An Overview of Minatom's Ten Closed Nuclear Cities

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Abstract

In the late 1980s the Former Soviet Union (FSU) began to decrease the size of their nuclear stockpile. This had a ripple effect throughout the FSU's large and redundant nuclear weapon complex that continues to be felt in the daily lives of the individuals working at these sites. No longer were these sites given the privileged status that provided additional foods and consumer goods for its workers, but rather became relics of the cold war. To compensate for the reduction in defense orders, the Ministry of Atomic Energy (Minatom) created and began implementing a defense conversion plan in the late 1980s. Ten of the Minatom sites were given a unique status based upon their work in nuclear weapons production. These sites are the Minatom's ten "closed nuclear cities" (CNCs) as their economic development is hampered by the fact they are still physically closed off from visitors and continue to be under Minatom's direct control. Federal laws have been passed that provide economic advantage to the closed nuclear cities. The purpose of this paper is to provide an overview of the Minatom sites and the legal basis for their economic status.

Introduction

During the past ten years the United States (US) has been working with the Former Soviet Union (FSU) in helping to reduce the nuclear danger. Several projects have been created within the US Departments of Energy and Defense to help meet this goal. Each project has specific objectives and addresses a part of the overall issue. The purpose of this paper is to review:

1. the current and future government roles of the closed nuclear cities,
2. the commercialization of Minatom, and
3. the US and Russian cooperations at each of the sites.

It is the long-term objective of our project to examine each of the US cooperations within Russia at the CNC's, where they overlap, and where there may be gaps or redundancies within the projects. We are addressing this issue from the perspective of an integrated look at the Russian nuclear complex. Much of the research for this paper is in the developmental phase, and therefore this paper provides an overview of a proposed methodology and preliminary results.

Closed Nuclear Cities: Past and Future Government Work

During the arms race, the Soviet Union created a large, highly redundant, and diverse complex capable of meeting a growing nuclear weapon stockpile. The Soviet Union continued to expand and build their capabilities until the end of the 1980's. This represents the beginning of the end of the Soviet Union and the re-emergence of the individual states. As a result of the political changes, the Russian defense sites had to re-evaluate their mission and restructure. Currently Minatom is downsizing to reflect the reduction in military orders. As Minatom continues to downsize and transition the Russian nuclear complex, the planning and implementation of US projects needs to reflect these changes.

The Russian nuclear weapon production complex is made up of 17 industrial enterprises and scientific research institutes. Ten of these sites are critical for the manufacturing of nuclear weapons

and are located within the Russian territory (Ref. 1). These are the Minatom ten closed nuclear cities (see Figure 1). In the early 1990s they were given special legal status as a result of their sensitive work, creating limitations on the ability to commercialize their sites. The total population of the Minatom CNCs is reported to be 756,000 with a reported 75,000 persons working directly on federal projects. According to the First Deputy Minister of Atomic Energy, Lev Ryabev, the goal of Minatom is to reduce the number of defense procurement order employees from 75,000 to 40,000 by the year 2005 (Ref. 1).

Although government funding was decreasing from 1992 to 1994, the population in the CNCs actually increased. This is believed to reflect the migration of Russian scientists returning to their institutes from countries outside of Russia, the difficulty in obtaining housing, and the safety of a low crime zone (Ref. 2). Under existing Russian legislation the restriction to emigrate abroad is automatically lifted ten years after employees stop working on state secrets (Ref. 3). Therefore, even though the population in the CNCs has actually increased, there is concern that as the opportunity to leave becomes available more of the scientists and workers will leave the closed cities and migrate to other countries. Table 1 provides a list of the ten Minatom CNCs, the total population of each city, an overview of their current federal work, and a listing of potential future federal work (Ref. 1, 4, 5 and 6).

Ryabev has reported that the Russian nuclear weapon complex will be downsized to reflect the reduced levels of defense orders. He recently stated that the production of nuclear weapons has already been reduced by more than a factor of ten and the State procurement defense order was reduced by a factor of seven in 1990 (Ref. 1). He stated that the redundancy within the complex will be reduced and the work consolidated. In November 1998, Minister of Atomic Energy Yevgeniy Adamov stated that the Minatom of the future must have the national laboratories (for basic science), the defense complex, and Atomprom. Atomprom represents the commercial-side of Minatom (Ref. 7).

Currently in Russia there are four nuclear weapon production plants: Arzamas-16 (Avangard), Penza-19, Sverdlovsk-45 and Zlatoust-36. Ryabev has recently stated that beginning in the year 2000 two of the plants will cease assembling nuclear warheads and beginning in 2003 two plants will cease dismantling nuclear weapons (Ref 1). It has been reported that the two plants that will undergo conversion are the "Avangard plant at Sarov and the enterprises with weapons specialization in the city of Penza-19" (Ref. 8). There are currently two plants that manufacture nuclear weapon components: Tomsk-7 and Mayak (Chelyabinsk-65) (Ref. 4 and 5). Ryabev reports that manufacturing of fissile material components will be reduced to one of the two plants.

Production of highly-enriched uranium (HEU) (enrichment greater than 20%) and plutonium for nuclear weapons has ceased in Russia at the Minatom sites. HEU has been produced at Tomsk-7, Krasnoyarsk-45 and Sverdlovsk-44, and nuclear weapons plutonium has been produced at Mayak, Krasnoyarsk-26 and Tomsk-7. Each of these sites, with the exception of Krasnoyarsk-26, are actively participating in the down-blending of highly-enriched uranium for sale to the US and for use by Russian commercial reactors.

Nuclear weapon testing has been limited to one of two sites. The Novaya Zemlya nuclear weapons test site is continuing to be used for hydrodynamic testing to verify the condition of old weapon stock and not to upgrade, according to the Press Secretary of Russian Minatom Yuri Bespalov (Ref. 9).

Minatom and Closed Nuclear Cities Commercial Ventures

The process of commercializing the Minatom institutes began as early as 1989 as the government began to reduce defense orders. In 1991, a government plan was put into place outlining the strategy for defense conversion both Minatom and the Ministry of Defense facilities. The plan was poorly funded, and the institutes were unprepared for conversion. It was recognized that the commercialization of the closed MOD and Minatom sites was more difficult due to heightened security at the sites. Therefore, on July 14, 1992 a law was enacted called "On Closed Administrative-Territorial Formations" (O-ZATO) (Ref. 10). This law established special tax shelters within the ZATOs for business both within the area of the Minatom and MOD sites and business that were registered within the sites but located externally. The tax law provided direct finances to the CNCs and at the same time afforded significant tax breaks to the company registered within the zone. As of 1998 there were a total of 42 MOD and Minatom CNCs (Ref. 10). This arrangement continued until this year when the law was changed that tightened a company's eligibility requirements to obtain tax breaks. This is significant in a country where barter is thought to account for up to 80 percent of all transactions due to the high tax rate and nonpayment of goods within the country (Ref. 11). The economic plight of the CNCs, while unique based upon the skills that exist at that site, cannot be separated from the economic issues that Russia as a whole is currently facing.

The ZATOs banded together, created a leadership council, and presented their technical capabilities at the Moscow trade show in November of 1995 and the Paris trade show in April of 1997 (Ref. 12 and 13). Initially the CNCs were given poor direction that led to development of goods and services that were economically unfeasible within Russia and not of the quality to be sold on the world market. In general, the first couple of attempts at commercialization failed. The CNCs continue to find new venues for their technical capabilities that are more realistic to a market economy.

But that is not to say there have not been successes. The sites that have built upon their unique nuclear expertise have faired best within the global economy. Minatom has created three primary joint ventures for the international sale of their nuclear technologies. Lev Ryabev claims that Minatom earned $2.2 billion from the export of nuclear equipment, materials and technology in 1998 and that he expects major increases in earnings during 1999 (Ref. 11). Many of the ZATOs are currently commercially viable and several more will be if Russia implements their aggressive policy of selling nuclear power stations, reactor fuel elements, and accepting commercial nuclear power fuel for storage and reprocessing.

Minatom Deputy Minister Bulat Nigmatulin recently stated that Russia is constructing one VVER-1000 nuclear power plant in Iran, two in China, and two in India. He claims that an agreement to build five or six new plants may be signed with Iran, China, and India within the next year (Ref. 14). This work will provide funding directly to Minatom for the design and construction of the facilities, manufacturing of nuclear power components and instruments, capabilities for uranium enrichment, fuel fabrication, spent fuel storage, and possibly in the future, spent fuel reprocessing. This may lead to an international capability for commercial nuclear power plants and will strengthen the Minatom nuclear complex overall.

Domestically Minatom has plans to complete construction of three plants at Rostov, Kursk, and Kalinen. They have recently completed the construction of a new zirconium cladding plant and

have updated designs for Sosnoyy Bor and Novovoronezhskiy nuclear power plant station 2 (Ref.15). Minatom continues to fund the construction of a nuclear waste storage facility at Sverdlovsk-45 to store missile recycling products for 200 to 300 years (Ref.16).

The Minatom domestic finances should also increase in the next year or so as the tax offsets were outlawed in January of 1998. The law now requires that services such as electricity must be paid in cash for it to be provided (Ref. 17). The law was enacted to reduce the role of barter within the Russian economy and force unprofitable businesses to shutdown. This should in turn increase the revenues to the domestic nuclear power stations operated by Minatom.

A key question is whether or not the Minatom CNCs are economically viable today and will they be in the future? Table 2 provides a cursory look at some of the commercial ventures at the CNC's. The implementation of the HEU downblending and purchase by the US over 30 years at a rate of approximately 30 mtons per year has helped to drive the uranium handling sites into commercially viable enterprises. It has been reported that Krasnoyarsk-45 is financially independent (Ref. 18). Sverdlovsk-44, Mayak and Tomsk-7 also have strong economic bases due to their commercial work. Over ten of the Minatom sites commercially sell radioisotopes produced on-site using the nuclear capability developed under the Soviet regime.

The ratio of civilian to defense work at Sverdlovsk-45 is reported to be roughly equal. They are already manufacturing oil, gas and electrical-technical equipment for Surgot, Yugorsk and Ukhta fields. They are now discussing the repair of gas valve fittings with Gazprom (Ref 19). The work is internationally viable, meets a national need, makes use of highly skilled technical workers trained in production-type work, and has a high probability of success.

The director of Zlatoust-36 recently stated in an interview that in 1997 5766 out of a total of 6400 workers were engaged in military production and by the year 2001 the number is to decrease to less than half that value (Ref. 16). Zlatoust-36 began a restructuring and conversion program in March for the production of instruments for nuclear power plants, sulfur-hexafluoride equipment and auxiliary power systems (Ref. 3). The Director of Zlatoust is quoted as saying "Fifteen years ago they forced us from above, now the initiative comes from below."

According to the Institute of National Economic Forecasting report on the CNCs published in 1996, "the percentage of employees under 40 is steadily declining, whereas the proportion of specialists 45 or older is growing. If the existing trends with regard to the mobility of personnel are maintained, the work force of the enterprises will age rapidly in the future" (Ref. 2). According to this study, in January 1995, the unemployment is highest for a mid-level generalist at 39% and at 15% for those with higher education. This is consistent with Arzamas-16 director Ilkalov's statement that those at Arzamas-16 with higher education have less problems finding funding than those in the "middle" ranks (Ref. 13). An understanding of the skill-base of unemployment at each site is critical for the implementation of job programs for each site.

One factor that needs to be considered is the attrition rate of the workers, as many of the younger generation choose not to work for or remain within a CNC while the older generation retires. The directors of Arzamas-16 and Chelyabinsk-70 have recently stated that the loss of highly qualified specialists is proceeding on a large-scale, while replacement with the new young cadres is practically ceasing (Ref. 20). Based upon these trends, why are we not seeing the current and future estimates of staff numbers decreasing?

Minatom is clearly pursuing an aggressive policy of commercial nuclear expansion by building upon its cold war capabilities. As Minatom expands, what will be the future role of the CNCs? Currently, the number of people engaged in government work out of 756,000 people at the CNCs is not clear, as is how many people are part of the large Minatom joint ventures, and how many are currently covered under international cooperations such as the ISTC and IPP. How many CNCs need to have new ventures now and in the future as Minatom is restructured? And as sites become commercially viable meeting domestic and international commercial needs, should the US do a needs-based prioritization of projects and funding?

International Programs and Cooperations

Within Russia today the US government has implemented over eleven programs in support of nonproliferation and arms control. President Clinton stated in his January 1999 State of the Union address that over the next five years $4.2 billion will be spent in Russia to help reduce the nuclear danger (Ref. 18).

US cooperations with Russia includes:

1. Nuclear Cities Initiative (NCI)
2. Highly Enriched Uranium Purchase Agreement (HEU PA),
3. Fissile Material Storage Facility under the Cooperative Threat Reduction (FMSF),
4. FMSF Transparency under the Cooperative Threat Reduction (CTR), (FMSF T)
5. Plutonium Production Core Conversion (CC),
6. Materials Disposition (MD)
7. Initiatives for Proliferation Prevention (IPP),
8. International Science and Technology Center (ISTC),
9. Second Line of Defense (SLD),
10. Dismantlement Transparency (DT), and
11. Material Protection, Control and Accounting (MPC&A).

A list of the projects by site and a short list of their commercial ventures is provided in Table 2:

Each of the US projects focuses on a piece of the nonproliferation issue. They are independent and yet, inter-dependent of one another. Many of the projects overlap and in some cases it is difficult to ascertain if they are redundant or simply two parallel solutions to a problem. Each project must be evaluated both on its own merit and on its relationship to each of the other projects. To ensure future success, each project providing funding and equipment to Russian institutes needs to be evaluated with respect to the Minatom work today, projected work for the future, and the government goals for commercialization.

Another important factor in the implementation of the US cooperations with Russia is to ensure that the goals specific to nonproliferation are consistent with the goals set forward for arms control. Given the established goals of nonproliferation and arms control, what is the best means of implementation? The best means of addressing this issue is through a systems analysis of the Russian complex as it exists today and how it may change in the future. A systems analysis can help answer whether or not the US/Russian cooperatives are providing unique capabilities that are inconsistent with short-term and long-term US nonproliferation or arms control goals.

Table 2: US Projects by Closed Nuclear Cities

City	Alias'	US Projects	Commercial Ventures
Sarov	Arzamas-16 and Avangard	MPC&A, IPP, NCI, MD, ISTC, FMSF, DT, FMSF T	HE vehicles/containers, Plastic dinnerware, high-tech equipment, high-purity radioisotopes
Zarechnyy	Penza-19		Security equipment, electronics
Novoural'sk	Sverdlovsk-44	HEU DB, MPC&A	Nuclear power plant LEU
Lesnoy	Sverdlovsk-45	IPP	Radioisotope production
Ozersk	Chelyabinsk-65	IPP, ISTC, FMSF, PPIA, NFT, CC, MD HEU DB	Commercial fuel reprocessing, radioisotope production
Snezhinsk	Chelyabinsk-70	NCI, IPP, ISTC, MD	
Trekhgornyy	Zlatoust-36		Oil field equipment
Seversk	Tomsk-7	MPC&A, IPP, ISTC, HEU PA, CC	Radioisotope production, LEU production
Zhelenznogorsk	Krasnoyarsk-26	MPC&A, IPP, ISTC, CC, NCI	VVER1000 spent fuel storage
Zelenogorsk	Krasnoyarsk-45	HEU PA	LEU production

As new projects come on line like the NCI it becomes important to optimize the funding to meet the greatest need and to remember the lessons from projects such as IPP and ISTC. According to a report published in January 1999 by the Russian American Nuclear Security Advisory Council, the NCI goal is to create 30,000 to 50,000 jobs in the Russian nuclear complex by the end of the program (estimated at 5-7 years) at a cost of approximately $550 million (Ref. 6). An understanding of the commercial development and government work, the active US cooperations, and the workforce available within the CNCs are all critical factors that need to be evaluated as part of the implementation of new programs.

Conclusions

It is an exciting time to be working with the people within the Russian government and their scientific institutions in solving issues of great importance to both countries. US and Russian cooperations represents a bond of tremendous trust and friendship. Our time and resources are limited, however, and the effort could perhaps reach even greater gains if they are more closely integrated. We believe that due to the complexity of the issue it must be addressed systematically. We have begun to ask which of the ten sites have done well in their commercial conversion versus those that have not. We know that as the nuclear complex changes, the Minatom mission will require ongoing nuclear weapons production capability and the full suite of nuclear material handling this entails. The redesign of the complex should be taken into account as the US and Russia lay out their current and future goals for cooperation.

Finally, it must be acknowledged that as the US provides support for the dismantlement of nuclear weapons and for the storage, downblending or disposition of special nuclear materials, it can conversely help to sustain Russia as a weapons power and improve her standing in the realm of commercial nuclear power. As the US support to Russia reaches the proposed $4.2 billion level for the next five years, we should consider if we are doing the right work at the right locations at a cost we can afford both today and in the future. An integrated approach is required to understand how to

best invest the funds available for Russia. A risk-based evaluation of the sites should be brought into the decision making process not as an absolute form of direction but for general guidance.

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Table 1: Closed Nuclear Cities Population, Current and Future Defense Production

City	Alias'	Pop. Of City	Current Main Defense Production	Future Main Defense Production
Sarov	Arzamas-16 and Avangard	83,000	Nuclear warhead (NWH) design. NWH assembly.	NWH design.
Zarechnyy	Penza-19	64,000	NWH assembly.	
Novoural'sk	Sverdlovsk-44	96,000	Uranium enrichment.	Uranium downblending. Low Enriched Uranium (LEU) enrichment.
Lesnoy	Sverdlovsk-45	58,000	NWH assembly.	NWH assembly.
Ozersk	Chelyabinsk-65	88,000	Plutonium (Pu) production. Tritium and radioisotope production. Nuclear weapon components manufacturing. VVER440 reactor reprocessing.	Tritium and radioisotope production. HEU oxidation/purification for downblending. NWH nuclear material repacking and long-term storage. Potential location for MOX facilities. NWH components manufacturing.
Snezhinsk	Chelyabinsk-70	48,000	NWH design.	NWH design.
Trekhgornyy	Zlatoust-36	33,000	NWH assembly.	NWH assembly.
Seversk	Tomsk-7	119,000	Pu production. Uranium enrichment & downblending. NWH components manufacturing.	HEU downblending and enrichment of LEU. NWH components manufacturing.
Zhelenznogorsk	Krasnoyarsk-26	100,000	Pu production.	
Zelenogorsk	Krasnoyarsk-45	67,000	Uranium enrichment and downblending.	HEU downblending and enrichment of LEU.

Figure 1: Map of Russia Showing the Locations of the Closed Nuclear Cities