[SE8-LT-2] Russia's Nuclear Energy

Crispin Rovere
Strategic & Defence Studies Centre
Australian National University

Full Summary

The ending of the Cold War and the collapse of the Soviet Union resulted in a massive reduction in government patronage of Russia's nuclear energy industry. The unregulated transition to a market economy seriously disrupted Russia's nuclear apparatus, producing a sudden over supply of nuclear expertise.

Throughout the 1990s, Russia struggled to develop a competitive energy industry that was sustained on export driven growth. At the same time, anxieties persist about the proliferation potential of Russia's latent nuclear capacity, both in terms of fissile material and under employed nuclear scientists.

Over the past decades Russia's nuclear energy industry has been expanding. In the quest to combat climate change, the so called 'second nuclear age' meant that many nations were considering civil nuclear programs for the purposes of producing nuclear energy.

Recently Russia's industry has suffered a series of major setbacks. The Global Financial Crisis weakened investment both domestically and abroad, sanctions on countries like Iran have increased pressure and tightened export controls, and the disaster at Fukushima has devastated public confidence in the safety of nuclear energy, prompting a serious rethink in countries considering expanding their nuclear programs.

It is in this environment of commercial and security uncertainty that four experts, three Russian energy veterans, and one retired US Air Force General, discussed the issues, both present and future, impacting Russia's nuclear energy industry.

Viacheslav Amirov:

The Soviet Union was a pioneer of nuclear energy, producing the world's first fissile electricity generation in 1954. Unfortunately, the Chenobyl accident and the upheavals in the

1990s following the collapse of the Soviety Union caused Russia a lot of problems, particularly the economy related to nuclear industry and related machinery.

In the last decade Russia started to revive its nuclear industry. Currently, Russia has 32 reactors in operation. Nuclear energy provides 15-16% of domestic electricity production and also provides around 5% of Russia's heating requirements. The government hopes the industry will develop further, and make the economy less dependent on mineral resources.

In support of this agenda the Russian government released the 'Platform for Nuclear Development 2030' program. The program was intended to greatly increase the percentage of nuclear energy in overall energy production; however in the wake of the Global Financial Crisis these objectives have been revised.

By 2020, the percentage of nuclear power generation in Russia's electricity grid will be 23%, but both consumption and production will be different from projections. It is intended also to upgrade the reactors and equipment. Rosatom, Russia's state nuclear energy corporation, is eager to participate in the reactor upgrade market, as it is one of the most profitable dimensions of the nuclear energy business.

Mikhail Kobrinskiy:

In the wake of the Fukushima disaster, it is important to also discuss the evolution of nuclear safety conceptions in the nuclear power industry. This process began after the Three Mile accident which resulted in a partial meltdown. Even without a significant radiation leak into the environment, or negative human consequences, safety was much more carefully addressed, and the process of introducing greater safety and control systems began.

As a result, the nuclear energy industry is governed by a 'culture of safety' incomparable to other industries around the world. This culture of safety has given overriding priority to nuclear safety issues and ensured they receive the attention warranted by their significance. Nuclear safety is managed by professionals, scientists, and regulatory institutions.

Further analysis confirmed that many accidents are caused by human error or poor attitude towards safety issues. Anthropogenic accidents can be comparable with natural disasters in the modern world. This requires that the culture of safety evolve into an overall philosophy of safety.

Yet there is a major difference between actual safety and the perception of safety. A philosophy of safety considers safety as human wellbeing and the feeling of safety as well as its reality. Individual and collective perceptions of hazards are not simple issues, and stereotyping of dangers can inhibit practical and measured responses.

Therefore mechanisms for governing the conception of acceptable safety levels had to be developed. Safety level can be called acceptable if and when day to day running of this object does not cause large scale social objection. It is a consolidated human attitude between community and nations to everyday use of nuclear technology. It transcends rationality and is almost always irrational.

From there we move to the engineering sphere that measures risk, without considering human attitude, based on the mathematical expectation of integral damage. This is the rational assessment of risk.

However the image of safety in the public mind demonstrates quite the opposite picture. Comparing with motor vehicle accidents, for example, which kills over 1 million people each year, and leaves 25 million injured, the risk from radiological accident is negligible. Nevertheless, population anxieties in relation to nuclear power plants greatly exceed that of vehicle accidents. Unlike nuclear power plants, no one is suggesting the prohibition of motor vehicles, public opinion considers their safety acceptable. In stark contrast to motor vehicles, the risk of severe accidents at nuclear power plants is 10 to minus 6 (1 accident per power plant, per 10 million years). Still, this does not impress the public.

This was reinforced by the earthquake in Japan and the accident at the Fukushima power plant.
The Tsunami cost 27,000 lives and caused damage to the tune of $200-300 billions. On the other hand, two workers died from hydrogen explosion and 11 injured, no one was exposed to dangerous radiation levels, and has an overall total damage bill of around $2 billion. Nevertheless, mass media focused on this being a nuclear accident rather than treating it as a natural disaster.

This phenomenon is known as radio forbear. For the nuclear industry it is a dangerous factor for humans. Radio-phobia itself can be harmful. In 2004, there was a training exercise at a nuclear power plant in Russia. Training simulated a significant accident and the leaking of radioactivity into the environment. During the training, the emergency system was triggered owing to insignificant leakage into a steam pipe line. However, pictures of people near the plant were published in the news for three full days. As a result, approximately 25 million people were alarmed and all medical iodine sold out in 2 days. Excessive spirit consumption was also observed; spirits being seen in Russia as a cure for inhaled poisons. This example shows profound risks even in the absence of an accident, merely the rumor of one.

This poses a serious challenge for further development of the nuclear power industry. Analysis shows several myths pertaining to nuclear power persist in the human mind, such as:

1. Myth - Normal power plant operation is harmful for the environment.
   Fact - Nuclear power is the most pure when compared with other forms of power production.

2. Myth - The radiation level near a nuclear power plant is higher than in nature.
   Fact - In Finland, for example, people in the natural environment receive 5.5mSv per year, whereas the average in nuclear power plants is 2.4mSv, and yet there are no ill effects to people in Finland.

3. Myth - The nuclear industry is a byproduct of nuclear weapons.
   Fact - To the contrary, with the ending of the Cold War and the dismantling of strategic warheads, the fissile material is being blended down to produce nuclear reactor fuel.

We cannot remove these stereotypes. All you can do is systematically provide education from primary school and all through human life.

Yet there are significant consequences of using nuclear energy as a power source. Some factors can be reduced; however some cannot and must be recognized as potential hazards:

1. There is a huge energy concentration in nuclear fuel. 1kg of U 235 releases huge amounts of energy in the fission process.

2. Nuclear power plants cannot be instantly switched off. Residual heat can cause meltdown in the event of a break in the cooling system. It therefore requires an independent along with additional protection.

3. Proper design solutions should be applied to prevent Chernobyl like disasters, particularly with respect to fast neutron reactors which are rapidly developing.

4. Nuclear power plants create waste and therefore measures should be introduced to isolate this waste from the environment.

Nevertheless, the nuclear power industry is one of the safest forms of power production. When comparing accidents from various different plant types, nuclear power is a lower hazard than both thermal and coal plants. Moreover, next-generation reactors can either eliminate the risks that do exist or at least substantially reduces them.

Jonathan George:

A lot of discussions have been taking place with respect to how smaller nuclear powers interrelate and the impacts this has on the disarmament agenda and non-proliferation. At the same time there exists only two nuclear superpowers, the United States and Russia, and almost no progress can be made on any nuclear issue without close cooperation between these two states in meeting nuclear challenges.

Since the Obama administration 'reset' relations with the Russian Federation, a number of agreements have been reached with benefits to both nuclear energy and security. The US-Russia deals remove 70 tons of weapons grade plutonium, increase nuclear sales, improve nuclear storage, and have culminated in the signing the of New Start and 123 agreements. In addition, we are seeing the establishment of nuclear fuel banks, improved forensic analysis and a more coordinated response to Iran's nuclear intransience.

In other areas cooperation continues to improve. Greater collaborative efforts are now underway toward understanding the intent and strategy behind nuclear weapons and terrorism, as well as developing greater legal frameworks for the peaceful uses of nuclear energy.

These new steps forward are important not just for the US and Russia, but for the world. Understanding China's nuclear ambitions, Extended Deterrence, the future of the Nuclear Non-Proliferation Treaty and managing hotspots like Iran, North Korea, and the ongoing tension between India and Pakistan, are all dependent on improving US-Russia relations.

Questions:

Question One: Why was Chernobyl so disastrous? How does it compare with Fukushima?

Mikhail Kobrinskiy: Chernobyl was the result of a chain of factors. In the final stages people tried to remove the control rods in active zone. The control rods were made of graphite, when absorbers moved down, additional moderator was put into the reactor zone. What happened was it started to exceed the unity of neutrons which resulted in a thermal explosion. The explosion was a stream vessel (as opposed to hydrogen at Fukushima).

Question Two: Russia had plans to export nuclear powered ice-breakers, the designs for those reactors however are quite old, can the panel inform us as to the intended future of this project?

Viacheslav Amirov: The Russian Federation operates 10 Light Water Boiler Reactors. Following Chernobyl, a close analysis by IAEA of these reactors, under very tight regulations, saw no breach being observed.

Nevertheless, no new Light Water Boiler Reactors will be constructed. All future projects will now be on Pressure Water Reactors or Fast Neutron reactors.