



# EURATOM Supply Agency

*Nuclear Fuel Market Observatory Sector*

## ● Quarterly Uranium Market Report 1<sup>st</sup> Quarter 2019

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## International and EU developments

In an opinion published at the end of 2018, the European Economic and Social Committee (EESC) declared its support for the European Atomic Energy Community's 2.4 billion EUR research and training budget, including money for nuclear safety and security research, as well as nuclear fusion, for the period 2021-2025. This research budget is subject to a two-year extension during which additional funding would be provided. Noting that clean energy is a top priority, the EESC emphasized that "nuclear safety must be understood as a dynamic concept, which entails constant monitoring of and adjustments to existing legislation in accordance with recent developments and innovations, covering the whole life span of the plant."

On 24 January, the U.S. Energy Information Administration (EIA) released its [Annual Energy Outlook 2019](#) (AEO) which provides long-term energy projections based on EIA's assessment of how U.S. and world energy markets will operate through 2050. According to the report, the U.S. would become a net energy exporter in 2020 and remain as such through 2050 as large increases are envisioned in crude oil, natural gas, and natural gas liquids (NGPL) production, coupled with slower growth in domestic energy consumption. The reference case presented in the report projects a steady decline of 17% in nuclear electric generating capacity from 99 gigawatts (GW) in 2018 to 83 GW in 2050. No new plant additions occur beyond 2021, and existing plants have 2 GW of uprates starting in 2030. Projected nuclear retirements are driven by declining revenues resulting from low growth in electricity load and from increasing competition from low-cost natural gas and declining-cost renewables. Smaller, single-reactor nuclear plants with higher average operating costs are most affected, particularly those plants operating in regions with deregulated wholesale power markets and in states without a Zero Emission Credit policy.

## Developments in the Member States

### **BELGIUM:**

Belgium's Nuclear Research Centre (SCK-CEN) and the Institut National des Radioéléments (IRE) will collaborate on a project - RECUMO (Recovery of Uranium from Mo-99 Production)- to recycle, according to the most stringent security and nuclear safety standards, highly radioactive residues resulting from the production of radioisotopes for medical purposes. These residues are currently stored in special containers at IRE's site in Fleurus, the storage capacity of which is expected to reach its limit by the end of 2019.

Early February, Ondraf/Niras, the Belgian agency for the management of radioactive waste, submitted to the Federal Agency for Nuclear Control a complete licence application for the construction of a low- and intermediate-level radioactive waste disposal facility at Dessel. The authorisation could be granted by mid-2020, and waste could already be placed in the facility starting from 2024.

### **BULGARIA:**

On 11 March, the Energy Ministry officially launched the process for selecting a strategic investor for the construction of two 1,000 MWe reactors at the Belene NPP project. The investors have 90 days to submit an application and to declare their interest in acquiring a minority participation in the future project as well as purchasing electricity from the plant, and the final decision should be taken within a year.

### **CZECH REPUBLIC:**

On 15 February, ČEZ reported its intention to invest 1.5 billion crowns (~65.8 million USD) during the coming months for more than 180 improvement projects at the Temelin NPP. The focus will be on the plant's continuous modernization, enhanced security, and traffic optimization, including new security systems.

Official reports from February indicate that, by signing a contract with the utility ČEZ for the construction project, the Czech government aims to maintain control over the construction of the reactors planned at the Dukovany NPP .

#### **ESTONIA:**

As part of the country's plans to establish carbon-free energy production in the Baltic region, Fermi Energia of Estonia and Moltex Energy signed in March a Memorandum of Understanding stating their intention to work together, including through a feasibility study for the siting of a Moltex advanced reactor and the development of a suitable licensing regime.

#### **FINLAND:**

At the end of February, TVO reported that the first 8 Westinghouse Triton11 fuel assemblies had been delivered to its plant and were going to be loaded during the Olkiluoto 2 reactor's upcoming outage. Westinghouse's first 11x11 BWR fuel design represents a new generation of BWR fuel, said to significantly reduce fuel cycle costs and increase overall fuel reliability.

Early March, the Finnish Cabinet granted the Olkiluoto-3 EPR its operating license, the first new power reactor license issued in Finland in 40 years. The license is a key step toward finally putting the 1,600-MW EPR into commercial operation following years of delays and cost overruns. Scheduled to go into commercial operation in January 2020, the reactor will supply about 15% of Finland's electricity.

#### **FRANCE:**

On 25 January, the French government published its multiannual energy mix plan, known by its French initials as PPE. This energy sector roadmap defines the French electricity mix up to 2028 in two periods, from 2019-2023 and 2024-to 2028, and includes details on how nuclear energy's contribution to the power mix will decline over the coming years as reactors are going to be shutdown. The PPE indicates that, by 2035, nuclear energy's share in the French electricity mix will drop to 50%, compared to 75% today.

#### **GERMANY:**

In a statement released in March about its 2018 financial results, EnBW declared it planned to invest, during 2018-2020, the money refunded from the payment of nuclear fuel taxes in its nuclear and renewables generating units, as well as in building nuclear waste processing centres at its Neckarwestheim and Philippsburg NPPs.

The company also stated that during 2018 it had received final dismantling approval for its Obrigheim plant, shut down permanently in 2005.

#### **THE NETHERLANDS:**

According to the terms of a contract signed in the beginning of the year with Terrestrial Energy, NRG will provide expert technical services to support "in-core" materials testing, including graphite, for key components of Terrestrial Energy 's Integral Molten Salt Reactor power plant in the High-Flux Reactor at Petten and the development of its generation IV plant. NRG's services include technical advice and in-process and post-irradiation examinations and evaluations of the test materials.

#### **POLAND:**

According to the results of PGE EJ1's latest commissioned survey, support for the construction of Poland's first NPP remains high among residents in the three areas under consideration for hosting the facility. The plant is expected to enter operation by 2033.

#### **ROMANIA:**

NuScale Power and Societatea Nationala Nuclearelectrica SA (SNN SA), signed on 14 March a memorandum of understanding to exchange business and technical information in order to evaluate the development, licensing and construction of a NuScale small modular reactor plant in Romania. The first company to submit an SMR design to NRC for certification, NuScale has already signed agreements to explore deployment of its SMR technology in Canada and Jordan.

#### **SPAIN:**

According to official reports released at the end of March, Endesa intends to extend the operating life of all the NPPs in which it holds a stake and the licenses of which are due for renewal in 2019 and 2020. Also at the end of March, Iberdrola, Endesa, and Naturgy reached an agreement to keep Spain's oldest reactor, the two-unit Almaraz NPP they jointly own, in operation until 2027 and 2028, respectively.

#### **UNITED KINGDOM:**

Hitachi has put on hold its plan to build two nuclear plants in the UK. Planning to cut jobs at its UK subsidiary Horizon Nuclear Power Ltd., the Japanese conglomerate is also considering a sale of Horizon Nuclear.

### **... and worldwide**

#### **CHINA:**

Unit 2 at the Haiyang NPP started to operate on 9 January, thus becoming the fourth Westinghouse AP1000 unit currently in commercial operation in China. China's nuclear fleet now totals 45 commercial reactors with a combined capacity of around 43 GWe.

On 10 January, JSC TVEL and one of China National Nuclear Corp. (CNNC)'s subsidiary signed a contract for the supply of nuclear fuel for the initial loading and the first seven years of operation of the fast neutron CFR-600 demonstration reactor currently under construction in China. The agreement also covers the supply of equipment and services, software licenses, and documentation examination services.

#### **TAIWAN:**

On 1 February, the Ministry of Economic Affairs published a revised national energy strategy, which maintains the government's objective of phasing out nuclear power by 2025. Due to an anticipated increase in energy consumption by large electronics firms in Taiwan, it is likely that the country will have to increase its use of fossil fuels in order to avoid the energy shortages expected as soon as 2021.

#### **USA:**

In the beginning of the year, the U.S. DoE's Office of Nuclear Energy announced the signature of a Memorandum of Understanding with Utah Associated Municipal Power Systems (UAMPS) and Battelle Energy Alliance relating to DOE's intent to use electricity from one of the two proposed NuScale small modular reactors. It is envisaged that the reactor could provide up to 70 MWe of power to the DOE's Idaho National Laboratory from 2025 to 2030, while the second one should to be used for research, development, and demonstration purposes under the Joint Use Modular Plant (JUMP) program.

Also in January, DoE concluded that the proposed use for fuel for research and development purposes of approximately 10 metric tons of DOE-owned high-assay low enriched uranium (HALEU), produced and stored at Idaho National Laboratory, would not have a significant impact on the environment, and would contribute greatly to advancing nuclear power. The construction and operation of any reactors that propose using HALEU fuel would require an additional National Environmental Policy Act review.

Westinghouse Electric Company announced early 2019 a plan to implement the first phase of its reorganization process, which includes improving the company's focus on its customer base and enhancing global services and supply chain management. The restructuring process should be complete by the third quarter of 2019.

## Uranium production

The Australian company Aura Uranium signed in January a binding offtake agreement with London-based Curzon Uranium Trading Limited for up to 30% of the production at its Tiris uranium project in Mauritania. With an anticipated production of 1 million lbs U<sub>3</sub>O<sub>8</sub>/ year, the project is expected to start up in 2020. The offtake agreement covers the sale of 800,000 lbs U<sub>3</sub>O<sub>8</sub> (308 tU) of uranium at fixed prices, with a further 1.8 million lbs available to Curzon as options at fixed and market pricing.

According to a draft program for the development of the country's mineral resources, released in February, Uzbekistan's government plans to invest 59 million USD between 2020 and 2024 to increase by approximately one-third, through new exploration, the country's proven uranium reserves. To that end, Navoi Mining and Metallurgical Combinat has been designated as a standalone, state-owned company for uranium mining and reprocessing: it will operate 20 conventional uranium mines and in-situ recovery facilities and develop 10 additional uranium deposits in Uzbekistan.

Ukraine published end of March national future mining plans, according to which the country intends to increase by 150% in the next 3 years the uranium ore output from its largest deposit. As part of the same strategy aimed at reducing its reliance on Russian conversion services and nuclear fuel, Ukraine also plans to build its own nuclear fuel manufacturing facility within 3 years, with technology from Westinghouse.

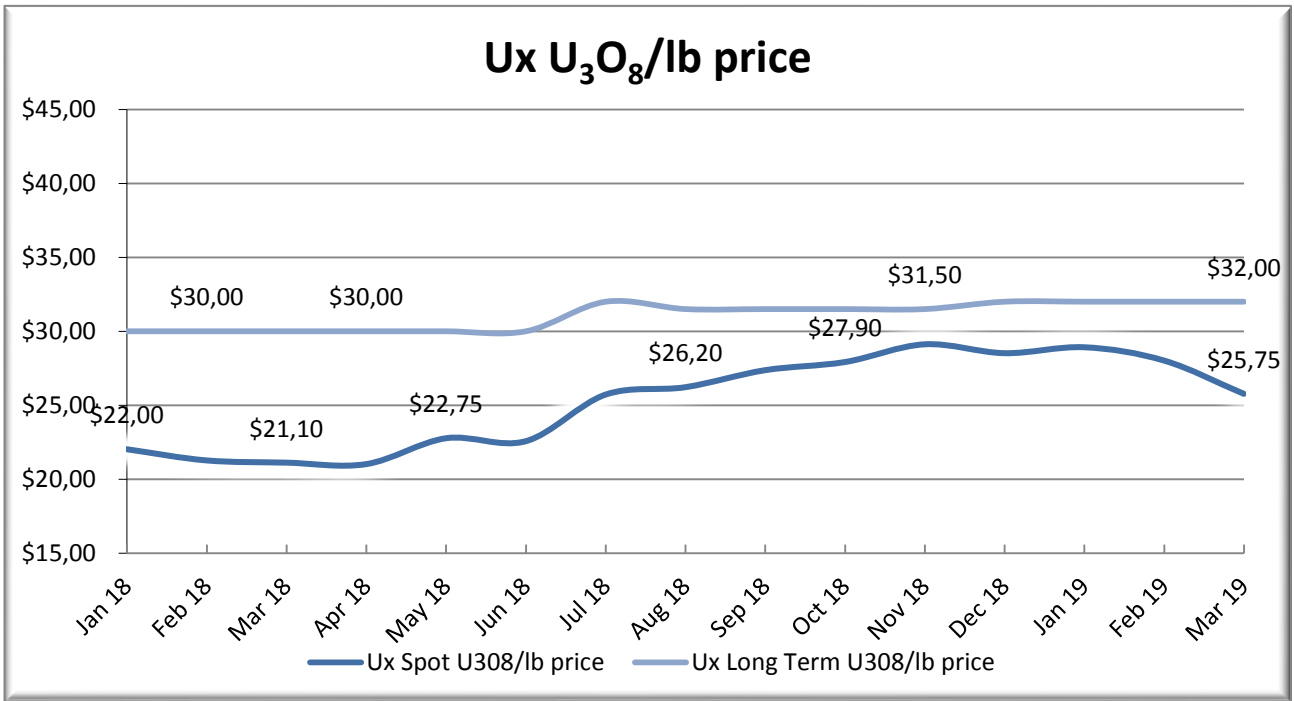
## Uranium prices<sup>1</sup>

In the first quarter of 2019, the UX monthly spot uranium price decreased by almost 10% comparing quarter to quarter and, at the end of March, it accounted for US\$25.75/lb U<sub>3</sub>O<sub>8</sub>. It was up by 22% compared to the first quarter of 2018.

The UX long term uranium price for the first quarter of 2019 accounted for US\$32.00/lb U<sub>3</sub>O<sub>8</sub> at the end of March which means no change when compared quarter to quarter and almost 7% up compared to first quarter of 2018.

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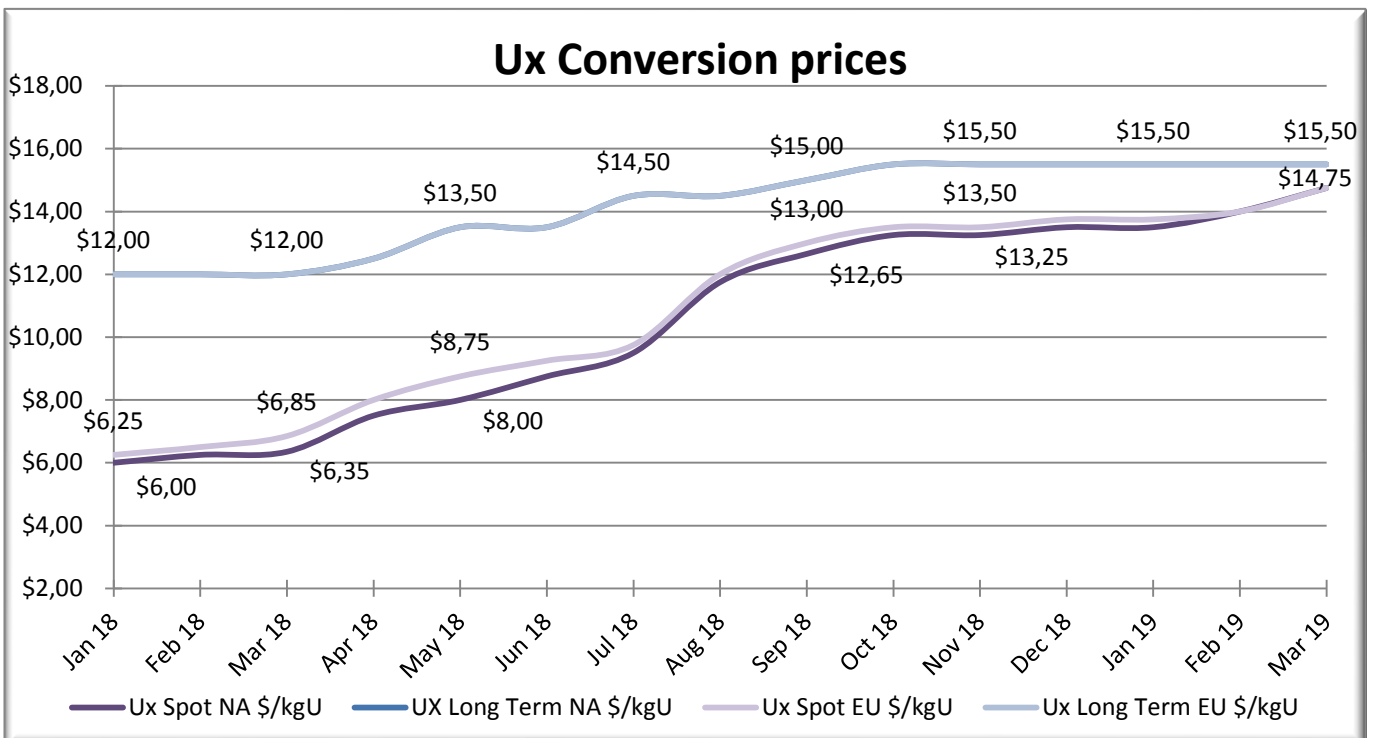
<sup>1</sup> The market price information in the following chapters: *Uranium prices, Conversion and Enrichment* is provided with permission of the UxC, LLC ([www.uxc.com](http://www.uxc.com)). UxC does not bear any legal liability for the use of these data.



## Conversion

In the first quarter of 2019, UX spot conversion prices in the European Union and in North America increased by 7% and 9%, respectively, compared to the previous quarter and amounted to US\$14.75/kg in the EU and US\$13.50/kg in North America at the end of March. In an annual comparison, they increased by 115% and 132%, respectively.

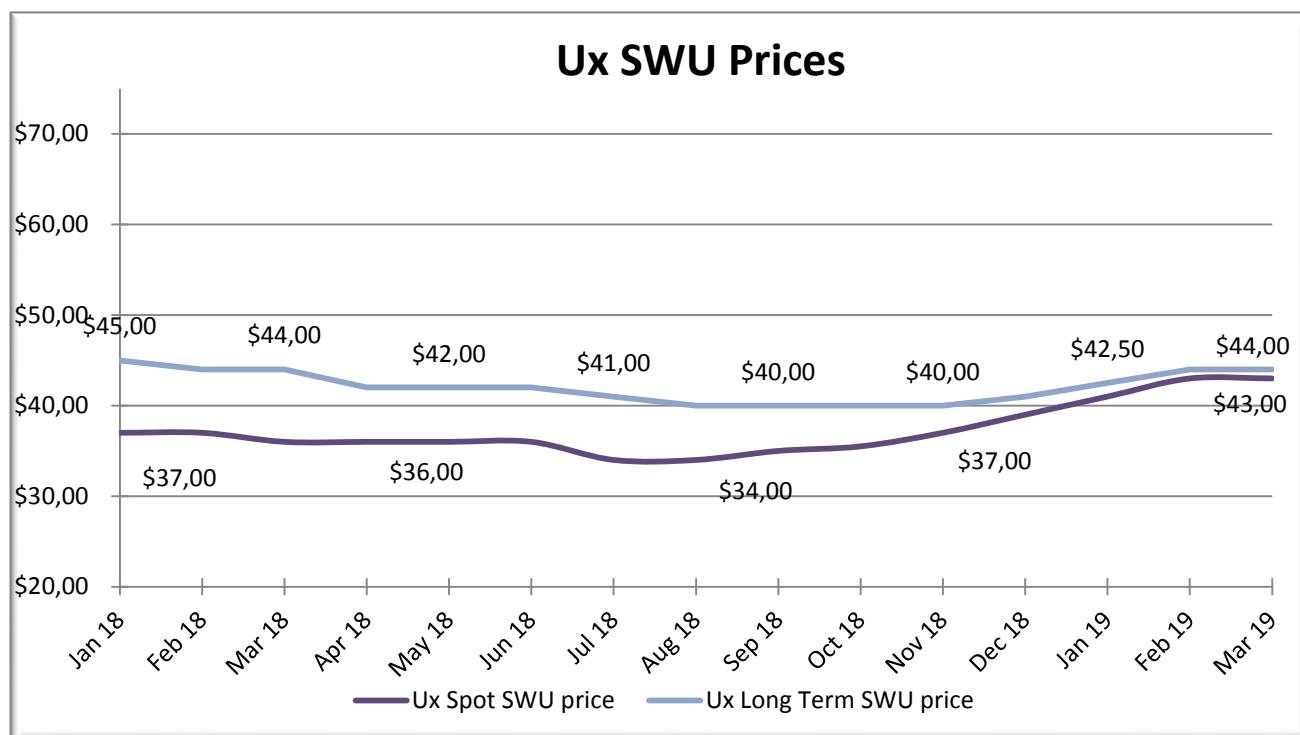
UX long term conversion prices amounted to US\$15.50/kg both in the EU and North America, which were unchanged compared to the previous quarter and increased by 29% in an annual comparison.



## Enrichment

At the end of March 2019, the UX spot SWU price amounted to US\$43.00 per SWU and it increased by more than 10% compared to the previous quarter. It was up almost 20% in an annual comparison.

The UX long term SWU price amounted to US\$44.00 and it was up by more than 7% compared to the previous quarter and stayed unchanged compared to the first quarter of 2018.



On 7 January, it was officially reported that the U.S. DoE intends to spend 115 million USD on a cascade of 16 centrifuges at the Ohio legacy enrichment site. The centrifuges will use AC100M technology to produce small amounts of HALEU, which will be used by the DOE for research and development required by some Generation IV reactor designs.

Australia's Silex Systems and Canada's Cameco have agreed to buy out GE-Hitachi Nuclear Energy's ownership share of GE-Hitachi Global Laser Enrichment (GLE), a company trying to commercialize Silex's technologies to produce enriched uranium. Under the terms of the agreement, Cameco would increase its stake in GLE to 49% while Silex will have a 51% ownership stake in the company. The agreement's signature also depends on DOE's approval to continue a 2016 agreement under which GLE was authorized to purchase DOE-owned depleted uranium that would be used in a laser enrichment facility to be built at the Kentucky enrichment facility.

Urenco USA announced in February a new programme covering the production of HALEU at a dedicated unit to be built at its US uranium enrichment facility.

## Fuel fabrication

All over the world, fuel fabricators have intensified their efforts towards producing accident-tolerant fuel (ATF), with increased financial support from governments.

On 28 January, TVEL announced that the first batch of experimental ATF assemblies were loaded into the MIR research reactor for testing at the State Research Institute of Nuclear Physics in Dimitrovgrad, Russia, with a view to bringing to the market a Russian ATF design.

The US DoE's Office of Nuclear Energy awarded in late 2018 a total of 111.2 million USD in funding to three industry partners, General Electric, Framatome and Westinghouse, to develop ATFs. In the first 14-month budget period, all three fuel vendors must ensure, among others, that an initial Lead Test Assembly has been installed in a US commercial power plant, and continue development of licensing approaches that include the involvement of at least one NPP owner/operator per ATF concept. Additional funding is planned

Framatome announced in January that the U.S. DoE had granted it 49 million USD in funding over a 28-month period to speed up development of its enhanced accident tolerant fuel (EATF), which not only allows operators additional response time in the event of active cooling loss, but also ensures improved performance during normal operation.

On 18 January, Westinghouse Electric Co. announced it had been awarded 93.6 million USD in funding from the DoE to support the development of its EnCore Accident Tolerant Fuel design. Westinghouse stated that the EnCore Fuel program includes the development in two phases of both short- and long-term products that provide advanced safety features, enhanced fuel cycles, and economic advantages.

On 22 January, China General Nuclear (CGN) reported that it had begun irradiation testing on a prototype ATF in a research reactor.

## **Nuclear medicine**

As part of an initiative led by the US DoE's Pacific Northwest National Laboratory, the Australian Nuclear Science and Technology Organisation (ANSTO)'s medical isotope production facility installed a high-resolution monitoring system to track emissions from its production of medical radioisotopes. A similar monitoring system is already in place at the Institute for Radioelements in Belgium.

In the Netherlands, the Advancing Nuclear Medicine consortium has been awarded a 6.8 million EUR subsidy from the European Fund for Regional Development to develop FIELD-LAB, an initiative aimed at accelerating the development and introduction of new radiopharmaceuticals.

Niowave has started producing medical radioisotopes including molybdenum-99, iodine-131, xenon-133 and strontium-89 by fissioning LEU using a superconducting electron linear accelerator.

NorthStar Medical Radioisotopes is reportedly expanding its current Good Manufacturing Practice manufacturing capabilities in Wisconsin to support increased Mo-99 production capacity.

The US DoE's NNSA has selected four companies (Niowave Inc, NorthStar Medical Radioisotopes LLC, Northwest Medical Isotopes and Shine Medical Isotopes) to begin negotiations for potential new cooperative agreement awards for the supply of Mo-99 without using HEU. The USA currently does not produce molybdenum-99 and imports all of its requirements.

On 27 March, Bruce Power completed the first harvest of medical-grade cobalt-60 produced inside the Bruce 7 nuclear power reactor, as a measure meant to prevent a shortage of this cancer-fighting isotope. The medical-grade material harvested from Bruce 7 has been inside the reactor for nearly two years, and will now be processed by Nordion, a company based in Ottawa.

## **Concluded natural uranium contracts in the EU<sup>2</sup>**

During the first quarter of 2019, ESA processed 87 transactions, including contracts, amendments and notifications on the front-end activities. Between January and March, European utilities concluded 6 new spot natural uranium supply contracts (including purchases, sales, exchanges and loans) and 3 new long term contracts.

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<sup>2</sup> The statistics and data analysis provided by ESA are for information purposes only, and ESA does not bear any legal liability for using them. ESA ensures confidentiality and physical protection of the commercial data.



Quarter	ESA quarterly spot uranium price EUR/kgU	ESA quarterly spot uranium price USD/lb U <sub>3</sub> O <sub>8</sub>	ESA All Users quarterly spot uranium price EUR/kgU*	ESA All Users quarterly spot uranium price USD/lb U <sub>3</sub> O <sub>8</sub> *	Number of spot natural uranium contracts concluded by EU utilities**	Number of spot natural uranium contracts concluded by all parties**	Total number of contracts processed by ESA***
2018 Q2	-	-	45.75	20.72	2	7	65
2018 Q3	-	-	61.2	23.53	1	-	115
2018 Q4	62.39	27.39	55.35	24.30	8	18	75
2019 Q1	-	-	65.33	28.54	8	10	87

**List of common abbreviations:**

ESA	Euratom Supply Agency
IAEA	International Atomic Energy Agency
OECD	The Organisation for Economic Co-operation and Development
(US) DoE	United States Department of Energy
(US) EIA	United States Energy Information Administration
WNA	World Nuclear Association
NA	North America
USEC	United States Enrichment Corporation
NPP	Nuclear Power Plant
PWR	Pressurized Water Reactor
ABWR	Advanced Boiling Water Reactor
EPR	European Pressurised Water Reactor
VVER	Water-Water Power Reactor
SWU	Separative Work Unit
tU	tonne U (= 1 000 kg uranium)