

REVIEW ARTICLE

## An Update: Nuclear Power and Uranium Markets, Ownership and Uranium One (Russian Government) and Other Ownership of Uranium Resources in the World

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This is a brief update since the 2017 Annual Report [1] from the Chair, [EMD Uranium \(Nuclear and Rare Earth\) Committee](#) [2]. Some 99 Nuclear power plants in the U.S. remain in operation [3], a few are scheduled for retirement [4], two new reactors are being built in Georgia [5]. Japan is slowly upgrading and re-starting its fleet of nuclear power plants after Fukushima [6]. China is rapidly building some 25 new plants and hundreds more are planned [7], along with financially underwriting the construction of more than 40 projects in joint ventures with other countries [8].

Russia too is building new nuclear plants at home [9], testing a “fast breeder” design that consumes most waste [10]. Russia also is building nuclear plants on behalf of other countries as well, and providing financing [11]. India has turned to nuclear to ramp up electricity production to match population growth rates and is also working on “fast breeder” designs [12]. Other countries are also building nuclear plants funded from a variety of sources [13].

The market for uranium intended as nuclear fuel is currently in balance regarding demand but having favored supply since Fukushima with yellowcake prices well below break-even levels for most production from U.S. mines [14]. Ownership of uranium properties in North America ranges from U.S. uranium companies to Canadian uranium companies (all funded by Toronto, Vancouver, and other stock exchanges in London, Germany, Australia, and South Africa).

Russian and Chinese interests are also involved in North American uranium exploration, mining, and processing and milling. Russia, through Uranium One, a uranium holding company, once funded by the South African Stock Exchange (Figure 1), was purchased along with a Canadian company (Urasia Energy), both now controlled by Russian government nuclear monopoly, the history of [Rosatom](#) [15]. Uranium One, is on various stock exchanges as a subsidiary of [Rosatom](#).



Figure 1: History of Uranium One.

Any uranium produced in the U.S. (by the currently operating the [Christensen Ranch/ Irigaray](#) in-situ recovery mine in Wyoming; or by the Texas in-situ mine, [El Mesquite](#), which is not currently operating), is sold to civilian power reactors in the U.S., according to [EIA](#) [16]. But U.S. owners and operators of commercial nuclear reactors purchase the vast majority of their uranium from foreign sources. Only 11 percent of the 50.6 million pounds purchased in 2016 came from U.S. domestic producers, according to the [2017 EIA](#) report [17].

Although Uranium One once held 20 percent of licensed uranium in-situ recovery production capacity (not uranium resources) in the U.S., that is no longer the case [18]. There were [only four](#) in-situ recovery facilities licensed by the NRC in 2010. Currently, there are [10 such facilities](#), so Uranium One’s mining operations now account for an estimated 10 percent of in-situ recovery production capacity in the U.S. [19] But more recently, Uranium One has been responsible for no more than 5.9 percent of domestic production, according to a [September, 2017 report](#) by the U.S. International Trade Commission [20]. Such uranium production cannot be exported without an export license. EIA reported that Russia provided 22% of the

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foreign uranium enrichment service in 2016 (and returned that production to the U.S.) [17].

China is establishing long-term contracts with Canadian mines to help secure uranium supplies over the decades ahead to fuel their major nuclear plant construction program, and before the anticipated rise in prices over the next few years. Canadian resources include numerous high-grade uranium deposits, but most of which are deep requiring underground mining.[21]

As the uranium price rises in the next few years, the in-situ mines in Wyoming, Texas, Utah, and South Dakota will come back on-line to reduce foreign imports, although the number of new discoveries continues to increase around the world, e.g., Canada, Peru, Argentina, Saudi Araba, etc. Whether these will go to mine are yet to be determined [22].

**Uranium One Property Ownership in United States**

- (50%) [Green River North](#), Emery County, Utah, USA
- (50%) [Green River South](#), Emery County, Utah, USA
- (39.2% option) [North Hansen Deposit](#), Colorado, USA
- (100%) Uranium One USA, Inc.
- (100%) [Christensen Ranch / Irigaray](#), Wyoming, USA
- (71%) [El Mesquite](#) (MALCO, Texas, USA)

For actual reserves, see company reports for the mine above. Owning a uranium property requires drilling of uranium resources to obtain the actual in-place uranium mineralization, which then must undergo an assessment of the cost to mine and process the identified reserves to ultimately produce yellowcake [17].

Once a company produces a report of recoverable product then the project must undergo an independent economic assessment

in the form of a N 43-101 report, or qualified persons report, for the Vancouver, Toronto, Australian and other stock exchanges. For the London Stock Exchange, a Competent Persons Report is required for new mining companies. Not all Uranium One properties will produce yellowcake; the properties listed above would require detailed follow-up, independent investigations before their potential can be assessed for their development, from both an economic and environmental perspective.

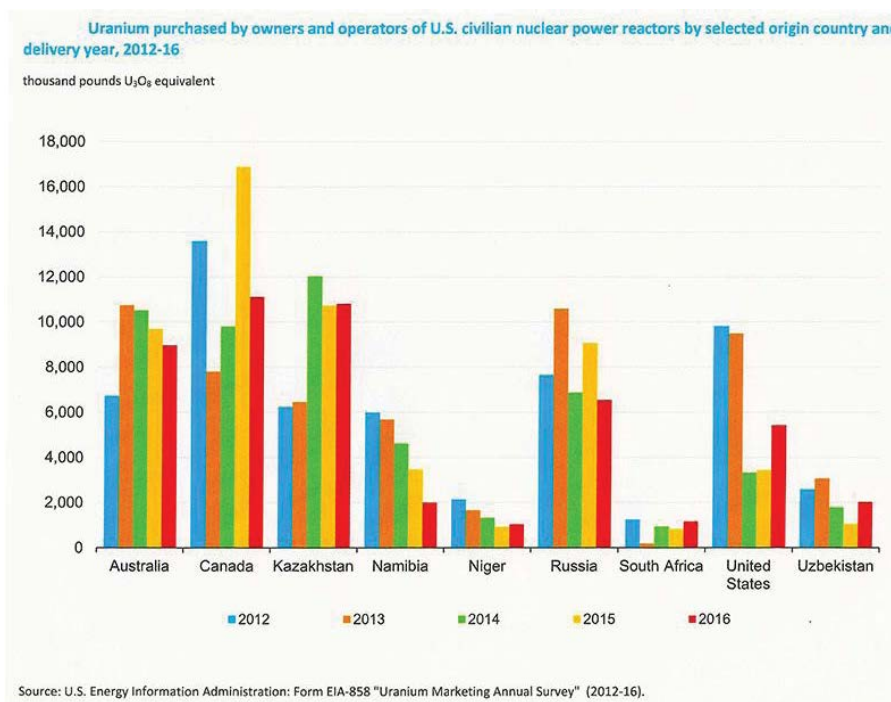
The U.S. Stock Exchanges require similar independent reports on mining and processing yellowcake and other minerals. For examples of independent reports on uranium properties, see [\(here\)](#).

**Uranium One Property/Company Ownership in the World**

- (50%) [Karatau LLP](#), Kazakhstan
- (50%) - [JSC Akbastau](#), Kazakhstan
- (49.98%) - [Zarechnoye joint venture](#), Kazakhstan
- (100%) [UrAsia Energy Ltd.](#)([more](#))
- (100%) [Energy Metals Corp.](#),U.S.([more](#))
- (13.9%) [Mantra Resources, Ltd](#), Tanzania
- [Mkuju River project](#), Tanzania
- [Bahi North project](#), Tanzania ([more](#))
- [Zambezi Valley Project](#), Mozambique ([more](#))

On Sep. 11, 2017, Rosatom announced that Uranium One, a ROSATOM global mining company, has opened a new trading company, under the name [Uranium One Trading AG](#) in Zug (Switzerland).

The Kazakhstan uranium mining company has also opened a trading company in Switzerland), for more, see: ([more](#))



**Figure 2:** Source of Fuel for U.S. Power Plants: Years 2012 to 2016.

In the U.S., owners and operators of civilian nuclear power reactors (civilian owner/ operators) purchased a total of 50.6 million pounds of yellow cake deliveries from U.S. and foreign mines during 2016, at a weighted-average price of \$42.43 per pound  $U_3O_8$ . The 2016 total of 50.6 million pounds  $U_3O_8$  was 10% lower than the 2015 total of 56.5 million pounds  $U_3O_8$ . The 2016 weighted-average price of \$42.43 per pound  $U_3O_8$  was 4% lower than the 2015 weighted-average price of \$44.13 per pound  $U_3O_8$  (yellow cake). Eleven percent of the 50.6 million pounds yellow cake delivered in 2016 was of U.S.-origin at a weighted-average price of \$43.92 per pound [17].

Foreign-origin uranium accounted for the remaining 89% (45 million pounds yellowcake) of deliveries at a weighted-average contract price of \$42.26 per pound.

Sources and shares of purchases of uranium produced in U.S. and other countries in 2016 are listed in Figure 2.

### **U.S. Source of Uranium**

**Domestic Origin: 11%**

**Foreign Origin: 89%**

Canada: **25%** [23]

Kazakhstan: **24%** [24]

Australia: **22%** [25]

Russia: **14%** [26]

Uzbekistan: **4%** [27]

Malawi+Namibia+Niger+and+South Africa: **9%** [28]

and

Brazil [29]+ Bulgaria [30]+China [31]+Czech Republic

[32]+Germany [33], and+Ukraine [34]: **2%**

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