, 2002-04-30. http://www.nti.org/db/nistraff/2002/20020400.htm

The third category is radioactive material that can not be utilised for a nuclear weapon, but can potentially injure people by emitting ionising radiation.

- ***Diversion of a nuclear weapon, or material that can directly be used to produce a nuclear weapon (i.e. primarily weapons-grade HEU or plutonium)***
  There is good evidence to suggest that no nuclear weapons have ever disappeared from Central Asia. The 'window of opportunity' for such a thing to occur was without doubt between 1991 and 1995. Contradictory alarm reports often occur, but sources to such stories are often less reliable. Of course, since 1995 when all nuclear weapons in the region had been transferred to Russia, there has been no risk of nuclear weapons going astray from this part of the world.

  Less than 200 kilograms of weapons-grade HEU now remain in Central Asia. A major advantage from a security point-of-view is that it is located at only three different sites, Semipalatinsk, Almaty, and Tashkent. Today, it seems to be well secured and probably accounted for. The danger of diversion of this material is probably small and an attempt to do so would surely have to involve personnel working on those sites.

- ***Diversion of material that can be converted to weapons material (by enrichment or reprocessing), but need significant infrastructure to do so***
  There is plenty of uranium in Central Asia, primarily natural uranium.[25] Nuclear fuel pellets with an enrichment level of 2-4% U-235 are produced at the Ulba Plant in Kazakhstan. Small quantities (kilograms) of such fuel pellets have been stolen, but objectively pose a small risk to health. Uranium is the least radioactive of all radioactive substances because of its extremely long half-lives (4.5 billion years for U-238). A physicist would regard it as a weak radiation source, but the general public's perception of the uranium threat is different. This was clearly demonstrated by the public outcry when depleted uranium (which is about half as radioactive as natural uranium) was used during the wars in the Gulf and the Balkans.

  A proliferating country trying to clandestinely enrich uranium would potentially be interested to acquire low-enriched nuclear fuel pellets. It could both be used to facilitate production of weapons-grade uranium and to produce plutonium. A deal with a state would probably require that several hundreds of kilograms, if not tons, were up for sale. It seems hard to imagine that such large quantities of nuclear fuel pellets could go missing at this time when authorities in the Central Asian countries are quite aware of the problem. The situation was different in the first years after independence when the states had not grasped the magnitude of this problem. During those years, it is likely that thefts regularly did occur as demonstrated when the Ust-Kamenogorsk Gang was uncovered in 1995 (see page 43). It is difficult to decide whether it is reassuring or alarming that most thefts of uranium, weapons-grade material, or radioactive sources are unveiled and stopped by national security officials. It can be regarded as reassuring if it points to the fact that buyers on this market are almost non-existent, which means that a seller sooner or later has to get in contact with probing undercover agents. On the contrary, it is indeed alarming if it points to the fact that security officials operate in numbers high enough to regularly stop such deals because that would implicate that we only see the tip of the nuclear trafficking iceberg. As often is the case, the truth might lie somewhere between those extremes. If that really is the case, we have every reason to worry about the future consequences.

The 3 tons of plutonium at MAEK in Kazakhstan would normally be enough plutonium to make several hundred nuclear weapons. However, it is really not that bad because the plutonium is still part of 300 tons spent fuel. To be able to use this plutonium in a nuclear weapon, you have got to reprocess the spent fuel and to separate plutonium from spent fuel is not a trivial task. It is both a dangerous and dirty job. First, the radioactive fuel is chopped up by a remotely controlled mechanism behind heavy lead shielding. This material is then dissolved in boiling nitric acid in a process that will release radioactive gases. The plutonium is regained after it has been separated from the acid solution by chemical means. The entire process will leave large quantities of highly radioactive liquid waste behind. Reprocessing is only done at a few places in the world, for example at Sellafield in England, La Hague in France, and Mayak in Russia. It is not clear what kind of quality plutonium from power reactors might have for nuclear weapon applications as plutonium from a power reactor will contain Pu isotopes that from a nuclear weapon quality perspective are unwanted, since they are considered to decrease the yield. Despite this, it is claimed that the U.S. in 1962 performed a successful underground nuclear weapon test with plutonium from a power reactor.[114]

- ***Diversion of radioactive material that can be used to make a 'dirty bomb' or placed in a location to potentially injure people***
  The most significant threat from diverted nuclear material from Central Asia falls into this category. At least two types of sources of radioactive material qualify to be included here: spent nuclear fuel and radioactive sources from industry and medicine.

  Spent nuclear fuel elements are highly radioactive (in contrast to fresh fuel elements). This is a significant problem for the perpetrator as he may be injured during theft and subsequent handling and storage. However, it appears today that the prospect of injury and death does not stop determined groups, as we recently have witnessed what committed and well-equipped groups can achieve in terms of destruction. The groups that attacked the U.S. on September 11, 2001 were not even well-equipped, just very committed and well-financed, but caused destruction previously unthought-of. The Chechen group that attacked the Moscow theatre in October 2002 is another example of a relatively large group that was committed to sacrifice their own lives. If such a group with the addition of one or several 'nuclear experts'[115] was to attack a spent fuel facility in Kazakhstan, Uzbekistan or elsewhere, the outcome would probably depend on the timing of the attack, i.e. the resistance and professionalism of the guards on site at that particular moment.
  Radioactive sources that are professionally used in applications in industry and medicine may be easier for a criminal to handle if the source is small (and then of course less dangerous). It may then already be shielded by lead or depleted

---

[114] H.W. Hubbard, Plutonium from light water reactors as nuclear weapon material, 2003-09-12. http://www.npec-web.org/projects/hubbard.pdf

[115] The kind of nuclear expert needed in such a scenario is probably a person that is working or has previously worked in a radioactive environment, nuclear power plant for example, and has a good knowledge of practical radiation issues. There are probably many in Central Asia that fits this description.

uranium. Two men could certainly carry away with a source, put it in a vehicle and drive away without exposing themselves to significant amounts of radiation. A more powerful source will also be more difficult to steal, as the radiation shield may be too heavy for transport. To be able to obtain that kind of source would require that the perpetrators are ready to expose themselves to some radiation. They probably would have some kind of provisional radiation shield with them to be able to transport the source from the location where it was stolen.

Another type of radioactive source that exists in Central Asia is a type of battery that was used all over the former Soviet Union in lighthouses and other types of equipment needing a long-lasting energy source. The scientific denomination of a battery like this is Radioisotope Thermoelectric Generator (RTG). Uncontrolled sources of this type have been claimed to have emerged both in Kazakhstan and Tajikistan, as well as in Russia[116] and Georgia.[117] An RTG generally consists of Strontium-90, a beta-radiation emitter. Normally, this type of radiation will be of limited danger since the radioactive material is shielded by non-radioactive aluminium, some lead, and stainless steel. However, Strontium-90 in such large quantities as in these batteries will generate intense bremsstrahlung, which is a type of gamma-radiation that will penetrate skin and cause whole-body irradiation. In addition, if Strontium-90 is inhaled (after an explosion) it could give a significant beta-radiation dose to the lungs.

Nuclear Material Diversion in Central Asia - A Decreasing Problem?

Much can still be done to improve security of nuclear material and radioactive sources in Central Asia, but with the help of primarily the U.S. the worst security problems with weapons-grade material seem to have been taken care of. The situation after independence was far from satisfactory when it came to securing radioactive material. The worst known case of nuclear diversion in the newly independent states took place in Obninsk in Russia, where nearly 400 grams of plutonium and almost 3 kilograms of nearly weapons-grade HEU were stolen in 1993 or 1994. The situation after independence was quite chaotic, so as previously discussed it is difficult to establish with any certainty that similar thefts did not occur in Central Asia, primarily Kazakhstan.

There are probably a great number of radioactive sources on the loose, so-called ‘orphaned sources’, in Central Asia, but this is not a problem unique for Central Asia. The United States Nuclear Regulatory Commission reports that US companies have lost track of nearly 1,500 radioactive sources between 1996 and 2001. More than half of them were never recovered. Another study estimated that every year up to about 70 sources are lost from regulatory control within the EU.[118] In view of this information, it is difficult to see that terrorists need to be even particularly clever to get hold of a radioactive source in order to produce a ‘dirty bomb’.

Risk of Diversion of Nuclear Equipment

As has been discussed previously in the chapter on Nuclear Weapons Policy after Independence (page 19), the core of the USSR nuclear industry was always inside

---

[116] Rashid Alimov, Bellona’s working paper: Radioisotope Thermoelectric Generators. http://www.bellona.no/en/international/russia/navy/northern_fleet/incidents/31772.html , 2003-11-24.

[117] IAEA, Upgrading the Safety and Security of Radioactive Sources in the Republic of Georgia. http://www.iaea.or.at/worldatom/Press/News/georgia_radsources.shtml, 2002-02-04.

[118] IAEA, Inadequate Control of World's Radioactive Sources, 2002-06-25.

Russia. Some of the least vital nuclear facilities from a security point-of-view were located to Central Asia. However, this does not imply that equipment, if stolen or diverted from Central Asia, would not be useful in a nuclear weapons program.

Risk of Diversion of Nuclear Experts

Kazakhstan was the only of the five Central Asian states with nuclear expertise in all fields of the nuclear fuel cycle. Uzbekistan, Kyrgyzstan, and Tajikistan also had nuclear experts, but they did probably not cover the entire width of nuclear research and development. It is questionable if many of the Central Asian experts were the type of expert that single-handedly could set up an entire nuclear weapons research & development program, if they had 'gone missing' to a country or terrorist group with nuclear ambitions. Nevertheless, these experts still are valuable to a proliferator because in collaboration with other experts they might be instrumental for the progress of such a country or organisation.

Nuclear scientists are in a sense 'less dangerous' from a proliferation perspective than scientists with a background in the biological or chemical weapons programs. Nuclear scientists are in need of much more large-scale facilities than their biological or chemical counterparts, who can produce deadly material from rather simple facilities. Of course, simple facilities might not be the preferred choice if their aim is to produce sophisticated biological agents, but it would probably be sufficient to cause outbreaks of disease or as shown in Japan in 1994 and 1995 sufficient to produce a nerve agent. The Japanese terrorists fortunately were lacking an effective dispersion mechanism. Otherwise, they would have killed many more than the altogether 19 persons that died in the attacks in Matsumoto and Tokyo.

An attack with radiological material is similar to attacks with biological and chemical weapons in that the expertise does not need large-scale facilities. Furthermore, when it comes to the nuclear expertise needed for the 'dirty bomb' scenario, many hundreds, if not thousands, of experts are to be found in Central Asia. Any one of these teamed up with an explosives expert would be able to create a 'dirty bomb'.

The most critical types of expertise for the success of a nuclear weapons program are probably a) for a HEU program, experts on uranium enrichment and b) for a plutonium program, experts on manufacture of the explosive lenses. In the Soviet Union, the experts on HEU production were found in Tomsk-7 (Seversk today), Sverdlovsk-44 (Novouralsk), and Krasnoyarsk-45 (Zelenogorsk). Plutonium weapon components were produced at Tomsk-7 and Chelyabinsk-65 (Ozersk). All of these sites are located in Russia and so were all the other important sites for nuclear warhead design or assembly.[119]

Thus, the number of that kind of critical experts was probably low in Central Asia. No doubt there existed a number of experts on uranium enrichment in Kazakhstan, and it is possible that experts of Central Asian origin working at Russian nuclear weapons sites have moved back after independence, but top-quality expertise was and still is probably limited. Deteriorating economic conditions for such highly qualified expertise with substantial problems in getting their salaries might have meant that they would have

[119] Oleg Bukharin, Downsizing Russia's Nuclear Warhead Production Infrastructure, The Non-Proliferation Review 8:116-130, (2001).

been tempted to team up with potential proliferators in a region of the world where many countries with questionable behaviour concerning nuclear non-proliferation are located.

International Assistance Programs to Support Former Weapons Scientists

To help with financing of salaries for critical experts, several international assistance programs have emerged to help expertise from the former nuclear, biological, and chemical weapons programs as well as missile technology experts. These programs offer experts a possibility to redirect their skills to non-proliferation issues where their scientific background can be used in commercial research and development projects in a peaceful way.

The International Science and Technology Center (ISTC), which is based in Moscow and the Kiev-based Science & Technology Center in Ukraine (STCU) are two such non-proliferation programs directed to aid scientists from the former Soviet Union. The ISTC is an organisation established in 1992 by agreement between the European Union, Japan, Russian Federation, and the U.S. Since then, Norway and the Republic of Korea have joined as parties to the agreement. ISTC funds research projects in Russia, Kazakhstan, Kyrgyzstan, Armenia, Georgia, and Belarus.

STCU is an organisation with similar aims, but covering a different geographical area. It was established in 1993 by agreement between Ukraine, Sweden, the U.S., and Canada. Sweden's chair was overtaken by the EU after Sweden joined the Union in 1995. The six-person STCU secretariat includes representatives from these four parties. Together with Japan, the EU, the U.S., and Canada are the sole financial contributors to the STCU. Scientists in Ukraine, Uzbekistan, Georgia, and Azerbaijan are supported by the STCU. Tajikistan submitted two proposals to the STCU in 2000 and may soon join the STCU. Moldova has also expressed an interest in joining the STCU.

To give an idea of the difference in financial strength between the two organisations, STCU funded projects for around US$ 10 million[120] and ISTC spent almost US$ 85 million in 2002.[121] That brought the cumulative ISTC funding to almost US$ 500 million, whereas STCU now has reached a cumulative figure of US$ 75 million. ISTC has averaged over US$ 50 million during 9 years of administering grants and STCU has averaged US$ 10 million over its 7-year funding history.

[120] STCU, Annual Report 2002.
[121] ISTC, Annual Report 2002.

How Does Central Asia Fare in Competition for Grants?

Kazakhstan and Kyrgyzstan

Examining the information given at the ISTC[122] and STCU[123] websites, a number of observations can be made regarding how the Central Asian states have fared in the competition for grants.[124] Until the end of 2001, ISTC had received 3,495 research applications. The majority of which, or 2,538, naturally came from the Russian Federation. Kazakhstan submitted 222 and Kyrgyzstan 88 applications. On the average, 44% of all applications were successful. Kazakhstan (success rate: 41%) and particularly Kyrgyzstan (44%) were more successful than Armenia (35%), Belarus (34%) and Georgia (33%), but less successful than Russia (47%).

During the first ten years of the ISTC program, 77% of all of the initiated projects were Russian, reflecting the fact that the other states joined at a later stage. Only 2.5% and 5.7% (arbitrarily) of the grants had been given to researchers in Kyrgyzstan and Kazakhstan. At the end of 2001, the percentage of active Russian projects was 73%. At the same time, the projects originating from Kazakhstan (6.4%) and Kyrgyzstan (3.5%) had reached almost 10%. All these figures relate to experts from the entire field of Weapons of Mass Destruction technology including missile experts.

In Kazakhstan, the National Nuclear Center is probably the most successful institution in obtaining grants. Also the Ulba Plant has received a number of grants and MAEK in Aktau has also received one grant. In Kyrgyzstan, only two approved projects touch upon the nuclear field. The Institute of Physics of National Academy of Sciences in Bishkek has received two grants; to look at the environmental effects of uranium production and biochemical effects of radioisotopes.

Uzbekistan

As noted above, Uzbekistan decided to join the STCU instead of the ISTC. This decision probably once again reflects Uzbekistan (Karimov's) will to show independence from Russia. The first Uzbekistani grants were administered by the STCU during the 1998 fiscal year when five projects totalling US$ 317,000 were given the go-ahead. In 1999, five more projects were initiated totalling almost US$ 700,000. In 2000 and 2001, ten new projects were initiated and two projects were prolonged. The grants totalled more than US$ 1.8 million showing a steady increase since 1998. It should be noted that some of the Uzbekistani projects are collaborations with Ukrainian research institutions.

In Uzbekistan, the Institute of Nuclear Physics of the Academy of Sciences is undoubtedly the most successful individual institute winning six grants from nine applications in the period 1998 – 2001. No other institute in Uzbekistan has received more than one grant.

---

[122] http://www.istc.ru

[123] http://www.stcu.int

[124] It should be noted that the type of information varies between the two websites. ISTC, for example, does not state size of individual grants, which STCU does.

Is This Enough?

- No, probably not, if we want to stop every former weapons scientist to leave their positions. ISTC does not make economical figures concerning individual projects official. Thus, we can only estimate the number of researchers paid from ISTC grants in Kazakhstan and Kyrgyzstan. ISTC claim that 58,000 researchers have received grants by now. Grants from ISTC, but also salaries, are probably lower in Central Asia than in Russia. We noted previously that 8.2% of all ISTC grants had been given to Kazakhstan and Kyrgyzstan. A perfect correlation between percentage and the total number of individuals receiving salaries would mean that about 4,800 of them were from Kazakhstan and Kyrgyzstan. However, it must be remembered that probably most of those individuals only temporarily have been paid by an ISTC grant and that the figure is the aggregate for biological, chemical, nuclear and missile expertise. To get another perspective on this figure, KazAtomProm, in comparison, employs about 10,000 individuals of which 3,500 are engaged in production.[125]

- Yes, it is probably enough if we want to keep key scientists at their desks provided that those we consider as the key scientists (the most vulnerable from a proliferation view) are able to compete successfully for the grants. 'Former weapons scientist', which is the term used by ISTC and STCU is a wide description that might be further stretched by the applicants themselves. Unfortunately, nothing suggests that the cleverest from a scientific point-of-view also are the ones that are the foremost when it comes to winning grants.

To summarise, the assistance through ISTC and STCU is important to prevent former weapons scientists in Central Asia to try their luck elsewhere. However, we cannot be sure that this kind of support always will serve what is optimal from a non-proliferation standpoint.

Nuclear Control & Ownership

Fortunately from a proliferation point of risk, few actors control the Central Asian nuclear assets. The research reactors in operation in Kazakhstan are run by the Institute of Nuclear Physics in Alatau outside Almaty and the Institute of Atomic Energy at Semipalatinsk test site. Both institutes belong to the National Nuclear Center of Kazakhstan. The research reactor in Uzbekistan is controlled by the Institute of Nuclear Physics in Tashkent. KATEP controls the dismantlement of the power reactor BN-350 at Aktau. KazAtomProm, however, is the major player completely controlling uranium exports and almost the entire uranium industry as well as the Ulba Plant in Ust-Kamenogorsk. In Uzbekistan, it is the state-owned Navoi Mining and Metallurgy Combine that in a similar way controls uranium mining and milling.

The foreign actors on the Kazakhstani uranium market have been few. It is perhaps only logical that the three largest suppliers of nuclear fuel components in the world, Cameco of Canada, COGEMA of France, and the US-German RWE NUKEM all have explored the possibilities of Kazakhstani uranium. All three companies have formed joint ventures with KazAtomProm in Kazakhstan. COGEMA were also active in Uzbekistan but have withdrawn from that project. However, all companies that have tried their luck in Kazakhstan have not stayed. World Wide Minerals of Canada is such an example and

[125] Kazakhstan Stock Exchange, Characteristics: NAC Kazatomprom. http://www.kase.kz/eng/Emitters/kzap21.ASP

when it withdrew, the Israeli-owned Sabton Ltd entered. A survey of the foreign companies that are, or have been in enterprise, in Central Asia is presented in Appendix 2.

Sabton Limited

Sabton Limited, the company that bought TGK at Stepnogorsk, differs from the other companies on the Kazakhstani uranium market. It is not a multi-national giant, but rather a small Israeli company. The company has a short, but quite interesting past. The main owner of Sabton Limited is Lev Leviev. He was born in 1956 in Tashkent in Uzbekistan as the son of a Rabbi, immigrated to Israel in his teens and has since there become a multimillionaire. Apart from his duties as a businessman, he also is the President of the Federation of Jewish Communities of the C.I.S., an organisation that represents over 200 Jewish communities in the former Soviet Union.[126] Leviev is also the chairman of the Israel-Russia & CIS Chamber of Commerce and Industry.[127]

On April 16, 1999, Sabton Limited bought TGK for 36 million Tenge (around US$ 300,000). Sabton also agreed to pay 320 million Tenge (US$ 2.8 million) in back wages and debts.[128] Thus, a quite small amount of money was necessary to get access to Kazakhstani uranium. The men behind the deal were reported to be Lev Leviev and Arcadi Gaydamak, who managed to persuade President Nazarbayev to accept their own bid and leave Canadian World Wide Minerals out in the cold.

Sabton is a subsidiary of Africa Israel Investments Ltd.,[129] an Israeli-based holding company chaired, and to a large deal owned, by Leviev. In January 2000, Gaydamak bought 15% of the company for US$ 75 million.[130] Following the disclosure of a scandal involving illegal arms deals to support the Angolan government during the 1990s civil war; Gaydamak reportedly was forced to sell back his share to Leviev in August 2001 for the same price.[131] Gaydamak has an outstanding international warrant for his arrest. Crimes he is searched for include illegal gun sales, tax evasion, money laundering and corruption. Despite this, Gaydamak is reported to regularly travel between Israel, Angola, and Kazakhstan.[130]

Gaydamak, who now like Leviev is residing in Israel, probably introduced Leviev to the Angolan market in 1997, a fact that Leviev today refuses to admit. Gaydamak has also stated it was his idea to set up Angola Selling Corporation (Ascorp). Ascorp is a partnership between Leviev, Belgian-owned Omega Diamonds, and the Angolan state represented by Sociedade De Comercialização de Diamantes de Angola S.A.R.L. (SODIAM) as majority owner with 51%. Ascorp managed to force De Beers, which previously almost had a monopoly status in Angola, to withdraw from the lucrative diamond market there in just a few years. However, reports claimed De Beers was

[126] Federation of Jewish Communites of the CIS website, Biography of Lev Leviev. http://www.fjc.ru/leviev1.htm

[127] Israel-Russia & CIS Chamber of Commerce and Industry website. http://www.isrutc.org/english/

[128] Nuclear Threat Initiative website, Kazakhstan: Mining and Milling Developments, Tselinnyy Combine Sold to Israeli Firm, 99-04-16. http://www.nti.org/db/nisprofs/kazakst/fissmat/minedev.htm

[129] Africa-Israel Investments Ltd website. http://www.africa-israel.com/eng/B_E.asp

[130] The International Consortium of Investigative Journalists website, The Influence Peddlers, 2002-11-13. http://www.icij.org/dtaweb/icij-bow/documents/8_InfluencePeddlers_PDF_1022.pdf

[131] Mazal U'Bracha Magazine, Lev Leviev Buys Out Interests from Controversial Partner Arcadi Gaydamak, August 2001. http://www.diamondsview.com/news_430_aug.htm

planning a comeback,[132] but no apparent progress had been made in mid-2003.[133] Leviev's own company Lev Leviev Diamonds is fast becoming an impressive rival to the once completely dominant De Beers on the world market.

Lev Leviev himself may be a genuine businessman, but his short-lived partnership with Gaydamak has no doubt tainted his name and thrown questions on how reliable one can consider the Kazakhstani uranium market to be from a proliferation point. If Gaydamak managed to find his way into the uranium market there, other less serious traders, but with large purses, may be able to do the same.

[132] Minews.com, Lev Leviev Continues To Exert Pressure On De Beers All Over The World, 2002-12-06. http://www.minews.com/archives/features_archive/2002/Dec-2002/leviev061202.htm

[133] Reuters, Talks Stall Between De Beers and Angola, June 2003. http://www.diamondregistry.com/News/2003/stall.htm

Map of Central Asia

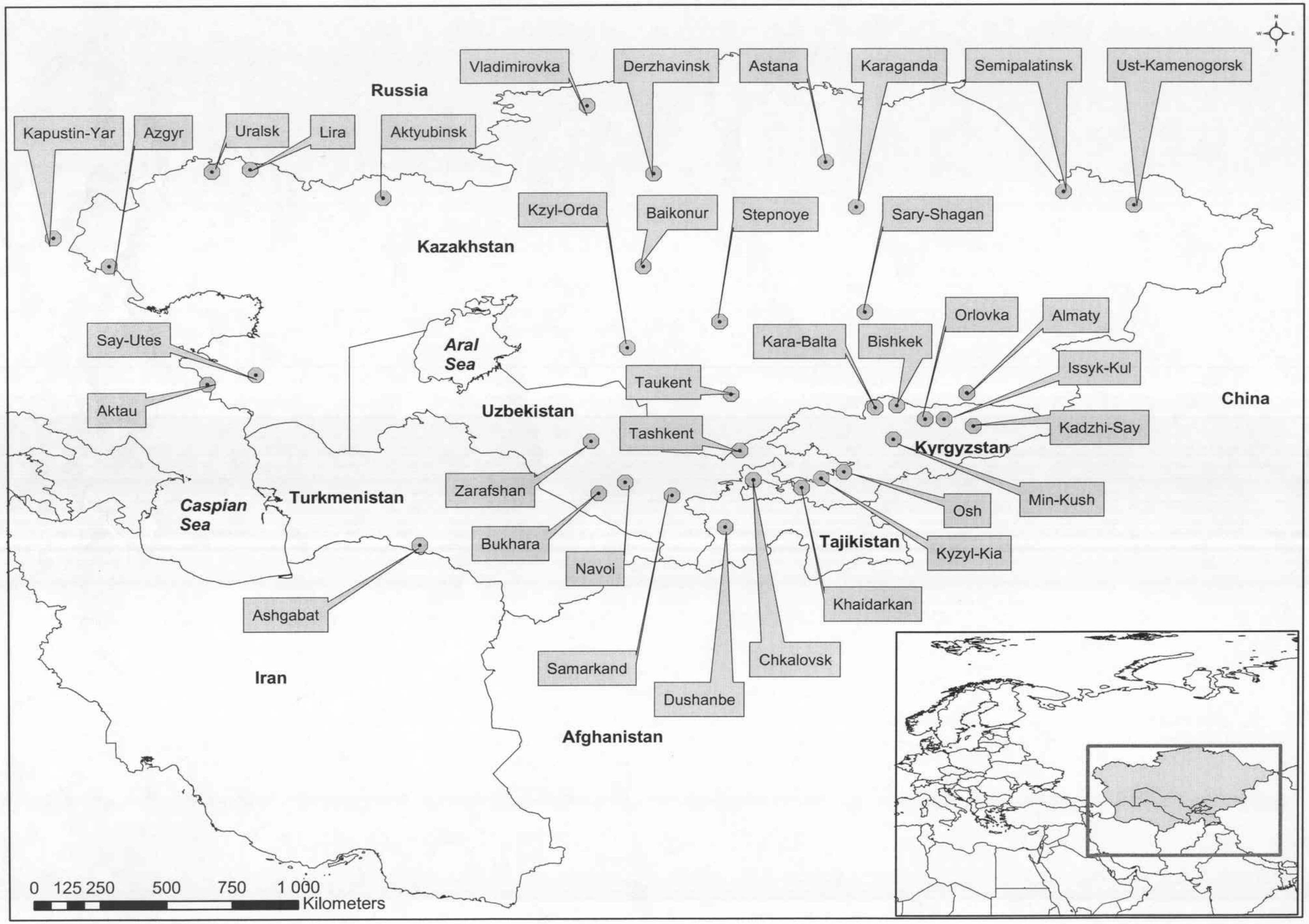


Table 5. Cities and Places in Central Asia Mentioned in this Report

Location	Activity	Location	Activity
Kazakhstan		**Uzbekistan**	
Aktau	Closed uranium mine, and nuclear power reactor (MAEK)	Bukhara	Major city
Aktyubinsk	Emba test site and seismic nuclear test	Navoi	Uranium mining
Almaty	Institute of Nuclear Physics (research), former capital	Samarkand	Major city
Astana	Capital	Tashkent	Institute of Nuclear Physics in Ulugbek (research), capital
Azgyr	24 underground nuclear explosions	Zarafshan	Uranium mining
Baikonur	Rocket launch site leased to Russia	**Kyrgyzstan**	
Derzhavinsk	One of two nuclear ICBM sites, missile launch infrastructure	Bishkek	Institute of Physics of National Academy of Sciences, capital
Kapustin-Yar	4th State [of Russia] Central Test Range, rocket test site	Issyk-Kul	Closed uranium mine, nuclear submarine missile test site
Karaganda	Seismic nuclear test in 1973	Kadzhi-Say	Closed uranium mine, radioactive waste dump
Kzyl-Orda	Uranium mining, seismic nuclear test in 1973, and Leninsk Test Range (missile launch infrastructure)	Kara-Balta	Uranium processing, radioactive waste dump
Lira	Six underground PNEs in 1983-84	Khaidarkan	Radioactive waste dump
Sary-Shagan	Rocket launch site, missile testing	Kylzyl-Kia	Closed uranium mine, radioactive waste dump
Say-Utes	Three PNEs in 1969-70	Min-Kush	Closed uranium mine, radioactive waste dump
Semipalatinsk	Nuclear weapons test site and nuclear research facility	Orlovka	Closed uranium mine, thorium mining
Stepnoye	Uranium mining	Osh	Closed uranium mine (Mayli-Suu), radioactive waste dump, environmental problems
Taukent	Uranium mining	**Tajikistan**	
Uralsk	City close to Lira	Chkalovsk	Uranium milling, Vostokredmet rare metal production facility
Vladimirovka	929th State Flight Testing Center	Dushanbe	Argus nuclear reactor (never loaded), capital
		Turkmenistan	
		Ashgabat	Capital

Acknowledgements

This work was mostly done while I spent ten weeks during Nov. ’02 – Feb. ’03 at the Department of Peace Studies, Bradford University. I would like to thank Dr. Owen Greene for advices given during this period.

The assistance of Christina Edlund, FOI NBC Defence, to make a map of Central Asia with the locations mentioned in this report, is greatly acknowledged.

The author is also grateful for valuable comments and suggestions by the ‘report opponent’ Dr. Lena Oliver, FOI Systems Technology.

The Evolution of IAEA Safeguards

The most important international nuclear non-proliferation regime is probably the International Atomic Energy Agency (IAEA), which was set up in 1957. Safeguards were not on IAEA's immediate agenda in 1957, but the Safeguards program soon developed. In 1961, the first safeguards document INFCIRC/26, which covered control of reactors with a thermal energy output of 100 MW or more, was published. In 1965, INFCIRC/66 followed, which called for control of all nuclear reactors. The year after, INFCIRC/66 was revised to also include reprocessing plants. A second revision of INFCIRC/66 in 1968 extended to fuel fabrication plants.[1]

When the NPT entered into force in 1970 it called for a more comprehensive kind of safeguards and the INFCIRC/153 was developed. With INFCIRC/153, emphasis was put on *the nuclear material* in safeguarded facilities. However, INFCIRC/153 also set tighter limits on what the IAEA could do and thereby provided protection for states against escalation of future safeguards. The IAEA emphasised verification of state records regarding declared nuclear material from peaceful nuclear activities, rather than ensuring the absence of undeclared nuclear material or activities.

This was the weakness of IAEA safeguards, as demonstrated by the revelation that Iraq ever since the early 1970s had clandestinely pursued a secret nuclear program despite having signed the NPT already in 1969. Iraq had no problem dealing with IAEA inspections since these only made sure that declared material was in place at the right location. Undeclared material in undeclared sites was at no risk of detection.

The response from the IAEA to these shortcomings was to introduce its 93+2 program in 1993 (+2 for the fact that it would be finished in two years) with the aim of improving safeguards. Following this work, INFCIRC/540[2] was launched in 1997. As of September 2003, 37 nations have agreements that have entered into force.[3]

The most important part of INFCIRC/540 (popularly known as the Additional Protocol or the New Model Protocol) is Article 2. It requires signatories to complete a declaration containing:

- Details of any current or previous nuclear fuel cycle-related research and development activities together with descriptions, including maps, of the locations where these activities are carried out or have been carried out.
- The location of uranium mines and uranium or thorium concentration plants and estimates of annual production capacity of these.
- A declaration of details of possible source material that exceeds ten metric tons of uranium or twenty metric tons of thorium. If such material is successively exported or imported and annually reach the limit of ten or twenty metric tons it must also be declared.

---

[1] Tohru Haginoya, The History of IAEA Safeguards, TCNC Newsletter 00-1, January/February 2000. http://www.tcnc.kaeri.re.kr/Newsletter/NL000102/TCNC000102-07.htm

[2] The official title of INFCIRC/540 is Model Protocol Additional to the Agreement(s) Between State(s) and the International Atomic Energy Agency for the Application of Safeguards.

[3] IAEA Website, Strengthened Safeguards System: Status of Additional Protocols. http://www.iaea.org/worldatom/Programmes/Safeguards/sg_protocol.shtml

- Details regarding waste containing plutonium, HEU, or uranium-233 that will be subject to ‘further processing’ with an intention other than long-term storage or disposal.
- Details regarding export or import of specified equipment and non-nuclear material that can be used in a nuclear program.
- General plans for the next ten-year period of relevance to the development of the nuclear fuel cycle and including research and development activities.

In the second section of Article 2, state signatories are requested to ‘make every reasonable effort to provide the Agency’ with information of location, a general description, and name of the person responsible of research and development activities that are pursued within the borders of the state, but is funded by other parties, and relates to enrichment, nuclear fuel reprocessing, or nuclear waste processing, again excluding material intended for long-term storage or disposal.

The third section of Article 2 calls for the state, if requested by the IAEA, to provide ‘amplifications or clarifications of any information it has provided under this Article’ that may be relevant for the purpose of safeguards.

The following articles describe in great detail timeframe of declarations and updates by the state, manner in which the IAEA shall have access to locations to assure the absence of undeclared nuclear material or activities, or to control correctness and completeness of information given by the state, or carry out wide-area environment sampling, and arrangements between the state and IAEA to prevent nuclear technology proliferation. Article 4 clearly states that the IAEA has the right to inspect locations in the country, declared under Article 2, without advance notice (‘in exceptional circumstances, it may be less than two hours’).

In short, the discoveries of the Iraqi nuclear weapons program brought about a need for strengthened safeguards. The IAEA response was a more codified arrangement to strengthen existing safeguards, primarily regarding undeclared activities. It was also important for the IAEA to broaden the scope of verification to include sites, where non-nuclear theoretical work of assistance to a nuclear program might be performed. Thus, the IAEA has become far more aggressive in its safeguards and verification role. For example, the IAEA can now perform environmental monitoring, as well as special inspections, and enhanced information gathering through means such as commercial satellite imagery. Naturally, greater access and non-routine inspections gives a better possibility to detect clandestine or anomalous activities.

International Corporations that have Explored the Central Asian Uranium Market

NUKEM Inc.

NUKEM Inc. is the US subsidiary of RWE NUKEM AG of Germany. RWE NUKEM AG is owned by TESSAG (Technical Systems and Services AG), which in turn is a subsidiary of RWE Solutions AG. The German parent company of NUKEM Inc. has been a worldwide nuclear fuel trader since the 1970s.

RWE NUKEM has purchased the majority of Kazakhstan's natural uranium production since 1992, when it entered into a long-term contract, which has since been extended to 2010. Through strategic cooperation agreements with its partner KazAtomProm, RWE NUKEM has developed markets for uranium conversion, processing and fabrication services as well as beryllium production from the Ulba Metallurgical Plant in Ust-Kamenogorsk, Kazakhstan.

Cameco

Cameco Corporation is a Canadian company owned by shareholders to 90% and the government of Saskatchewan to 10%. Cameco is the largest uranium producer in the world.[1] Its uranium is predominantly mined in North America. The company also operates and owns one-third of the Kumtor gold mine in Kyrgyzstan. In Kazakhstan, Cameco owns 60% of the Inkai uranium joint venture. KazAtomProm owns the remaining 40%. It became the majority owner of Inkai in 1998 after buying Uranerz Exploration and Mining Ltd and Uranerz USA Inc. from German Rheinbraun AG. The German company had until then owned about 30% of Inkai.[2] Rheinbraun AG is now a sister company of RWE Solutions (see NUKEM Inc. above) in the RWE company sphere.

The joint venture received licenses for uranium exploration and *in situ* leach mining in 1999. The following year it obtained a resource use agreement with the government of Kazakhstan. The agreement was necessary to open a US$ 2 million test mine at Inkai.[3] The test mining has met expectations and the joint venture is planning to proceed with the project aiming at full-scale commercial production by 2007.[4]

COGEMA

COGEMA is a French company, which is the second largest uranium producer in the world. The majority owner is Commissariat à l'Energie Atomique (CEA) with 74.7% of the shares. COGEMA is mining uranium worldwide and has ongoing mining operations on every continent. In Kazakhstan, COGEMA and KazAtomProm both hold 45% interest in KATCO, a company that has been evaluating the Moinkum deposit.

---

[1] Cameco and COGEMA together control almost 40% of the world market.
[2] Uranium Institute New Briefing 98.16, NB98,16-1.
[3] Cameco News Releases, Cameco/KazAtomProm to Assess Potential of Kazakhstan Uranium Project, 2000-07-21.
[4] Cameco Corporation Press Release, Cameco Reports Solid First Quarter Earnings, 2004-04-22.

In Uzbekistan, COGEMA set up a joint uranium-producing venture with NMMC in 1998 to begin joint uranium production at the Sugraly deposit. Three years later these plans were dropped when COGEMA withdrew from the project leaving NMMC to start developing it alone. COGEMA claimed world-market uranium prices were too low to justify the investment required.[5]

World Wide Minerals

World Wide Minerals is a Canadian company that came onto the Kazakhstani uranium market in 1996 when it struck a uranium production sharing deal with the Republic of Kazakhstan to develop Tselinny Gorno-Khimicheskii Kombinat (TGK) at Stepnogorsk. Two years later it commenced a legal action against the Republic of Kazakhstan in the United States Federal District Court in Washington D.C. The company was seeking damages in the amount of at least US$ 220 million rising from the cancelling of a management agreement and purchase option relating to TGK.[6] Court action came to an end in 2002 when the Columbia District Appeals Court finally dismissed the lawsuit brought by the company against KazAtomProm.[7]

[5] Reuters, Newmont Mining to Resume Uzbek Gold Project, 2001-05-18.
[6] World Wide Minerals Press Release, World Wide Commences Legal Action Against Kazakhstan and Reports 1997 Year-End Results, 1998-05-13.
[7] Gazeta.kz, Canadian "WWM" Against NAC "Kazatomprom", 2002-08-10.