1. You discuss in your testimony how manipulations on the price of uranium from Kazakhstan and Russia are disrupting the global market. Can you elaborate on how this is done?

Russia and Kazakhstan have a considerable capacity to affect the international market price of the traded form of uranium, U₃O₈. Russia has large stocks of weapons-grade uranium (U²³⁵) which can be down-blended to support civil nuclear reactor fuel requirements. In addition, Kazakhstan is the largest producer of uranium. The impact of their collaborative uranium supply relationship has sharply reduced the spot price of U₃O₈ as displayed in the figure below from a high of nearly $140/lb. in 2007 to the $20-30 range in 2018-19.

![U₃O₈ Price History](https://www.forbes.com/sites/jamesconca/2019/05/28/nuclear-power-wheres-the-uranium-coming-from/#7c90b9377b9f)

2. What has been the effect on the domestic uranium market over the past few decades?

Domestic production of uranium has withered as a sharp increase in supply from States of the Former Soviet Union adversely affected market prices. As shown in the graphic below, US production of U₃O₈ declined from a high of nearly 45 million pounds in 1980 to less than 2 million pounds in 2018.
3. (a) This bill cites a statistic from 2017 when the United States received 52% of its uranium imports from Canada and Australia combined.

The 2017 data is not representative sample in anticipating future developments as the dynamics of the uranium market are changing. In 2018, US production of uranium declined with a similarly negative impact on employment and prices throughout the industry. The share of US imports of U3O8 from Australia and Canada declined sharply from 55% of the US supply in 2017 to 45% in 2018 reflecting the growth of the share of US uranium imports from the States of the Former Soviet Union, Russia (24%), Kazakhstan (14%), and Uzbekistan (4%).

In Canada, pending legislation could significantly diminish prospects for increased supplies of uranium from Canada in the future.¹ The Bill C-69, was passed by Parliament in June 2019 and now awaits further action in the Senate [The Modernization of the National Energy Board and Canadian Environmental Assessment Agency]. The legislation would replace the National Energy Board with a new “Canadian Energy Regulator” and a new “Impact Assessment Agency”. The proposed changes in the Canadian energy regulatory infrastructure are extensive. The Canadian uranium mining sector sees the regulatory changes as likely impediments to uranium mining operations in Canada.

(b) As fellow free trade countries, are Canada and Australia being affected by Russian-driven price controls, just as American uranium producers are?

As uranium is a globally traded commodity, prices in all markets will be affect by increased supplies from the States of the Former Soviet Union. The prices at which Russian and Kazakh uranium are being sold is an “administered” rather than a price that reflects costs. There pricing policy facilitates Russia’s ability to capture a larger fraction of the global civil nuclear energy system, i.e. the entire system of producing electric power from nuclear energy. Russia is also a major developer and producer of civil nuclear power plants where the fuel cost is only a modest fraction of the total.

By driving the market price of uranium lower, Russia will be able to support a vertically integrated supply chain for nuclear power plants to enable it to develop the global market for a zero-emissions source of electrical base power.

4. You mentioned in your testimony that China and Russia are collaborating to dominate the uranium market. What behaviors have signaled that they’re working in tandem?
There have been significant developments this year that have strengthened the collaborative relationship between China and Russia in developing the global nuclear energy market. On June 5, 2019 at the ‘summit meeting’ of Chinese President Xi and Russian President Putin, the two leaders committed to an extraordinarily wide-ranging set of agreements. These agreements were expressed in *The Joint Statement of the Russian Federation and the People’s Republic of China on the development of a comprehensive partnership and strategic interaction entering a new era.*

In Article 2, of this bilateral agreement, China and Russia agreed to a significant broadening of their cooperation in the civil nuclear energy field.

To continue expanding and deepening cooperation in the field of peaceful use of nuclear energy, to search for promising projects of bilateral cooperation based on the Joint Statement of the Heads of Government of the Russian Federation and the People’s Republic of China on the development of strategic cooperation in the field of the peaceful uses of atomic energy.

The commitment of China and Russia reflects the mutuality of interests between the two nations as Russia seeks to leverage China’s “Belt-and-Road-Initiative” that now has nearly 100 affiliate countries, many of whom are energy-deprived. These circumstances permit Russia to offer a vertically integrated supply chain for civil nuclear power extending from the primary fuel (uranium) to electricity. Russia has advanced a concept for the leasing of civil nuclear power facilities as well. Hence, Russia has a powerful incentive to reduce competitive sources of supply of uranium for civil nuclear power applications.

5. Your testimony goes into several examples of Russia, in particular, sidestepping international arms control agreements, if not ignoring them altogether. Russia and China have been supplying nuclear weapons to other countries including Pakistan and North Korea.

(a) Russia has had an enduring problem of compliance with international arms control agreements. In 1984, the statutory General Advisory Committee on Arms Control and Disarmament conducted a comprehensive review of (then) Soviet compliance with arms control agreements, *A Quarter Century of Soviet*

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Compliance Practices Under Arms Control Commitments, 1958-83. In its report to the President in 1984, the Committee concluded:

*The Soviet Union’s actions since 1958 [to 1983] concerning arms control agreements demonstrate a pattern of pursuing military advantage through selective disregard for its international arms control duties and commitments.*

Russia as the successor State to the Former Soviet Union has continued its pattern of selective non-compliance with its arms control commitments. Russian non-compliance with the 1987 Intermediate Range Nuclear Forces Treaty, in July 2014, compelled President Obama to conclude that:

*The United States has determined that the Russian Federation is in violation of its obligations under the INF Treaty not to possess, produce, or flight-test a ground-launched cruise missile (GLCM) with a range capability of 500 km to 5,500 km, or to possess or produce launchers of such missiles.*

On March 1, 2018, President Putin announced that Russia would sidestep compliance with the New Strategic Arms Reduction Treaty of 2010 by building six new types of nuclear weapon delivery systems that were not controlled by the New START.

Similarly, Russia appear to be violating their commitment to end nuclear testing according to a public statement by the US Director of the Defense Intelligence Agency, Lt. General Robert Ashley. Ashley said in a public...

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statement on May 30, "Our understanding of nuclear weapon development leads us to believe that Russia's testing activities would help it improve its nuclear weapons capabilities".  

Perhaps we should not be too surprised about Russia’s reluctance to meet its arms control commitments. On December 22, 2010, the US Senate ratified the New START – an agreement that President Obama believed would lead to a reduction in nuclear weapons – and perhaps eventually their elimination. A week later (December 31, 2010), Russian President Medvedev announced the State Armament Plan, 2011-2020 that would recapitalize Russia’s entire Cold War inventory of strategic and sub- strategic (“tactical nuclear weapons”) nuclear delivery systems would move ahead.  

(b) Russia and China have been supplying nuclear weapons to other countries, including Pakistan and North Korea.  

Although complete nuclear weapon systems have not been provided to their allies, China and Russia have both provided substantial assistance to the nuclear weapons development and missile delivery systems to both North Korea and Pakistan. In a 2001 review of the global problem of nuclear weapons and missile proliferation, the Department of Defense stated:  

*China supplied Pakistan with nuclear materials and expertise and has provided critical assistance in the production of Pakistan’s nuclear facilities. Pakistan also acquired a significant amount of nuclear related and dual-use equipment and materials from various sources, principally in the FSU and Western Europe.*

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China provided Pakistan with nuclear weapon design information based on China’s CHIC-4 nuclear weapon design that was tested in its first missile-delivered atmospheric nuclear test in 1966. Another source (co-authored by the former head of intelligence for the Los Alamos National Laboratory) indicates that China tested the Pakistani nuclear device in atmospheric nuclear test in 1990.\(^\text{10}\)

The North Korean intermediate-range ballistic missile (IRBM) is based on the storable liquid-fuel rocket engine from the Soviet-era submarine launched ballistic missile, the SS-N-6 Serb. Moreover, as there has been significant collaboration between North Korean and Iran. As a result, most of the recently tested and fielded Iranian long-range ballistic missiles are derived from their collaboration with North Korea as the table below indicates. The table was produced by Uzi Rubin, the former head of Israel’s ballistic missile defense program.\(^\text{11}\)

### Links between North Korean and Iranian Ballistic Missile designs

<table>
<thead>
<tr>
<th></th>
<th>North Korea</th>
<th>Iran</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tactical Ballistic Missile</td>
<td>N-02 Tokska</td>
<td>Fateh-110 “Conqueror”</td>
</tr>
<tr>
<td>Short-Range Ballistic Missile</td>
<td>Extended-Range Scud</td>
<td>Shahab-2</td>
</tr>
<tr>
<td>Medium-Range Ballistic Missile (Liquid)</td>
<td>Rodong-1/Nodong-1</td>
<td>Shahab-3</td>
</tr>
<tr>
<td>Medium-Range Ballistic Missile (Solid)</td>
<td>Bukgeukseong-2</td>
<td>Sejjil</td>
</tr>
<tr>
<td>Precision Ballistic Missile</td>
<td>KN-17 MaRv Scud</td>
<td>Emad</td>
</tr>
<tr>
<td>Intermediate-Range Ballistic Missile</td>
<td>Hwasong-12</td>
<td>BM-25 Musudan</td>
</tr>
<tr>
<td>Submarine-Launched Ballistic Missile</td>
<td>Bukgeukseong-1</td>
<td>None</td>
</tr>
<tr>
<td>Intercontinental-Range Ballistic Missile</td>
<td>Hwasong-14</td>
<td>None</td>
</tr>
<tr>
<td>Space Launch Vehicle</td>
<td>Unha “Galaxy” (First Flight 2009)</td>
<td>Simorgh “Phoenix” (First Flight 2016)</td>
</tr>
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</table>

*Note: For geographical reasons, Iran is not seeking an SLBM capability; it also wants to avoid the external political pressure that would come from an ICBM program.*

*Source: Uzi Rubin, Rubicon Defense Consulting*

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(c) How important is it to our non-proliferation efforts that the US maintain its role as a global nuclear leader?

US global nuclear non-proliferation aspirations are embedded in a series of treaties and executive agreements.\textsuperscript{12} Nuclear non-proliferation as an international norm depend on the foundational role of the US a leading diplomatic, military, institutional, commercial, and industrial role. The US is the only nation with the capability to monitor compliance with international nuclear non-proliferation norms on a global scale. The unique American role of serving as both the global ‘provider’ of nuclear deterrence, and the State with the capacity to maintain a vertically integrated national industrial base and supply chain to maintain the deterrent – including its control over access to uranium supplies.

6. How important is it to have a robust domestic uranium industry in the event we faced an extended supply disruption from Russia or other countries in its sphere of influence?

The United States uniquely requires a vertically integrated supply chain for both the civil and military applications of atomic energy. I believe this to be so for several reasons.

• The US scientific and technical leadership in both the civil and military applications of atomic energy is at the heart of the ability to evolve and sustain global nuclear non-proliferation norms. The US needs to operate the entire nuclear energy and weapons as an indigenous capability.

• The US responsibility for sustaining a credible nuclear deterrent is a unique burden as well as an opportunity to sustain the international norm against nuclear use. The US government can never permit foreign dependence on a critical raw material that could affect its enduring capacity to develop, field, and maintain its nuclear deterrent.

• The US capacity to sustain its indigenous capability to privately develop and mine uranium resources is at risk from uranium supplies from adversary States.