BEFORE THE
UNITED STATES DEPARTMENT OF COMMERCE

PETITION FOR RELIEF UNDER SECTION 232 OF THE TRADE EXPANSION ACT OF 1962 FROM IMPORTS OF URANIUM PRODUCTS THAT THREATEN NATIONAL SECURITY

Energy Fuels Resources (USA) Inc. and Ur-Energy USA Inc.

PETITIONERS

EXHIBITS

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EXHIBITS

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Exhibit 1

Exhibit 1
Compliance with Regulatory Requirements

Requirements for the Petition may be found in the following locations but is not limited to the locations specified:

1. Sections I & II - Identification of the applicant;
2. Sections III & VIII - A precise description of the article;
3. Sections III & IV - Description of the domestic industry affected, including pertinent information regarding companies and their plants, locations, capacity and current output of the industry;
4. Section IV - Pertinent statistics on imports and domestic production showing the quantities and values of the article;
5. Sections V & VI - Nature, sources, and degree of the competition created by imports of the article;
6. Sections VI & VII - The effect that imports of the article may have upon the restoration of domestic production capacity in the event of national emergency;
7. Sections IV & VII - Employment and special skills involved in the domestic production of the article;
8. Section VII - Extent to which the national economy, employment, investment, specialized skills, and productive capacity is or will be adversely affected;
9. Sections II & IV - Revenues of Federal, State, or local Governments which are or may be adversely affected; and
10. Sections IV & VII - National security supporting uses of the article including data on applicable contracts or sub-contracts, both past and current.

Exhibit 2

The Market Impacts of US Uranium Import Quotas

Timothy J. Considine*

Executive Summary

This study develops an econometric model of the world uranium market to estimate the impacts of quotas on uranium imports into the United States. The econometric model estimates uranium supply and demand in the US and the rest of the world. The model is estimated with data from 1994 to 2016 and yields demand and supply elasticities in line with those reported in the peer-reviewed literature. The demand for uranium is very price inelastic and the supply curves are somewhat more responsive to market prices.

This model is used to estimate the changes in uranium supply, demand, prices, and imports under an import quota that ensures a 25 percent market share for domestic US uranium mining ("25 percent quota"). To provide a sensitivity analysis, the model also estimates the changes in uranium supply, demand, prices, and imports under an import quota that would ensure a 20 percent market share for domestic US uranium mining ("20 percent quota").

Overall, the results of econometric analysis and the model simulations indicate that uranium import controls would provide significant relief for the US uranium mining industry with minimal impacts on domestic electricity prices or the competitive position of nuclear power. Under the 25% import quota, prices to US producers would be expected to increase to levels in line with global production costs, with only a marginal

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* The author is a Distinguished Professor of Energy Economics with the School of Energy Resources and Department of Economics at the University of Wyoming. This research is supported with funds from UR Energy USA Inc. and Energy Fuels Resources (USA) Inc. Data from S. Kahouli are gratefully acknowledged. The views and findings here, however, are solely those of the author and not necessarily those of the University of Wyoming or the project sponsors.

impact on the price of electricity to consumers. A 20% quota, which would sustain a smaller US uranium mining industry, would result in a somewhat lesser increase in prices to US producers and electricity prices to consumers.

Under the 25 percent quota, prices increase $21 per pound in 2018 and $32 per pound in 2022 (see Figure ES1), which translate to a 69 and 104 percent increase in domestic prices respectively (see Figure ES2). For the 111 mines operating around the world, the average total cost of production is $40 per pound with a standard deviation of $15. Maximum production costs are $82 per pound. With current market prices of $24 per pound, the 25 percent quota would bring domestic prices back into range with average world production costs.

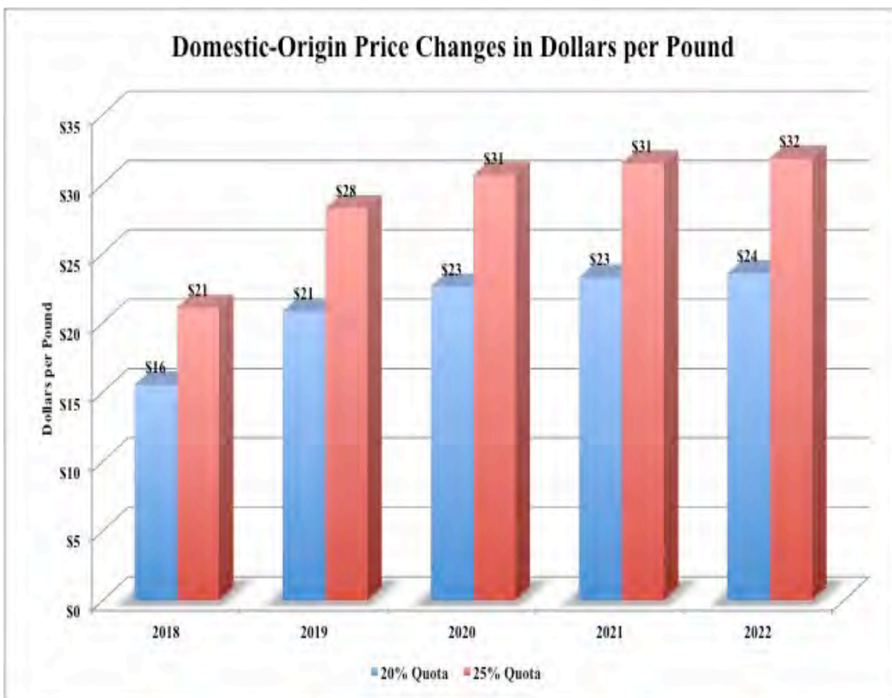

Figure ES1: Price impacts of uranium import quotas

Under a 20 percent quota, prices for domestic-origin uranium would increase somewhat less by $16 per pound in 2018 and $24 per pound in 2022 (see Figure ES1) representing a 61 and a 94 percent increase in domestic prices respectively (see Figure

ES2). Domestic uranium mining revenues increase from $550 to $700 million per year under the 25 percent quota and would increase from $364 to $448 million under a 20 percent quota.

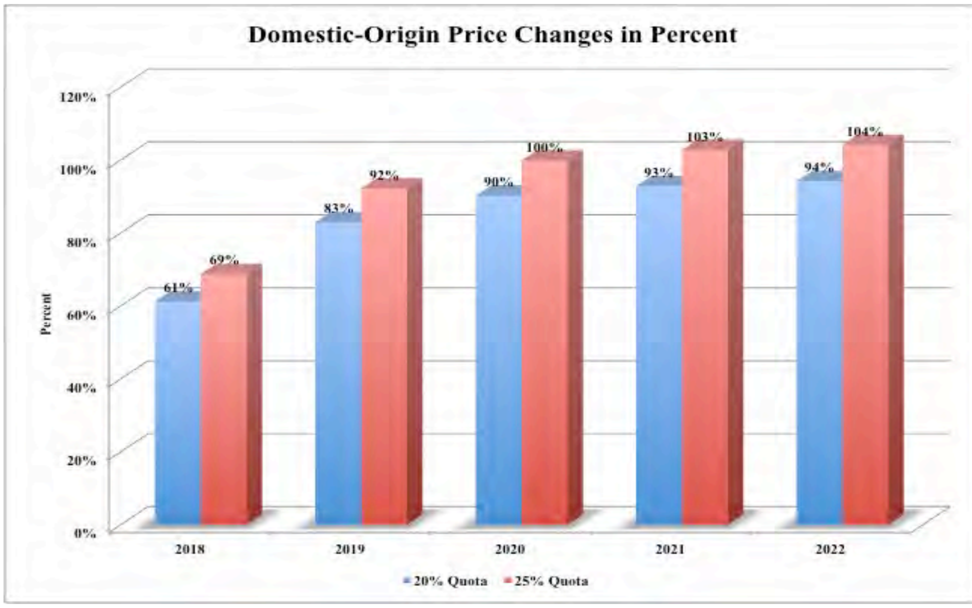

Figure ES2: Price impacts of uranium import quotas in percent

Under this import quota, prices decline for foreign-origin uranium. Even though prices for domestic uranium are higher under the import quota, the small share of domestic production limits the increase in average prices paid by civilian nuclear plant owners and operators (COOs). Average prices for uranium increase between 13 to 21 percent under the 25 percent quota and would increase between 7 and 12 percent for a 20 percent domestic production quota.

In wholesale power markets, the uranium production quota would slightly reduce the margin between nuclear operating costs and the costs of producing power from other sources. To measure how this competitiveness would be affected, the incremental uranium costs due to the quota is divided by nuclear electricity output. These unit incremental costs are from $0.27 and $0.41 per megawatt hour (MWh) under the 25 percent production quota and would be from $0.15 and $0.24 per MWh under a 20 percent production quota (see Figure ES3). These incremental costs are from 0.8 and 1.2 percent of average wholesale electricity prices under the 25 percent production quota. With a 20 percent domestic production quota, the unit incremental uranium costs facing COOs would be from 0.4 and 0.7 percent of the wholesale price of electricity.

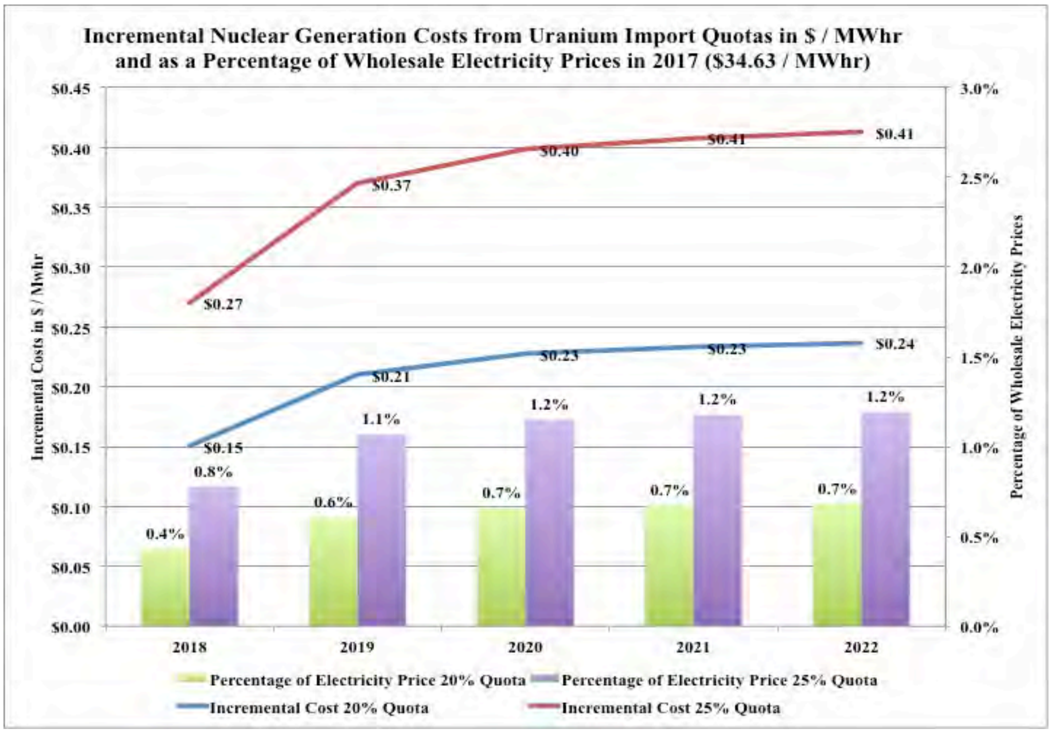

Figure ES3: Incremental costs and wholesale electricity prices

If the proposed domestic production quota was viewed as temporary, prices for future delivery could be lower than prices for spot transactions and buyers would delay purchasing uranium and draw down inventories. This could prevent buyers from entering into the higher-price long-term contracts with US producers that would be required to incentivize increased US production. The econometric model developed in this study allows the estimation of how sensitive uranium inventories are to these spreads between spot and future prices. Average uranium prices paid by COOs across the 25 percent quota increase slightly less than $5 per pound, and somewhat less under a 20 percent quota, which would be the expected price decline in the future once the quota expires. If this is the difference between spot and forward prices, model simulations indicate that the potential supply from inventory drawdowns averages 5.9 million pounds per year from 2.5 to 7.7 million pounds per year (see Figure ES4).

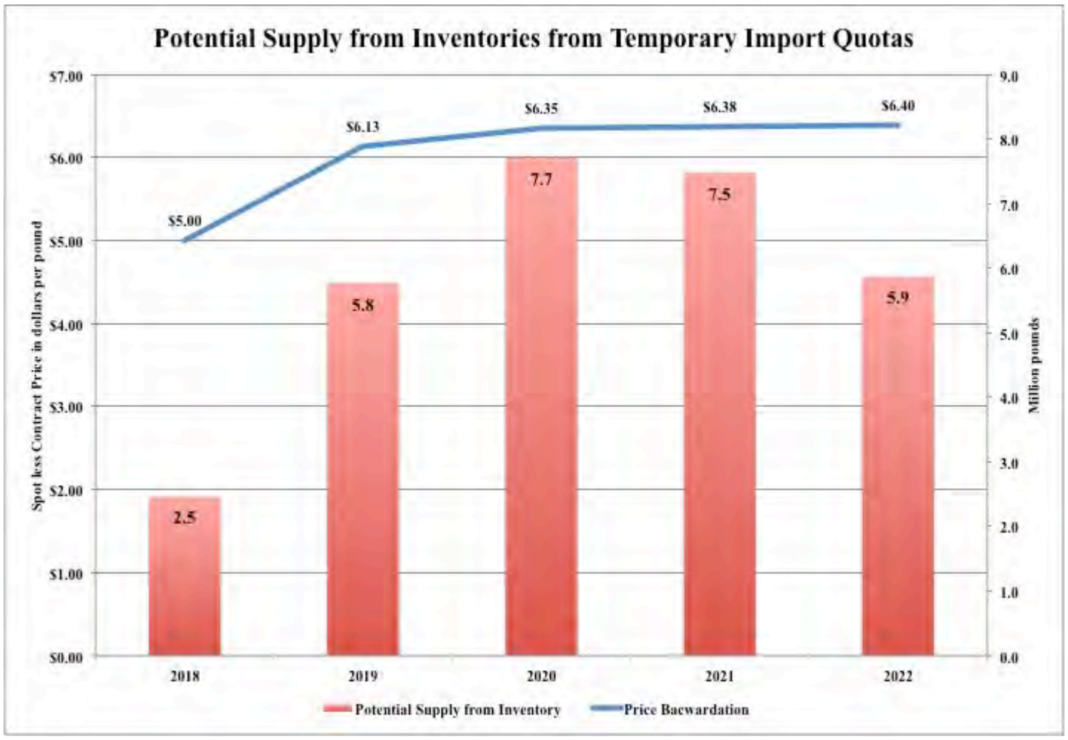

Figure ES4: Price impacts of uranium import quotas in percent

Over the past 20 years, total US commercial inventories were as low as 72.5 million pounds in 1995 and as high as 143.9 million pounds in 2016, which is a difference of 71.4 million pounds. If 5.9 million pounds per year were drawn from this inventory buffer, it would be depleted after 12 years. Hence, if uranium production quotas were adopted, they should remain in place for a minimum of a decade and probably longer. This would encourage US utilities to enter into the long-term contracts with US producers required to support the modeled increase in US production.

1. Introduction

Falling prices, rising imports, and declining domestic production are threatening the economic and financial viability of the US uranium mining industry. Higher production from Russia, Kazakhstan, and Uzbekistan in recent years is contributing to lower prices. Prices for uranium have been falling for the past five years and US production is down nearly 60 percent from the distressed levels more than 15 years ago. Uranium purchases from civilian nuclear plant owner and operators (COOs) in the US fell 10 percent in 2016 to 50.6 from 56.6 million pounds in 2015. The average weighted price of uranium concentrate (U_3O_8) fell 4 percent from $44.13 to $42.43 per pound of U_3O_8 during the same period. During 2016, COOs signed new purchase contracts for 8.7 million pounds of U_3O_8 for an average price of $24.86 per pound, more than 40 percent below the average weighted contract and spot price. Foreign-origin uranium comprises nearly 92 percent of total US purchases of uranium. Falling demand is exacerbating these challenging market conditions for US producers. As a result, commercial inventories of uranium at the end of 2016 were 6 percent higher than 2015 levels.

Lower demand, higher imports, and falling prices are contributing to lower US production of uranium concentrate, which was 2.9 million pounds during 2016, the lowest level since 2005 and substantially below the 6.3 million pounds of production in 1996. During the first half of 2017, production of uranium concentrate fell 14 percent from the first two quarters of 2015. These difficult market conditions have forced uranium-mining companies in the US to propose a quota on uranium imports. The objective of this paper is to estimate the market impacts of this import quota on the uranium market and the price of electricity in the US.

To achieve this goal, this study develops an econometric model of world uranium markets, including the US and the result of the world, which is presented in section 3 below. This regional framework builds upon the studies by Trieu et al. (1994), Auzans et al. (2014), Schneider (2017), and Kahouli (2011). The model determines nuclear power capacity and generation, uranium supply and demand, commercial inventories, and uranium prices in the US and the rest of the world. The parameters of the model are estimated with annual data from 1994 through 2016. An overview of the data sample is discussed in section 2. Given the simultaneous determination of prices, demand, capacity, and generation; the model equations are estimated with two-stage least squares. The econometric estimates for the relationships in the world uranium model are presented in section 4 below.

The model is used to simulate the market adjustments under an import quota that ensures a 25 percent market share for domestic US uranium mining ("25 percent quota"). To provide a sensitivity analysis, the model also estimates the changes in uranium supply, demand, prices, and imports under an import quota that would ensure a 20 percent market share for domestic US uranium mining ("20 percent quota"). Solutions for prices, quantities, and other endogenous variables are compared to estimate the market impacts of the quota. These model simulations are presented in section 5.

The demand for uranium is driven by the operation of highly capital-intensive nuclear power plants that must operate continuously to achieve economies of scale in electric power production. Nuclear power competes with electricity produced from wind, coal, natural gas, and other sources. As a result, COOs hold between 2 and 3 years of uranium requirements in inventory. This suggests that if import quotas are enacted, COOs could simply draw down inventories, especially if the trade restrictions were perceived to be temporary. The response of inventories, therefore, may be an important consideration in determining the duration of the domestic production quotas. To address this issue, the econometric model is simulated under a scenario in which expected uranium prices in the future are lower than current spot prices. This market simulation, which is presented in section 6, indicates that the inventory response is sizable and, therefore, if quotas are adopted they should be for a minimum of 10 years and probably longer.

The paper concludes with a summary of the key findings. Overall, the results of econometric analysis and the model simulations indicate that uranium import controls would provide significant relief for the US uranium mining industry with minimal impacts on domestic electricity prices or the competitive position of nuclear power. Such trade protection may be critical in maintaining a viable domestic uranium mining industry in the United States, see Spencer and Loris (2008), an issue that was previously under consideration circa 1990 by the US Department of Commerce (1989).

2. Overview of Data Sample

The data sample used for the econometric model presented in the next section is from 1994 to 2016 because the two key data series, purchases of domestic and foreign-origin uranium are only available from US Energy Information Administration (2107a) during this period. Developing an accurate market balance for a longer time period is not possible given the lack of data on the significant flows of uranium concentrate coming from the re-processing of spent weapons grade uranium, government stockpiles, and other secondary supply sources. The world data collected by Kahouli (2011) were updated for this study. Data for US uranium markets are collected from the US Energy

Information Administration (2107a, and 2017b). Summary statistics for the endogenous variables are presented in Table 1.

US nuclear capacity on average was 99.5 Gigawatts (GW) over the sample period with a standard deviation of only 1.3. Capacity in the rest of the world is more than twice as large with considerably more variation given its significant upward trend (see Figure 1). Nuclear generation of electric power averaged 757 thousand Gigawatt hours (GWh) in the US and 1,700 thousand GWh in the rest of the world. Uranium requirements or uranium in fuel assemblies in nuclear reactors are roughly twice as large in the rest of the world compared to the US.

Table 1: Summary statistics, 1994 - 2016

	Mean	*Standard Deviation*	*Minimum*	*Maximum*
Nuclear Capacity		*Gigawatts*		
United States	99.56	1.29	97.07	101.89
Rest of World	264.83	14.45	241.26	293.20
Nuclear Generation		*Thousand Gigawatt hours*		
United States	756.96	57.13	628.64	806.97
Rest of World	1,699.08	105.67	1,484.72	1,872.54
Uranium Requirements		*Million Lbs. U3O8*		
United States	49.59	5.96	38.20	62.27
Rest of World	92.74	6.81	76.98	107.03
US Uranium Purchases				
Domestic-Origin	8.00	0.55	7.72	10.81
Foreign Origin	44.41	6.80	30.56	55.73
Uranium Mining Shipments				
United States	4.11	1.26	1.60	6.30
Rest of World	94.99	21.12	69.45	134.50
US Commercial Inventories	110.19	19.17	72.50	143.86
Uranium Prices		*Dollars per lb. U3O8*		
Domestic	28.47	19.08	10.50	59.55
Foreign	27.12	17.98	9.97	55.98
Average	27.36	18.12	10.16	55.61
Spot	29.29	22.31	7.92	88.25
Contract	27.51	18.46	10.58	55.90

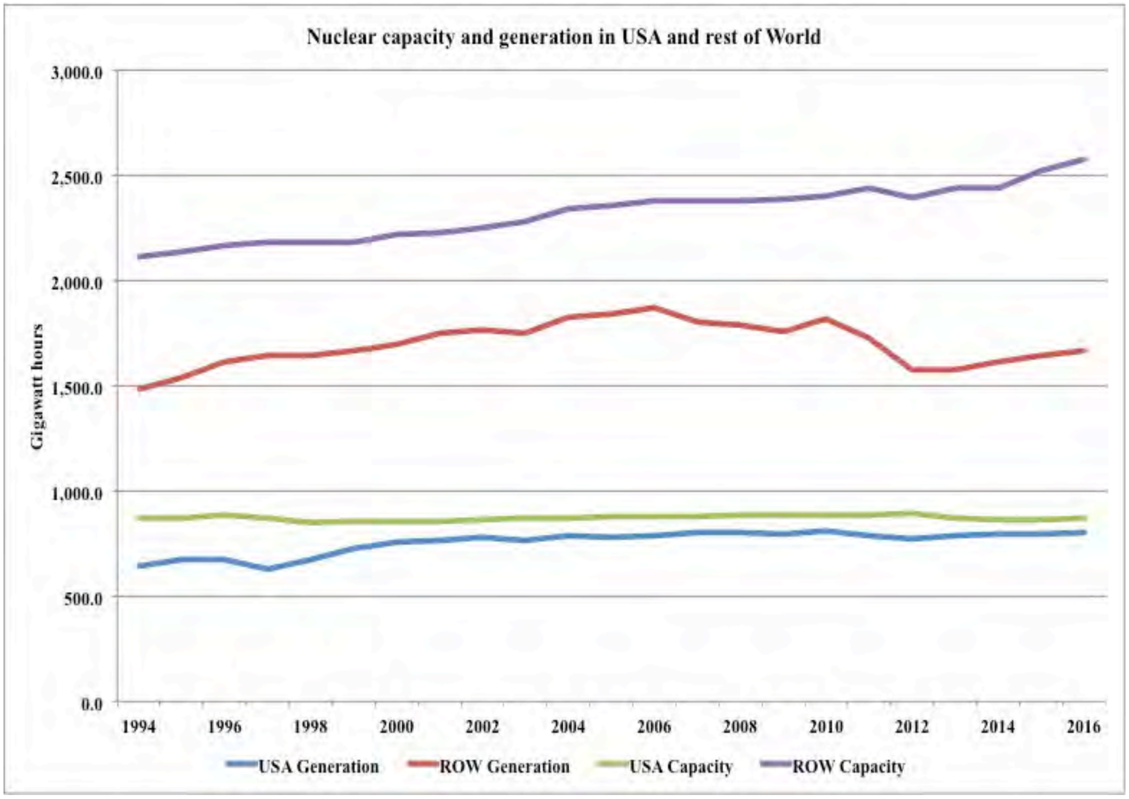

Figure 1: Nuclear capacity and generation

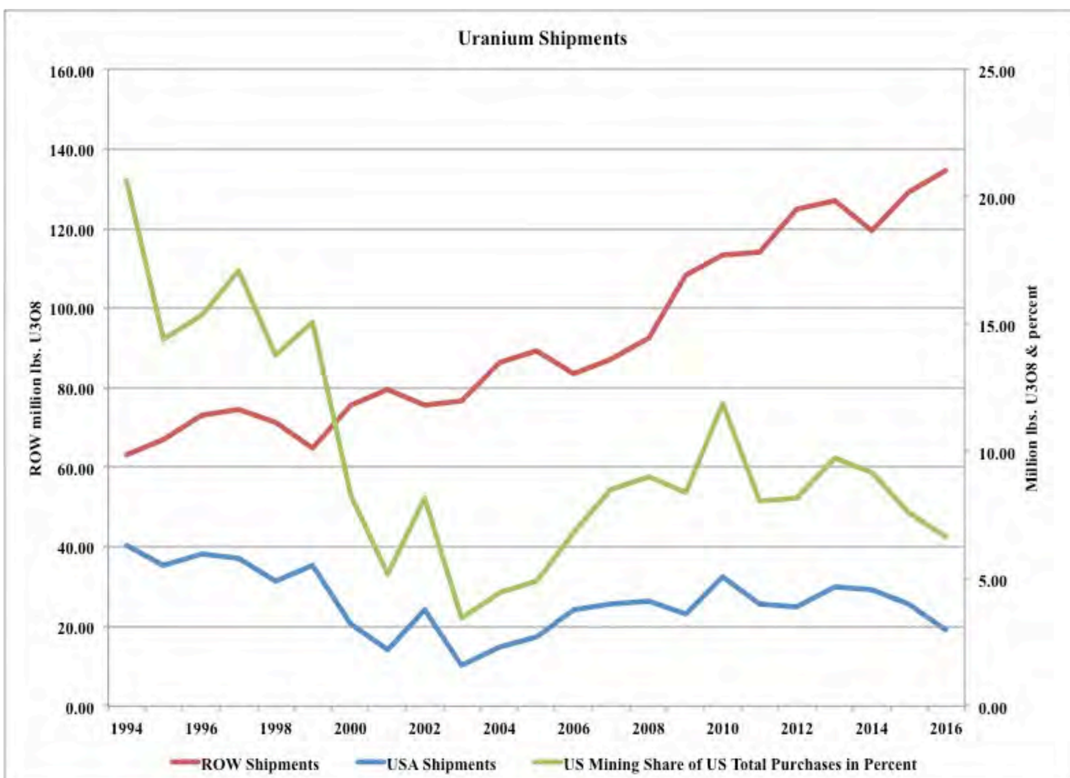

Figure 2: Uranium shipments

Purchases of domestic-origin uranium averaged 8 million pounds per year over the sample period while mining shipments were slightly more than half of this amount at 4.11 million pounds (see Table 1). The difference reflects secondary sources of supply from government stockpiles and re-processors of higher-grade uranium products. The US mining share of uranium shipments in total uranium purchases was over 20 percent in 1994, fell to less than 4 percent in 2003, recovered to nearly 12 percent in 2010 but then fell again to 6.6 percent in 2016. Uranium shipments from mines in the rest of the world more than doubled over the sample period while US uranium mining shipments fell (see Figure 2).

US commercial inventories averaged over 110 million pounds per year, which are more than twice annual uranium requirements (see Table 1). Changes in commercial inventories are also sizable and at times exceed purchases of domestic-origin uranium (see Figure 3). Purchases of foreign-origin uranium averaged more than 44 million pounds per year and peaked at more than 56 million pounds in 2006. Sales of uranium from government inventories are not included in commercial inventories and have been an issue for the uranium industry, see US Department of Commerce (2017) and Meade and Supko (2017).

Spot prices for uranium increased sharply in 2007 (see Figure 4). Contract prices and prices for domestic and foreign-origin uranium also increased and have remained above levels during 1994 to 2005. As previously mentioned, spot prices are currently $24 per pound.

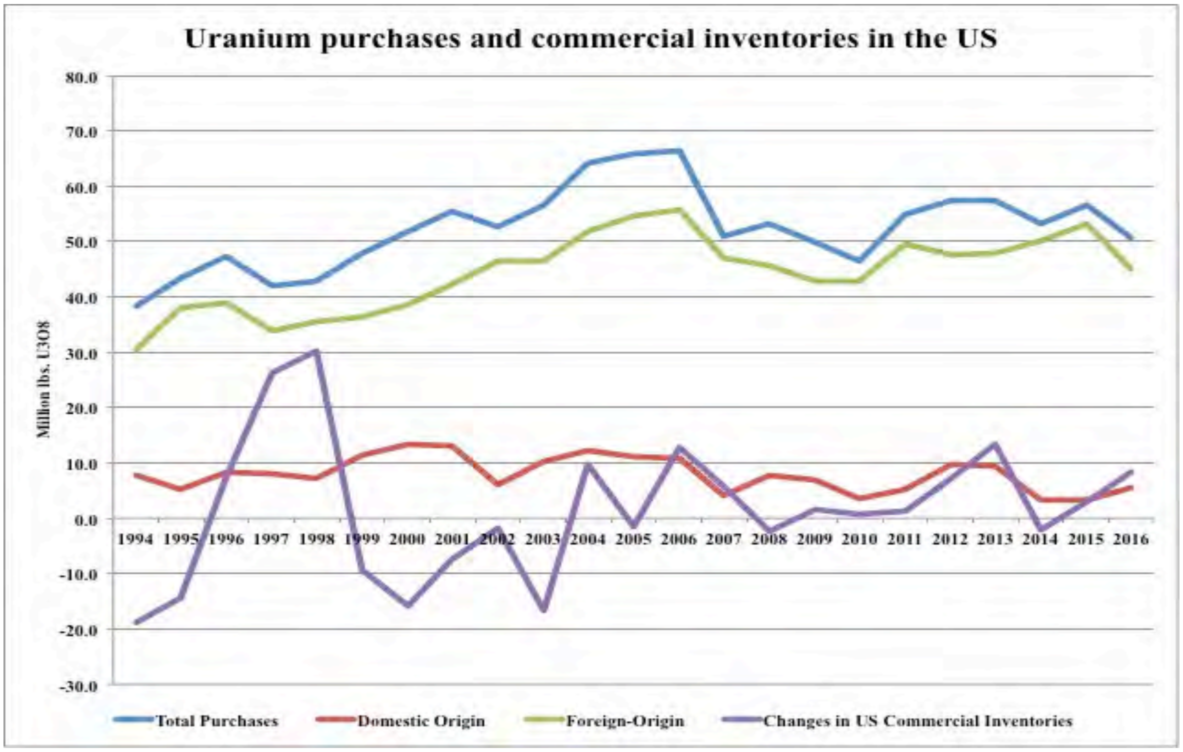

Figure 3: Uranium purchases and inventories

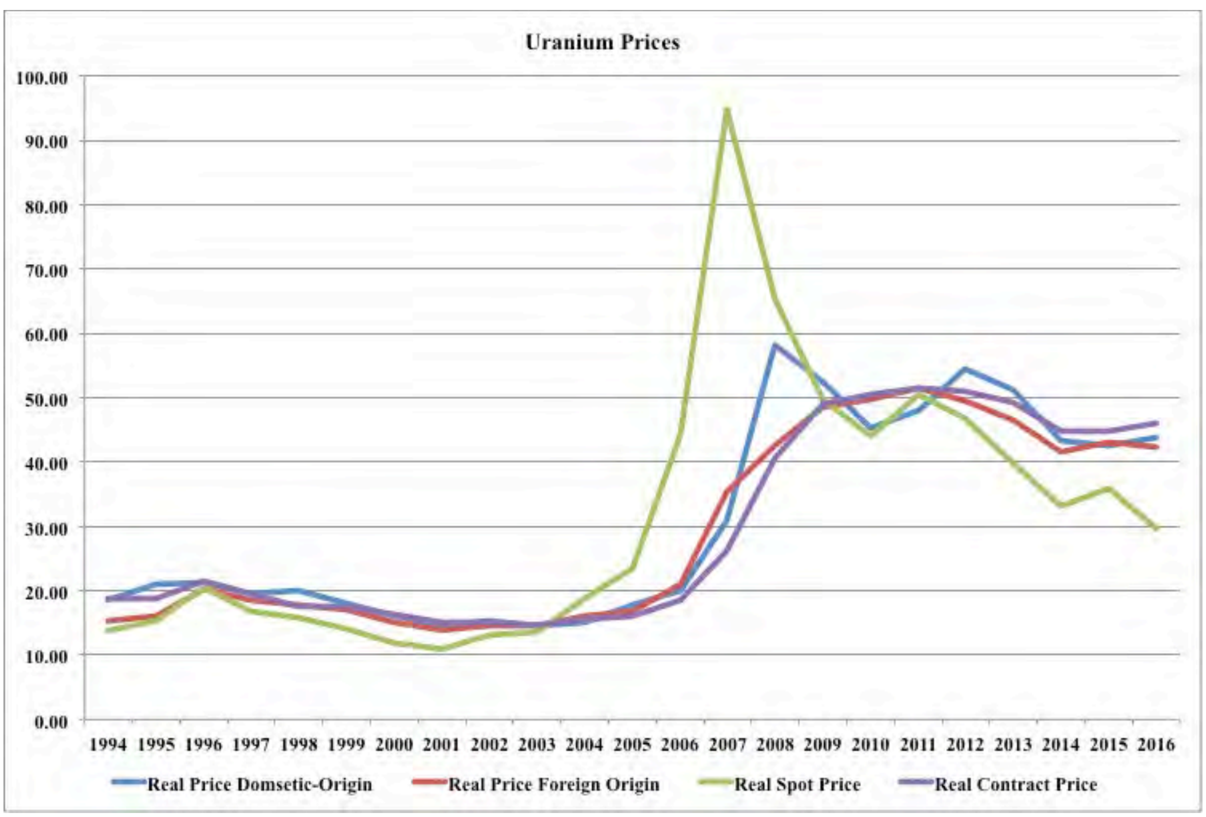

Figure 4: Uranium prices

3. Econometric Model

The econometric model has three blocks representing supply and demand in the U.S. and the rest of the world. Given the small sample available, the supply and demand equations are parsimonious, relating the endogenous variables in Table 1 with each other, lagged endogenous variables, and exogenous factors, such as the producer price index, interest rates, structural shifts, and market shocks. The three sub-sections below describe the behavioral relationships within each block.

3.1 US Demand

The US demand block determines nuclear electric capacity and generation and total purchases of uranium, purchases of foreign-origin uranium, and shipments from US uranium mines. The number of nuclear power plants has steadily declined over the sample period from 109 in 1994 to 99 in 2016. The resulting loss of electric power generation capability, however, has been offset by higher capacity factors due to more efficient management of nuclear electricity generation facilities. Accordingly, US nuclear capacity is hypothesized as a function of the number of plants, lagged capacity factor, and lagged capacity to capture dynamic adjustments. The US nuclear capacity equation, therefore, is as follows:

$$K_t^u = \alpha_0 + \alpha_1 NP_t + \alpha_2 CF_{t-1} + \alpha_3 K_{t-1}^u \quad (1)$$

where K_t^u is US nuclear capacity (the superscript u denotes the region, in this case the US), NP_t is the number of nuclear power plants operating, CF_{t-1} is nuclear capacity factor lagged one period, and αs are unknown parameters to be estimated. US nuclear generation, G_t^u, is simply a function of the lagged capacity factor:

$$G_t^u = \beta_0 + \beta_1 CF_{t-1} \qquad (2)$$

where the βs are unknown parameters.

Total purchases of uranium in the US, Q_t^u, are specified as a function of real prices, nuclear generation, and lagged purchases:

$$Q_t^u = \chi_0 + \chi_1 \left(P_t^a / PPI_t \right) + \chi_2 G_t^u + \chi_3 Q_{t-1}^u \qquad (3)$$

where P_t^a is the weighted average price of uranium defined below in the supply block, PPI_t is the producer price index, and the χs are parameters to be estimated. The relation for purchases of foreign-origin uranium, Q_t^f, follows the same specification:

$$Q_t^f = \delta_0 + \delta_1 \left(P_t^a / PPI_t \right) + \delta_2 G_t^u + \delta_3 Q_{t-1}^f \qquad (4)$$

where the δs are unknown parameters. Uranium in fuel assemblies at nuclear power plants are also specified in a similar fashion:

$$Q_f^b = \lambda_0 + \lambda_1 \left(P_t^a / PPI_t \right) + \lambda_2 G_{t-1}^u + \lambda_3 G_{t-2}^u \qquad (5)$$

where the λs are unknown parameters. Nuclear generation with a two-year lag is included to capture lags in fuel loadings, processing, and deliveries.

Uranium shipments from US mines, S_t^u, are determined by the following identify:

$$S_t^u = Q_t^u - Q_t^o - Q_t^f \qquad (6)$$

where Q_t^o are other sources of uranium concentrate, such as those from government stocks and uranium fuel processors. This source of uranium supply has dwindled in recent years and is, therefore, assumed to be exogenous in the model simulations presented in section 5.

3.2 US Supply

The supply block determines prices for uranium concentrate by transactions type, either spot or contract, and source of supply, either domestic or foreign-origin. The domestic-origin uranium price is specified as a function of domestic mining shipments and lagged prices. Klingbiel (2017) notes that world in-situ uranium resources peaked in 2007 at around 34 billion pounds and fell to 25 billion pounds by 2015 with increased incremental production cost. Accordingly, the US supply function allows for a structural shift in 2007 as follows:

$$P_t^d = \phi_1 S_t^u + \phi_2 H_t + \phi_3 P_{t-1}^d \tag{7}$$

where P_t^d is the price of domestic-origin uranium, S_t^u is domestic mining shipments, the dummy variable, H_t, is for the pre and post 2007 structural supply shift, and the ϕs are unknown parameters.

The domestic and foreign-origin uranium prices include spot and contract prices so that a weighted average of the former two prices is equal to the weighted average of the latter two prices. To maintain consistency with how market shocks affect US prices, spot and contract prices, P_t^s and P_t^c respectively, are specified as functions of the weighted average price of domestic and foreign-origin uranium, lagged spot and contract prices respectively, and a dummy variable for the speculative spike in uranium and other resource prices in 2007, D_t^{2007}:

$$P_t^s = \gamma_1 P_t^a + \gamma_2 P_{t-1}^s + \gamma_3 D_t^{2007} \tag{8}$$

$$P_t^c = \eta_1 P_t^a + \eta_2 P_{t-1}^c + \eta_3 D_t^{2007} \tag{9}$$

where the γs and ηs are parameters to be econometrically estimated.

Total US commercial inventories are specified as a function of user costs, see Considine (2006), of holding stocks of uranium, U_t, which is defined as follows:

$$U_t = \ln\left(P_t^s / P_t^c\right) + r - \ln\left(PPI_t / PPI_{t-1}\right) \tag{10}$$

where r is the risk free interest rate given by the three-month US Treasury bill rate. The last two terms in (10) represent the real opportunity cost of funds tied up in physical inventories. The first term in (10) is the percentage difference between the spot and contract price. The contract price serves as a proxy for expected prices to prevail in the future. If the spot price is greater than the expected price, which is known as a price backwardation, inventories should decline. Conversely, if the contract price exceeds the spot price, which is a price contango, inventories should increase. Hence, inventories should be inversely related to user costs. Accordingly, the relationship for US total commercial uranium inventories is specified as a function of user costs, sales or, in this case, nuclear power generation, and a two-year lag of inventories, which is consistent with the fuel loading cycles discussed above:

$$I_t = \kappa_1 U_t + \kappa_2 G_t^u + \kappa_3 I_{t-1} + \kappa_4 I_{t-2} \tag{11}$$

where the κs are parameters to be estimated. Inventories are expected to increase with nuclear electric power generation.

3.3 Rest of World

The final block of the model includes equations that determine the price of foreign-origin uranium, average prices for domestic and foreign origin uranium, nuclear capacity and generation, demand, and mining shipments for the rest of the world. The price of foreign origin uranium, P_t^f, is specified as a function of world uranium mining shipments, S_t^w, the dummy variable, H_t, for the pre and post 2007 structural supply shift discussed above, beginning inventories, and lagged foreign prices:

$$P_t^f = \varphi_1 S_t^w + \varphi_2 H_t + \varphi_3 I_{t-1} + \varphi_4 P_{t-1}^f \qquad (12)$$

where the φs are structural parameters. With the specification of price for foreign-origin uranium, average prices can be endogenously calculated in full model simulation as follows:

$$P_t^a = \frac{\left[P_t^d\left(S_t^u + S_t^o\right) + P_t^f Q_t^f\right]}{Q_t^u} \, . \qquad (13)$$

Nuclear power capacity in the rest of the world, K_t^r, is specified as follows:

$$K_t^r = \pi_0 + \pi_1\left[\left(P_{t-1}^f / PPI_{t-1}\right) / DI_{t-1}\right] + \pi_2 K_{t-1}^r + \pi_3 K_{t-2}^r \qquad (14)$$

where DI_{t-1} is the lagged trade weighted exchange value of the US dollar and the πs are unknown parameters. This dynamic formulation is similar to the model estimated by Kahouli (2011) with a lag in the real price of uranium in foreign currencies. Nuclear power generation for the rest of the world, G_t^r, has a similar specification:

$$G_t^r = \nu_0 + \nu_1\left[\left(P_t^f / PPI_t\right) / DI_t\right] + \nu_2 K_t^r + \nu_3 G_{t-1}^r \qquad (15)$$

where the νs are parameters whose estimates are presented in the following section.

The demand for uranium in the rest of the world, Q_t^r, is also specified as a function of real prices in foreign currencies and nuclear power generation:

$$Q_t^r = \mu_0 + \mu_1\left[\left(P_t^f / PPI_t\right) / DI_t\right] + \mu_2 G_t^r + \mu_3 D_t^f + \mu_4 D_t^{99} \tag{16}$$

where D_t^f is a dummy variable for 2011 when the Fukushima disaster occurred, D_t^{99} is a dummy variable for an inventory shock in 1999, and the μs are unknown parameters.

The model is closed with identities defining world uranium requirements and shipments of uranium from mining:

$$Q_t^w = Q_t^r + Q_t^b \tag{17}$$

$$S_t^r = Q_t^w - S_t^u - S_t^c \tag{18}$$

$$S_t^w = S_t^r + S_t^u \tag{19}$$

where S_t^c is other sources of uranium supply in the rest of the world, such as processing plants and commercial and government inventories, which are assumed exogenous in the policy simulations of the model.

The nineteen-equation model has thirteen behavioral equations and six identities. Under import quotas, the demand for foreign origin uranium (4) is replaced with an equation that specifies that foreign origin demand, Q_t^f, is equal to the product of the domestic quota share, ψ_i, and total domestic purchases, Q_t^u:

$$Q_t^f = \left(1 - \psi_i\right) Q_t^u \ . \tag{20}$$

4. Econometric Results

The parameter estimates for the behavioral equations are presented in this section. The equations for US nuclear capacity and generation are estimated with robust or heteroskedastic-consistent standard errors using ordinary least squares because these models contain no endogenous explanatory variables. The estimates for these equations appear in Table 2. All coefficients have the expected signs with capacity increasing with the number of nuclear plants and capacity factors. Generation is strongly related to lag capacity. Both equations have relatively high coefficients of determination, R^2, and the Breusch and Godfrey (BG) statistics indicate an absence of autocorrelation.

Table 2: Parameter estimates for demand side of U.S. uranium market

Dependent Variable *Explanatory Variables*	*Estimated Coefficient*	*Standard Error**	*t-Stat.*	*Adj. R^2*	*BG***
Nuclear Generation Capacity					
Intercept	-5.901	9.286	-0.635	0.854	16.460
Number plants	0.308	0.057	5.404		
Capacity factor lagged	0.139	0.019	7.316		
Nuclear capacity lagged	0.618	0.083	7.446		
Nuclear Electricity Generation					
Intercept	114.110	79.590	1.434	0.852	15.168
Nuclear Capacity lagged	7.501	0.889	8.438		
Total Uranium Purchases					
Real average price	-0.089	0.060	-1.483	0.567	10.063
Generation	0.040	0.013	3.077		
Total purchases lagged	0.478	0.208	2.298		
Foreign Uranium Purchases					
Intercept	-10.193	19.500	-0.523	0.670	13.138
Real average price	-0.088	0.062	-1.419		
Generation	0.036	0.062	0.583		
Foreign purchases lagged	0.684	0.699	0.979		
Uranium in Fuel Assemblies					
Intercept	10.931	16.621	0.658	0.559	10.876
Real average price	-0.233	0.085	-2.741		
Generation lagged	0.143	0.042	3.405		
Generation lagged twice	-0.083	0.057	-1.456		

* Standard Errors are heteroskedastic-consistent
** Breusch-Godfrey test for autocorrelation in the residuals, 5% critical value = 5.99

The remaining equations in the model are estimated using two-stage least squares with heteroskedastic-consistent standard errors. The instruments vary by equation but generally included lagged endogenous variables, crude oil prices, and the market shock dummies discussed above. Estimates for the three US demand equations appear in Table 2. The coefficients on real prices have the expected negative signs while the coefficients on nuclear generation have the expected positive signs.

The real price effects for total and foreign uranium purchases are only significant at the 15 percent level, suggesting a 15 percent probability that these effects are insignificantly different from zero. Nuclear power generation is significantly related to total uranium purchases and to uranium loaded into power plant fuel assemblies. All three equations have R^2 coefficients that suggest the models explain more than half the variation in the respective endogenous variable. The Breusch-Godfrey statistics indicate the absence of autocorrelation.

Estimates for the US supply-side equations are presented in Table 3. Prices for domestic-origin uranium are significantly related to US uranium mining shipments so that higher shipments are related to higher prices. Notice that the estimated coefficient for the structural shift after 2007 is large and significant, which is consistent with the view by Klingbiel (2017) that depletion has contributed to higher incremental production costs. The estimates for the spot and contract price equations also appear in Table 3 and have the expected signs and fit the data reasonably well with minimal autocorrelation.

Finally, the two-stage least squares estimation of the inventory equation also has the expected signs and reasonably high levels of statistical significance and goodness of fit statistics, given by the R^2 coefficient and the Breusch-Godfrey statistic. The estimated coefficient for user costs in the inventory equation is -14.4 with a t-statistic of -1.72, suggesting only an 8.5 percent probability that inventories are not affected by user costs.

Hence, US commercial uranium inventories are likely sensitive to user costs and, in particular, the spread between spot and contract prices, which drives most of the variability in the user cost of inventories.

Table 3: Parameter estimates for supply side of U.S. uranium market

Dependent Variable / *Explanatory Variables*	Estimated *Coefficient*	Standard *Error**	*t- Stat.*	*Adj. R^2*	*BG***
Domestic Uranium Prices					
Domestic shipments	2.036	0.746	2.729	0.899	16.435
Post 2007 Dummy	24.095	10.099	2.386		
Domestic prices lagged	0.316	0.245	1.437		
Spot Prices					
Average uranium price	0.471	0.156	3.019	0.924	17.091
Spot price lagged	0.467	0.133	3.511		
Dummy 2007	54.401	1.246	43.661		
Contract Prices					
Average uranium price	0.794	0.053	14.869	0.998	17.980
Contract price lagged	0.231	0.056	4.132		
Dummy 2007	-5.535	0.830	-6.668		
US Commercial Inventories					
User costs	-14.443	8.376	-1.724	0.581	10.876
U.S. nuclear generation	0.093	0.037	2.510		
Beg. Inventories	1.072	0.206	5.210		
Beg. Inventories lagged	-0.706	0.317	-2.230		

* Standard Errors are heteroskedastic-consistent
** Breusch-Godfrey test for autocorrelation in the residuals, 5% critical value = 5.99

The parameters estimates for the remaining four-equations in the model for the rest of the world appear in Table 4. World uranium demand is highly significant in the equation for prices of foreign-origin uranium, along with the post 2007 dummy variable for the structural shift discussed above. Lagged US commercial inventories are also statistically significant. Overall, the foreign uranium price equation fits the data very well with an absence of autocorrelation in the residuals.

The estimates for uranium demand in the rest of the world also appear in Table 4. Real prices are highly significant. Dummy variables for the Fukushima nuclear disaster and the 1999 inventory shock are also statistically significant. The remaining two equations for nuclear capacity and generation for the rest of the world indicate that reasonably significant price effects and plausible responses to lagged capacity and generation.

Table 4: Parameter estimates for rest of world (row) uranium market

Dependent Variable / *Explanatory Variables*	*Estimated Coefficient*	*Standard Error**	*t- Stat.*	*Adj. R^2*	*BG***
Foreign Uranium Prices					
World uranium shipments	0.139	0.036	3.860	0.969	17.705
Post 2007 Dummy	16.367	2.220	7.372		
Lagged U.S. inventories	-0.038	0.025	-1.519		
Foreign prices lagged	0.411	0.072	5.717		
Uranium demand					
Intercept	75.105	15.276	4.917	0.563	11.594
Real price dollar adj.	-0.386	0.123	-3.138		
Nuclear generation (row)	0.013	0.009	1.401		
Dummy for Fukushima	-11.368	1.868	-6.087		
Dummy 1999	-13.758	1.096	-12.556		
Nuclear Electricity Generation					
Intercept	27.633	167.006	0.165	0.793	14.848
Real price dollar adj.	-2.170	0.867	-2.503		
Nuclear capacity (row)	1.532	0.713	2.149		
Nuclear generation lagged	0.795	0.053	15.008		
Nuclear Capacity					
Intercept	-33.958	24.268	-1.399	0.945	16.347
Real price lagged	-0.091	0.065	-1.402		
Nuclear capacity lagged	0.739	0.218	3.382		
Nuclear capacity lagged twice	0.414	0.272	1.524		

* Standard Errors are heteroskedastic-consistent
** Breusch-Godfrey test for autocorrelation in the residuals, 5% critical value = 5.99

Unlike log-linear models with constant elasticities of supply and demand, the linear equations estimated here have variable elasticities. These elasticities are computed for each point in the sample and are summarized in Table 5 below. The demand elasticities are presented in the top panel of Table 5 and show very price inelastic demand in both the short and long run. The elasticities of demand with respect to nuclear generation are also inelastic in the short-run but are elastic or greater than one, except for uranium requirements in the rest of the world.

The elasticities of prices for domestic and foreign-origin uranium are also inelastic in the short-run and elastic in the long-run (see Table 5). The inverse of these price elasticities are supply elasticities with respect to price. The estimates in Table 5 indicate that the short-run supply elasticities are slightly elastic at 1.4 and 1.1 for the US and the rest of the world respectively. Very price inelastic demand combined with relatively low price elasticities of supply help explain why uranium prices, like many other fuel commodities, are so volatile.

Table 5: Demand and Supply Elasticities

Demand Elasticities		
Total Domestic Purchases of Uranium	*Short-Run*	*Long-Run*
Price	-0.053	-0.101
Nuclear Generation	0.582	1.116
Purchases of Foreign-Origin Uranium		
Price	-0.060	-0.189
Nuclear Generation	0.616	1.953
Uranium in Fuel Assemblies in USA		
Price		-0.153
Nuclear Generation		2.253
Uranium Requirements Rest of World		
Price		-0.079
Nuclear Generation		0.259
Price Elasticities		
Prices for Domestic-Origin Uranium	*Short-Run*	*Long-Run*
US Mining Shipments	0.728	1.062
Prices for Foreign-Origin Uranium		
Rest-of-World Mining Shipments	0.875	1.986
U.S. Commercial Inventories	-0.775	-1.760
U.S. Commercial Inventories		
Spot Prices	-0.128	-0.202
US Nuclear Generation	0.644	1.015

5. Market Impacts of Import Quota

The impacts of the import quota are estimated by simulating the above model under the 25 percent quota with a sensitivity analysis performed using a 20 percent quota. Under the 25 percent domestic production quota, prices for domestic-origin uranium rise between \$21 and \$32 per pound from 2018 to 2022 (see Table 6), which translate to a 69 and 104 percent increase in domestic prices. According to Ux (2017), for the 111 mines operating around the world, the average total cost of production is \$40 per pound with a standard deviation of $15. Maximum production costs are $82 per pound. With current market prices of $24 per pound, the 25 percent quota would bring domestic prices back into range with average world production costs. Domestic mining shipments would increase by 10.34 million pounds in 2018 and by 10.20 million pounds in 2022. Greater shipments at higher prices would result in an increase in domestic uranium mining revenues of $551 million in 2018 and $690 million in 2022. These revenues would provide a substantial stimulus to states with uranium mining facilities and would likely lead to even greater gains to domestic employment, income, and tax revenues.

Table 6: Differences from base simulation under a 25 percent domestic quota, 2018 – 2022

Endogenous Variable	*2018*	*2019*	*2020*	*2021*	*2022*
Nuclear Capacity			*Gigawatts*		
USA	0.00	0.00	0.00	0.00	0.00
Rest-of-World	0.00	0.01	0.03	0.06	0.09
Nuclear Generation			*Thousand Gigawatt hours*		
USA	0.00	0.00	0.00	0.00	0.00
Rest-of-World	0.29	0.79	1.37	1.93	2.39
Uranium Requirements			*Million pounds U3O8*		
USA	-0.93	-1.28	-1.37	-1.38	-1.37
Rest-of-World	0.00	0.01	0.02	0.03	0.03
Commercial Inventories	0.47	0.99	1.07	0.65	0.05
Purchases of Uranium					
Total US	-0.36	-0.66	-0.84	-0.94	-0.98
Domestic Mining	10.34	10.21	10.16	10.16	10.20
Foreign-Origin	-10.70	-10.88	-11.01	-11.10	-11.17
Rest-of-World Mining	-11.27	-11.48	-11.51	-11.52	-11.54
Prices for U3O8			*Dollars per pound*		
Domestic-Origin	21.06	28.22	30.63	31.48	31.85
Foreign-Origin	-0.13	-0.25	-0.33	-0.37	-0.36
Average	4.17	5.83	6.36	6.55	6.64
Spot	1.97	3.67	4.71	5.28	5.60
Contract	3.32	5.40	6.30	6.66	6.82
Commercial Inventories			*Percent*		
User Costs	-3.2	-3.4	-2.3	-1.4	-0.8
Domestic Mining Share	18.9	18.7	18.7	18.7	18.7
Revenues & Costs			*Million dollars*		
US Mining Revenues	551.4	642.3	673.0	684.5	690.4
Total Uranium Costs	218.2	299.1	322.0	329.7	334.0
			Dollars per MWh		
Avg. Retail Electric Rates	0.06	0.08	0.09	0.09	0.09

Incremental uranium costs for COOs are $218 million in 2018 and $334 million in 2022. If COOs pass these costs to consumers, however, electricity rates would rise imperceptibly. The incremental uranium costs due to the import quotas are less than one-tenth of one percent of the average retail price of electricity. Given lower demand for foreign-origin uranium, shipments from uranium mining in the rest of the world declines by more than 11 million pounds per year from 2018 to 2022 (see Table 6). Recently, several overseas producers have announced cutbacks in production due to low prices.

The results from a 20 percent domestic production quota appear in Table 7. In this case, prices for domestic-origin uranium would increase by $15.53 per pound in 2018 and

Table 7: Differences from base simulation under a 20 percent domestic quota, 2018 – 2022

Endogenous Variable	*2018*	*2019*	*2020*	*2021*	*2022*
Nuclear Capacity			*Gigawatts*		
USA	0.00	0.00	0.00	0.00	0.00
Rest-of-World	0.00	0.01	0.02	0.03	0.05
Nuclear Generation			*Thousand Gigawatt hours*		
USA	0.00	0.00	0.00	0.00	0.00
Rest-of-World	0.16	0.44	0.78	1.09	1.36
Uranium Requirements			*Million pounds U3O8*		
USA	-0.52	-0.72	-0.78	-0.78	-0.78
Rest-of-World	0.00	0.01	0.01	0.01	0.02
Commercial Inventories	0.27	0.58	0.64	0.40	0.05
Purchases of Uranium					
Total US	-0.20	-0.37	-0.48	-0.53	-0.55
Domestic Mining	7.63	7.54	7.50	7.51	7.54
Foreign-Origin	-7.83	-7.91	-7.98	-8.04	-8.10
Rest-of-World Mining	-8.14	-8.25	-8.27	-8.28	-8.31
Prices for U3O8			*Dollars per pound*		
Domestic-Origin	15.53	20.82	22.61	23.26	23.55
Foreign-Origin	-0.07	-0.14	-0.19	-0.21	-0.21
Average	2.32	3.29	3.60	3.72	3.78
Spot	1.09	2.06	2.66	2.99	3.18
Contract	1.84	3.04	3.57	3.78	3.88
Commercial Inventories			*Percent*		
User Costs	-1.9	-2.0	-1.4	-0.9	-0.5
Domestic Mining Share	13.9	13.7	13.7	13.7	13.7
Revenues & Costs			*Million dollars*		
US Mining Revenues	364.5	418.1	436.7	444.1	448.3
Total Uranium Costs	121.6	169.9	183.8	188.7	191.5
			Dollars per MWh		
Avg. Retail Electric Rates	0.03	0.05	0.05	0.05	0.05

by \$23.55 per pound in 2022. Domestic mining shipments would increase by 7.63 million pounds in 2018 and by 7.54 million pounds in 2022. Greater shipments at higher prices would result in \$364 million in additional uranium mining industry revenues in 2018 and over \$448 million in 2022. Uranium costs for COOs would increase by \$122 million in 2018 and if these costs would be passed through to customers, average retail electricity rates would increase \$0.03 per MWh or 0.03 percent.

For electricity supply regions with wholesale pricing of electricity, the uranium production quota would affect the competitiveness of nuclear power in power markets. To measure how this competitiveness would be affected, the incremental uranium cost due to the quota is divided by nuclear electricity output. Unit incremental costs are \$0.27 and \$0.41 per MWh under the 25 percent quota and would be from \$0.15 and \$0.24 per megawatt hour (MWh) under a 20 percent quota (see Figure 5). These incremental costs

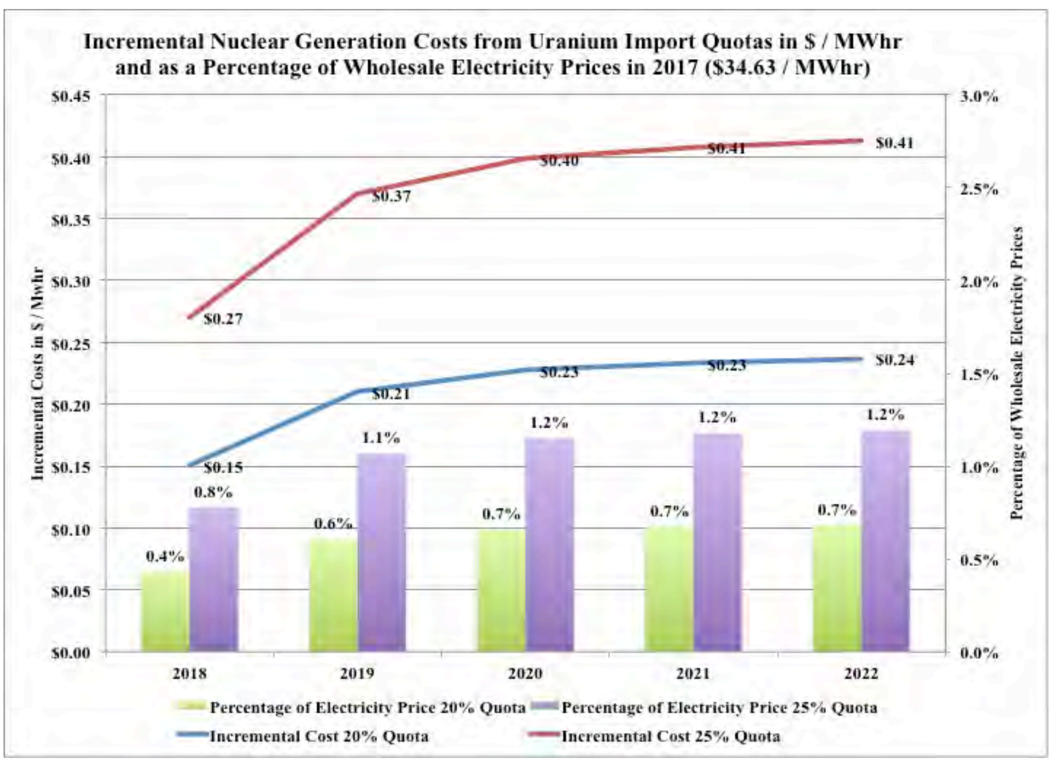

Figure 5: Incremental costs and wholesale electricity prices

are from 0.8 and 1.2 percent of average wholesale electricity prices under the 25 percent quota. With a 20 percent quota, the unit incremental uranium costs facing COOs would be from 0.4 and 0.7 percent of the wholesale price of electricity (see Figure 5).

6. Inventories and the Duration of Quotas

A simulation is also performed to understand the role of price expectations in inventory holding, which has implications for how long production quotas should remain in place to avoid a self defeating drawdown of inventories that would negate the sought after relief for the uranium mining industry. This final model simulation addresses the issue of how long quotas should be imposed if they are enacted. The US uranium industry holds between 1.5 and 3.2 years of domestic sales as inventory. This suggests that there is a considerable amount of supply that could be drawn from inventories. If a quota system were enacted for a temporary period, say two years, then producers would expect prices to decline once the quotas expired. While it would be unlikely for them to completely stock-out to avoid buying higher cost uranium now to re-stock later at a lower price, this does raise the question of how inventories would respond in such a situation. To address this issue, a simulation of a price backwardation is performed.

Under this scenario, contract prices, which serve as a proxy for prices expected to prevail in the future, are assumed to be lower than spot prices on uranium for immediate delivery. A temporary quota program would likely lead to a price backwardation that would provide incentives to meet current supply requirements from inventories because uranium would be cheaper to buy once import quotas are lifted. This could prevent utilities from entering into the higher-price long-term contracts with US producers that would be required to incentivize increased US production.

The increase in average prices paid by COOs under the quota is about $5 per pound. This suggests that once the quota is removed, average uranium prices could drop by this amount. Accordingly, a model simulation that reduces contract prices by $5 per year is performed and the results are displayed in Figure 6. The blue line plots the difference between spot and contract prices or the degree of the price backwardation from 2018 to 2022. For this price backwardation, the potential supply from inventory drawdowns range from 2.5 to over 7.7 million pounds per year. Hence, inventory drawdowns could negate the effects of the import quota.

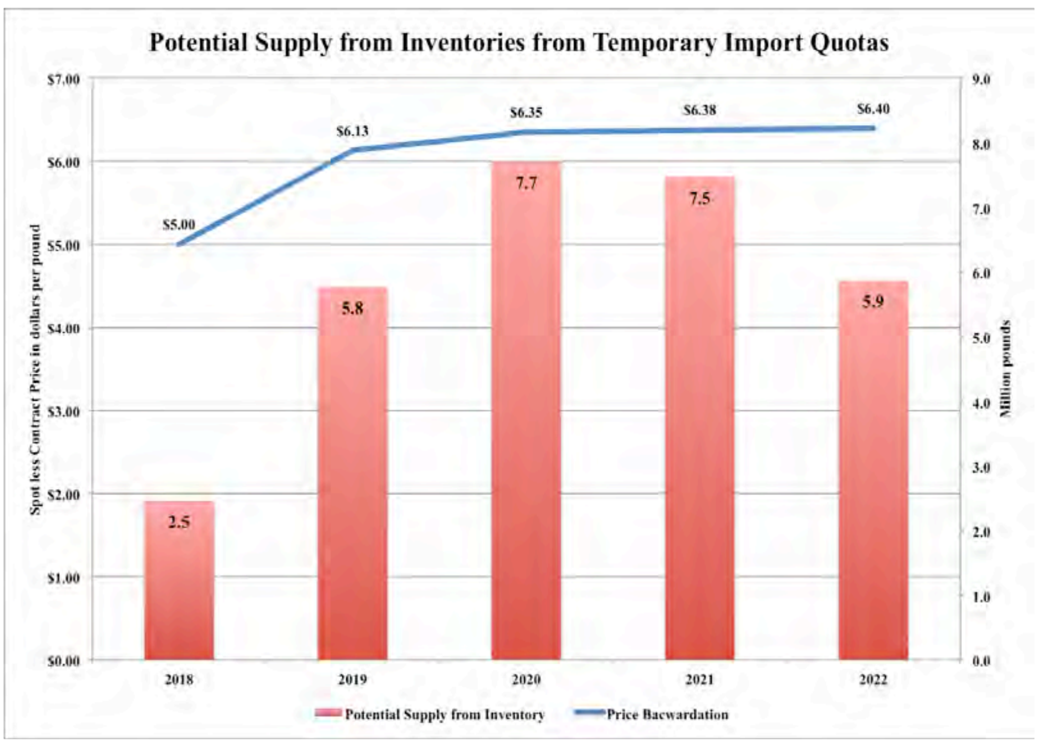

Figure 6: Potential supply from inventories under temporary quotas

Over the past 20 years, total US commercial inventories were as low as 72.5 million pounds in 1995 and as high as 143.9 million pounds in 2016, which is a difference of 71.4 million pounds. If 5.9 million pounds per year were drawn from this inventory buffer, it would be depleted after 12 years. Hence, a domestic production quota system should be adopted for a minimum of a decade and probably longer. This would encourage US utilities to enter into the long-term contracts with US producers required to support the modeled increase in US production.

7. Summary and Conclusions

The Fukushima nuclear accident in 2011 was a watershed event for the world uranium industry, forcing Japan to shutter its nuclear power industry. As a result, world nuclear power generation peaked in 2010 and has yet to recover. Meanwhile, mines developed on the premise of unrealized expectations of robust demand growth have come into production as demand fell and then stagnated. As a result, higher production from Russia, Kazakhstan, and Uzbekistan in recent years is contributing to lower uranium prices. These low prices are forcing US producers to reduce production and this combination is threatening the economic and financial viability of US uranium producers who, as a result, are proposing an import quota. This study estimates the market impacts of the proposed import quota by developing an econometric model of the world uranium market and simulating it out of sample from 2018 to 2022.

The model is estimated with a data sample from 1994 through 2016. The US generates slightly less than a third of world nuclear power production. Despite having the largest number of nuclear power plants, the US imports more than 90 percent of its uranium requirements. In 1994, this import dependency was roughly 80 percent. Uranium prices peaked in 2007 and have been sliding down ever since. Recently, prices are breaking even lower approaching price levels witnessed 20 years ago.

The econometric model developed in this study includes supply and demand relations for the US and the rest of the world. The econometric estimates are consistent with previous peer reviewed studies finding very price inelastic demand. The estimated supply elasticities, however, are somewhat higher than previous estimates, which intuitively is consistent with recent production increases from the world outside the US. The supply elasticities, however, are just barely in the elastic range. The econometric analysis also found that the incremental cost of US production had a sharp break upward after 2007, perhaps reflecting the effects of depletion of low cost sources of uranium.

Under the 25 percent quota, prices for domestic-origin increase by \$21 to \$31 per pound. Annual domestic uranium production increases over 10 million pounds. As a result, domestic uranium mining revenues increase between \$551 and \$690 million per year. Prices for foreign-origin uranium decline slightly, which moderates the cost increases facing civilian nuclear plant owner and operators. If these costs are passed completely through to customers, as is likely in regulated electricity markets, retail electricity prices would increase by less than one-tenth of one percent. Even in areas where nuclear power plants operate in competitive wholesale markets, operating costs would rise at most \$0.41 per MWh, which is about 1.2 percent of wholesale power prices, hardly a magnitude that would affect the position of these plants in the rank ordering of plants by cost. Under a 20 percent quota, prices for domestic-origin uranium would increase between \$15-\$23 dollars per pound and retail electricity prices would increase by approximately one-twentieth of one percent.

The model simulation analysis also examines the role of price expectations and inventories under a temporary import quota. The analysis suggests that a modest increase in the difference between spot and contract or long term expected prices would incentivize a substantial drawdown in inventories. Accordingly, if the quotas are temporary, COOs would likely draw down their inventories, waiting for the program to end and lower prices to return. Hence, if an import quota is adopted it should be imposed over at least a decade and probably longer in order to encourage US utilities to enter into the long-term contracts with US producers required to support the desired increase in US uranium production.

In conclusion, this study finds that a 25 percent quota would provide substantial relief for companies mining uranium in the US, with minimal impacts to US electricity prices and costs to consumers. If the US wants a uranium mining industry in the long term, such an import quota may be one option to consider.

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Exhibit 3

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Technical Memorandum

To:	Mark Herlach Allison Speaker	**Date:**	January 16, 2018
Company:	Eversheds Sutherland (US), LLP	**From:**	John Pfahl
Copy to:	David Frydenlund, Energy Fuels Resources (USA), Inc. Penne Goplerud, Ur-Energy USA, Inc.	**Reviewed by:**	Terry Braun
Subject:	Global Operating Cost Curve for Primary Uranium Production, Section 232 Investigation of Uranium Imports	**Project #:**	520200.010

1. Introduction

Eversheds Sutherland (US), LLP (Eversheds) retained SRK Consulting (U.S.), Inc. (SRK) to prepare a global operating cost curve for primary uranium production. SRK understands this cost curve will be part of a global economic evaluation of uranium markets conducted by others.

This memorandum describes the development and basis for the cost curve. SRK limited the cost curve to existing U_3O_8 (yellowcake) production from conventional and in situ uranium mines. In general, SRK relied on published cost documentation from financial reports and industry information. Where possible and within the limits of client confidentiality, SRK validated published cost information with private data from our internal project library. SRK itemized cost inputs in terms of US dollars to allow direct comparison of operating costs, including the impact of foreign exchange.

2. Methodology

SRK reviewed and compiled production cost data based on the following categories:

- Mining,
- Process,
- Site selling, general and administrative (SG&A),
- Corporate SG&A,
- Sustaining Capital, and
- Environmental.

These categories capture the full cost to produce yellowcake, including mining taxes / royalties (included in Corporate SG&A if reported separately) from existing mining operations.

SRK **excluded** the following costs:

- Capital depreciation and amortization,
- Corporate taxes on profits,

- Capital that can be attributed to the construction of new production volumes (note that many operators report some capital as expansion capital that does not actually increase production levels; SRK included this type of capital in the cost curve analysis),
- Financial costs (e.g. debt service). Although these costs can have a significant impact to a producer, if a corporation is restructured or an operation changes hands, these costs are not carried across and therefore not necessary to sustain production,
- Overhead / administrative costs that can be allocated to alternative business segments (e.g. enrichment), and
- Care and maintenance costs for operations not related to the operation of interest (e.g., costs from Paladin's suspended Kayelekera operation are not included in the costs for the operating Langer Heinrich mine).

As a result, all things equal, the full cost to produce yellowcake from new mines would be increased over the costs shown in the cost curve, to reflect the capital costs associated with permitting and construction of new facilities.

Global yellowcake production reflects our estimate of 2018 production and includes costs appropriate for the current uranium price environment, but also adequate to sustain long term production.

Given that the current uranium price environment is significantly depressed (i.e., prices either are at or near a long term cyclical low point), the costs reflected in the SRK cost curve are cyclically low as global producers have cut costs for the last three to four years in order to maintain profitability. These cost cuts have likely increased cutoff grades at conventional mines and pregnant leach solution (PLS) cutoff grades at in situ mines. If uranium prices remain low and cutoff grades remain elevated, SRK believes that the life of mine reserves will be reduced. If uranium prices return to a higher level, reducing cutoff grades will likely result in higher production costs.

From reviewing historic production data, SRK believes operators have cut overhead costs and improved operational efficiency to reduce mining and processing costs. Many producers also appear to have cut sustaining capital; however, SRK adjusted sustaining capital estimates to reflect sustainable long term production (i.e. SRK generally applied a higher cost than has been seen in the current environment which SRK generally considers inadequate to sustain long term production). Therefore, other than sustaining capital, SRK expects production costs to materially increase if the uranium price returns to significantly higher levels.

In terms of production volumes, operations included in the curve were already in production in 2017 and SRK assumes no new mines will come online in 2018. Operations expected to produce less than 100,000 pounds of yellowcake in 2018 are not shown in the curve (e.g., Peninsula's Lance mine in Wyoming). Operations that were on care and maintenance in 2017 are not expected to restart in 2018 and therefore are not included in the curve. Major operations on care and maintenance include Rabbit Lake in Canada and Kayelekera in Malawi as well as other smaller operations.

A number of operations currently produce at reduced run-rates given the low price environment. These include White Mesa, Nichol's Ranch and Lost Creek, all located in the USA. SRK does not anticipate these operations will ramp up production until uranium prices increase materially and therefore have included production estimates consistent with current reduced run-rates. In late 2017, SRK noted Cameco's suspension of production from McArthur River in Canada and Kazatomprom's planned 20% reduction in uranium production. Due to uncertainty in terms of timing or implementation of these production cuts, SRK did not include the impact of these announcements in the cost curve.

SRK notes foreign exchange rates have a significant impact on production costs, especially for in situ operations. Major cost inputs for in situ operations are fully leveraged to moves in foreign exchange (e.g., labor, well drilling/completion costs, acid costs, etc.). For conventional uranium mines, a significant portion of costs are tied to the United States Dollar (USD) (e.g., diesel and energy prices) and, therefore, are less sensitive to movement in foreign exchange. Therefore, SRK recorded costs in local currency for in situ mines and converted to USD costs at foreign exchange rates reflective of current levels. Conventional mines are only included in local currency if reported on that basis by the owner. Otherwise, they are reported in USD given the lower influence of foreign exchange. Foreign exchange rates used for the analysis are provided in Table 1.

Table 1: Foreign Exchange

Country		FX Rate
Kazakhstan	KZT:USD	0.003
Canada	CAD:USD	0.80
Australia	AUD:USD	0.75
Namibia	NAD:USD	0.08
Russia	RUB:USD	0.017
South Africa	ZAR:USD	0.077
Uzbekistan	UZS:USD	0.00013

3. Data Sources

SRK sourced the majority of cost data from public disclosures. For a small number of operations, SRK relied upon its industry expertise to develop the estimated costs. Public data sources included the following:

- **Financial Statements:** All public companies publish financial statements and several private companies also publish financials (e.g. Uranium One and ARMZ).
- **Technical Reports:** Generally sourced from companies that are listed on a Canadian stock exchange and therefore are subject to National Instrument 43-101 reporting requirements, including publishing technical reports for material operations.
- **Conference and Scientific Papers:** Sourced from global scientific databases (e.g. ScienceDirect and Elsevier) or other public locations (e.g. company/industry websites).
- **Global Nuclear Fuel Databases:** e.g., World Nuclear Association, International Atomic Energy Agency (IAEA) and Nuclear Fuel Cycle Information System (NFCIS).

SRK industry experience included developing costs based on SRK's institutional knowledge of the project or through developing a cost model based on similar benchmark operations.

SRK classified cost data based on the level of reliability (e.g., confidence) of the source data as follows:

- **High (+/- 10% accuracy):** Typically based on financial statements issued by the project owners. The owner cost data must be reported by segment (e.g. specific to that operation). The distribution of costs (e.g. allocation of cost to mining or processing) may be of a lower certainty. Even with a lower certainty on cost allocation, SRK still views the overall cost confidence of the project cost data as high.

- **Good (+/- 15% accuracy):** Typically based on technical reports with some level of financial reporting (although not necessarily segmented reporting).
- **Moderate (+/- 25% accuracy):** Generally based on a moderate level of technical data (e.g. grade, tonnage, mine depth, process route, process throughput, etc.) that can be used to generate a reasonable cost model. Recent technical reports or financial data are not available; however, similar benchmark operations can be used for comparison.
- **Low (+/- 50% accuracy):** These operations have little to no public data available. They do not have supporting technical reports or financial statements. Cost assumptions are based on inferred operational grades and type of operations (e.g. in situ, open pit, underground, mill, heap leach, etc.), if available.

Figure 1 shows the percentage of total global production by level of confidence in the cost estimate. Figure 2 provides the level of confidence based on the annual production level (million pounds U_3O_8). Figure 3 shows the number of operations associated with each level of confidence.

Figure 1
Production Cost Estimates

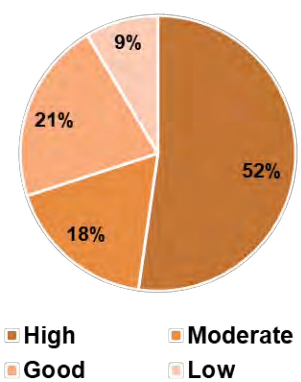


Figure 2
Annual Production Volume

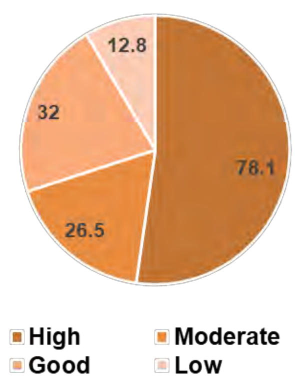
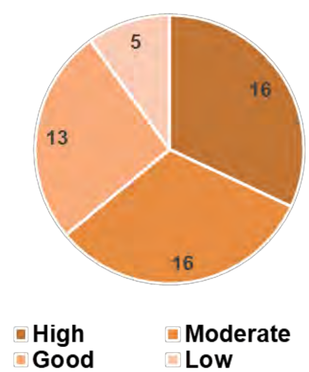


Figure 3
Number of Operations



SRK cautions that there will be variability in actual production costs on a year to year basis. This production cost estimates are a snapshot and as circumstances change, costs will also change. This variability may be seen in the short term (foreign exchange fluctuation, operational challenges such as a heavy rain year in at an open pit operation, grade fluctuations within the orebody, one-time capital expenditures, etc.). In addition, production costs will also be subject to longer term variability driven by the price environment such as depressed prices driving structural cost reductions and conversely high uranium prices resulting in structural cost increases.

Nonetheless, the ranking of projects is unlikely to change materially, with the exception of differential change driven by moves in foreign exchange rates.

4. Cost Curve

Figure 4 shows the production cost curve. Summary statistics from the production cost data set include the following:

- Approximately 150 million pounds of production forecast for 2018,

- The production cost curve shows break-even costs in US$ for existing mines and reflects current foreign exchange rates. The operating costs do not include capital costs associated with project development, which would be amortized over the life of mine for a new mine and could typically be $10 per pound, depending on the mine. The operating costs do not include the return on capital required to sustain production, even for existing mines, which would be expected to be approximately 20% for mines developed by private industry.
- The lowest cost producer is most likely Olympic Dam in Australia at approximately US$14 per pound due to uranium production being a byproduct of copper production,
- The highest cost producer is most likely the Rossing Mine in Namibia at approximately US$74 per pound due to its low grades, expensive cost inputs (water, power, etc.) and reduced throughput relative to historic levels (note that the Lance in situ operation in Wyoming is significantly higher cost than Rossing, but is not included due to its production level of less than 100,000 pounds per year),
- The 25th percentile producer is Kazatomprom's Mykuduk operation at approximately US$21 per pound,
- The 50th percentile producer is Uranium One's South Inkai mine at approximately US$31 per pound,
- The 75th percentile producer is ARMZ's Khiagda mine at approximately US$40 per pound,

At a spot price of US$24.15 per pound of uranium, approximately 65% of global primary yellowcake production would lose money if selling into the spot market. This suggests that a large percentage of world production is satisfied by production under pre-existing higher-priced term contracts or loses money at an operational level.

For fulfillment of the 150 million pound production forecast for 2018 from mined production (conventional or ISR), the break-even world price would have to be US$74 per pound or greater for existing mines in order to incentivize the full amount of production.

5. Conclusions

SRK emphasizes the key finding that foreign exchange has a significant impact on global uranium production costs, particularly over the last three years. These changes are most noticeable at operations in countries such as Kazakhstan, Uzbekistan and Russia where the respective currencies (the Tenge, So'm and Ruble) have devalued approximately 50%, 70% and 40%, respectively. Other major producers, Canada and Australia, have also seen their currency devalued relative to the US Dollar, but the level of devaluing has been less severe and these countries contribute more conventional production, which while still susceptible to moves in foreign exchange, is not as heavily impacted.

Kazakhstan, Uzbekistan and Russia rely heavily on in situ production, which is strongly leveraged to local currency swings. Production from these four countries contributes more than 60 million pounds of yellowcake to the global market or more than 40% of global production. As an example of the impact of foreign exchange, Uranium One, which sources 99% of its production from Kazakhstan, has seen its production costs fall from an average of $33/lb U_3O_8 in 2014 to only $14/lb U_3O_8 in 2016, as indicated in Figure 4. Approximately $5/lb U_3O_8 of this change can be attributed to improvement in operational costs; however, the remainder of the change is driven almost exclusively by the devaluing of the Kazakh Tenge.

In conclusion, SRK believes that current spot prices are not adequate to sustain global yellowcake production at existing mines. As higher priced contracts expire over the coming years, global uranium producers will either cut production or start taking operational losses if spot prices do not increase. This is likely one of the triggers in Cameco's announcement cutting production from McArthur River as well as Kazatomprom's decision to reduce production from its operations.

As part of this exercise, SRK did not evaluate costs required to justify development of new mines, which would require the recovery of capital costs and would require a return on investment over and above the break-even costs depicted in our cost curve. From our knowledge of global large scale development stage uranium projects, SRK believes that significantly higher prices are required to justify new mines of material scale production.

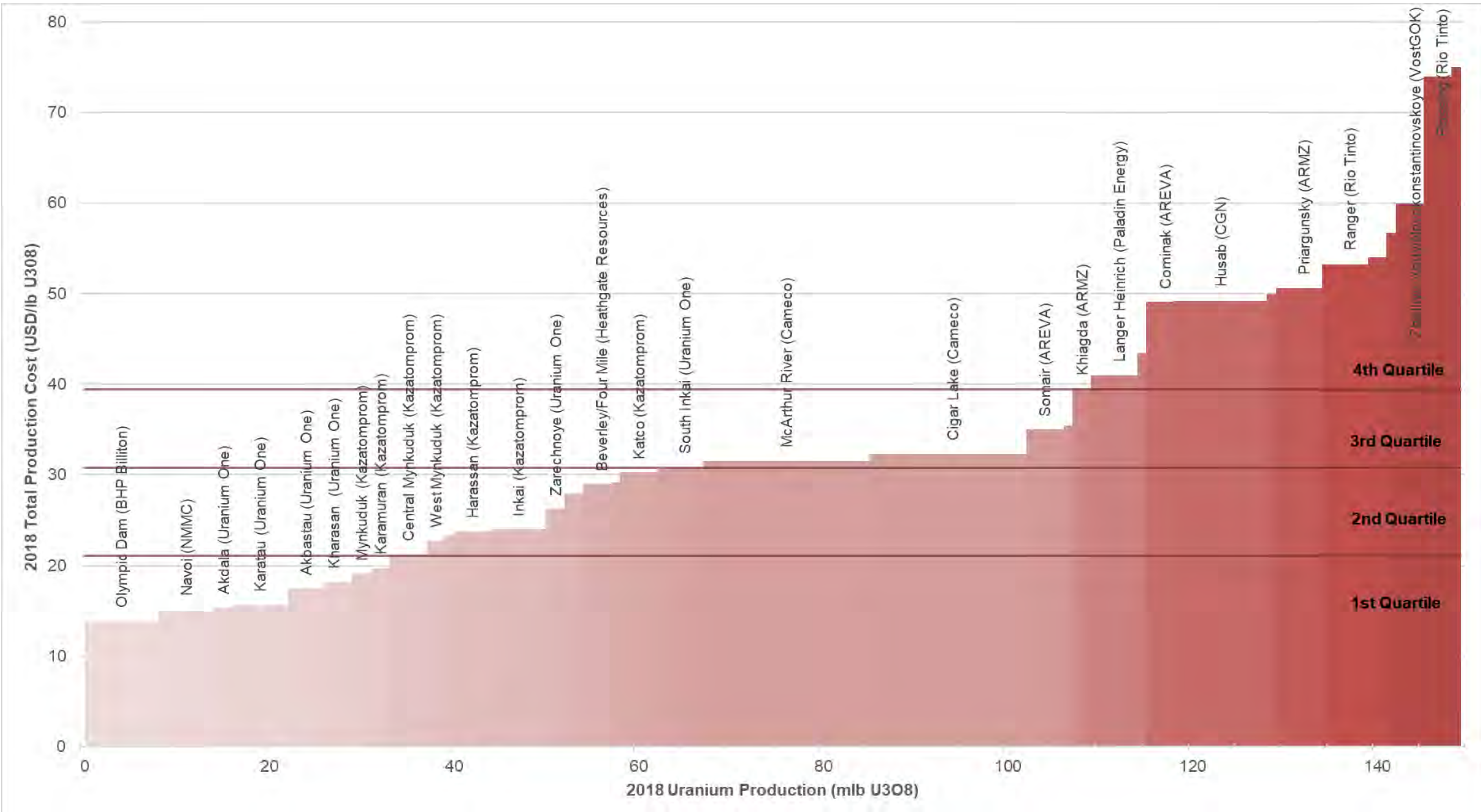


Figure 4: 2018 Global Uranium Production Cost Curve

Exhibit 4

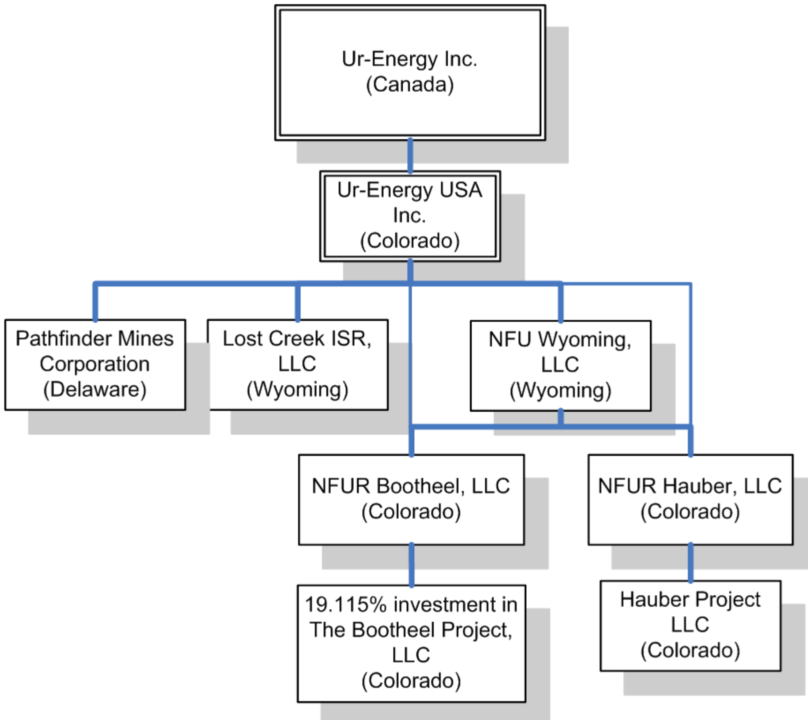
Exhibit 4
Ur-Energy Background[1]

Ur-Energy USA Inc. ("Ur-Energy USA") is a company incorporated under the laws of the State of Colorado in 2005 and has an office in Littleton, Colorado and an operations office in Casper, Wyoming. We are engaged in uranium mining, recovery and processing activities, including the acquisition, exploration, development and operation of uranium mineral properties in the United States. We began operation of our first in situ recovery uranium mine at our Lost Creek Project, Wyoming in 2013.

Ur-Energy USA has three wholly-owned subsidiaries: NFU Wyoming, LLC ("NFU Wyoming"), a limited liability company formed under the laws of the State of Wyoming to facilitate acquisition of certain property and assets and, currently, to act as our land holding and exploration entity; Lost Creek ISR, LLC, a limited liability company formed under the laws of the State of Wyoming to hold and operate our Lost Creek Project and certain other of our Lost Creek properties and assets; and Pathfinder Mines Corporation ("Pathfinder"), a company incorporated under the laws of the State of Delaware, which holds, among other assets, the Shirley Basin and Lucky Mc properties in Wyoming. Ur-Energy USA also has certain other subsidiaries which have been formed over time and exist to hold additional assets, including exploration ventures.

Ur-Energy USA's parent company, Ur-Energy Inc., was incorporated in Canada in 2004, as an Ontario corporation. The company was later continued under the *Canada Business Corporations Act* in 2006. The parent company is publicly traded; our Common Shares are listed on the Toronto Stock Exchange under the symbol "URE" and on the NYSE American under the symbol "URG." Our principal direct and indirect subsidiaries, and affiliated entities, and the jurisdictions in which they were incorporated or organized, are as follows:

[1] This discussion is largely drawn from the Annual Report on Form 10-K filed by Ur-Energy Inc. on March 3, 2017, together with other public disclosure from subsequent interim filings of Forms 10-Q.



We are engaged in uranium mining, recovery and processing operations, in addition to the exploration and development of uranium mineral properties. Our wholly-owned Lost Creek Project in Sweetwater County, Wyoming is our flagship property. The project has been fully permitted and licensed since October 2012. We received operational approval from the U.S. Nuclear Regulatory Commission ("NRC"), and started production operation activities in August 2013. Our first sales of production from Lost Creek were made in December 2013; and in the nearly four years since, sales from production have been made every quarter.

Since we began production operations, and currently, we have had multiple term uranium sales agreements in place with U.S. utilities for the sale of Lost Creek production or other yellowcake product at contracted pricing. Combined, these multi-year sales agreements represent a significant portion of our anticipated production into 2021.

The Company has contractually committed to sell 600,000 pounds of uranium yellowcake during 2017, at an average price of approximately $51 per pound. During 2016, we worked with our customers to establish our delivery schedule for these 2017 commitments, with distribution of sales throughout the year. This schedule was created in an attempt to avoid uneven cash flows that could result from uneven delivery schedules. Subsequently, we were able to take advantage of the low prices at the end of 2016 and in early 2017 to enter into purchase agreements for 410,000 pounds at an average cost of $22 per pound.

In addition to Lost Creek, our other material asset, Shirley Basin, is one of the assets we acquired as a part of the Pathfinder transaction which closed in December 2013. We also acquired all the historic geologic and engineering data for the project. During 2014, we completed a drill program of a limited number of confirmatory holes in order to complete a mineral resource estimate, pursuant to Canadian National Instrument 43-101 (NI 43-101), which was released in August 2014; subsequently, an NI 43-101 Preliminary Economic Assessment for Shirley Basin was completed in January 2015. The mineral resource described below (*Preliminary Economic Assessment for Shirley Basin Uranium Project*) estimates a project resource of nearly 9,000,000 pounds U_3O_8 in measured and indicated categories.

Baseline studies necessary for the permitting and licensing of the project commenced in 2014 and were completed in 2015. In December 2015, our application for a permit to mine was submitted to the State of Wyoming Department of Environmental Quality ("WDEQ"). Work is well underway on other applications for all necessary authorizations to mine at Shirley Basin. We have monitored the development of the Wyoming "agreement state" program, by which the NRC will delegate its authority for source material licensure and other radiation safety issues to the WDEQ. We understand that the development of the Uranium Recovery Program ("URP") remains on schedule for full implementation and transition likely occurring in 2018. Based upon that timing, we currently anticipate submitting our application for a source material license for Shirley Basin to the State URP.

We utilize in situ recovery ("ISR") of the uranium at Lost Creek and will do so at other projects where this is possible. The ISR technique is employed in uranium extraction because it allows for a lower cost and effective recovery of roll front mineralization. The in situ technique does not require the installation of tailings facilities or significant surface disturbance. This mining method utilizes injection wells to introduce a mining solution, called lixiviant, into the mineralized zone. The lixiviant is made of natural groundwater fortified with oxygen as an oxidizer, sodium bicarbonate as a complexing agent, and carbon dioxide for pH control. The complexing agent bonds with the uranium to form uranyl carbonate, which is highly soluble. The dissolved uranyl carbonate is then recovered through a series of production wells and piped to a processing plant where the uranyl carbonate is removed from the solution using ion exchange ("IX") and captured on resin contained within the IX columns. The groundwater is re-fortified with the oxidizer and complexing agent and sent back to the wellfield to recover additional uranium. A low-volume bleed is permanently removed from the lixiviant flow. A reverse osmosis (RO) process is available to minimize the waste water stream generated. Brine from the RO process, if used, and bleed are disposed of by means of injection into deep disposal wells. Each wellfield is made up of dozens of injection and production wells installed in patterns to optimize the areal sweep of fluid through the uranium ore body.

Our Lost Creek processing facility includes all circuits for the capture, concentration, drying and packaging of uranium yellowcake for delivery into sales. Our processing facility, in addition to the IX circuit, includes dual processing trains with separate elution, precipitation, filter press and drying circuits (this is in contrast to certain other uranium in situ recovery facilities which operate as a capture plant only, and rely on agreements with other producers for the finishing, drying and packaging of their yellowcake end-product). Additionally, a restoration circuit including an RO unit was installed during initial construction to complete groundwater restoration once mining is complete.

The elution circuit (the first step after ion exchange) is utilized to transfer the uranium from the IX resin and concentrate it to the point where it is ready for the next phase of processing. The resulting rich eluate is an aqueous solution containing uranyl carbonate, salt and sodium carbonate and/or sodium bicarbonate. The precipitation circuit follows the elution circuit and removes the carbonate from the concentrated uranium solution and combines the uranium with peroxide to create a yellowcake crystal slurry. Filtration and washing is the next step, in which the slurry is loaded into a filter press where excess contaminants such as chloride are removed and a large portion of the water is removed. The final stage occurs when the dewatered slurry is moved to a yellowcake dryer, which will further reduce the moisture content, yielding the final dried, free-flowing, product. Refined, salable yellowcake is packaged in 55-gallon steel drums.

The restoration circuit may be utilized in the production as well as the post-mining phases of the operation. The RO is initially being utilized as a part of our Class V recycling circuit to minimize the waste water stream generated during production. Once production is complete, the groundwater must be restored to its pre-mining class of use by removing a small portion of the groundwater and disposing of it (commonly known as sweep). Following sweep, the groundwater is treated utilizing RO and re-injecting the clean water. Finally, the groundwater is homogenized and sampled to insure the cleanup is complete, thus ending the mining process.

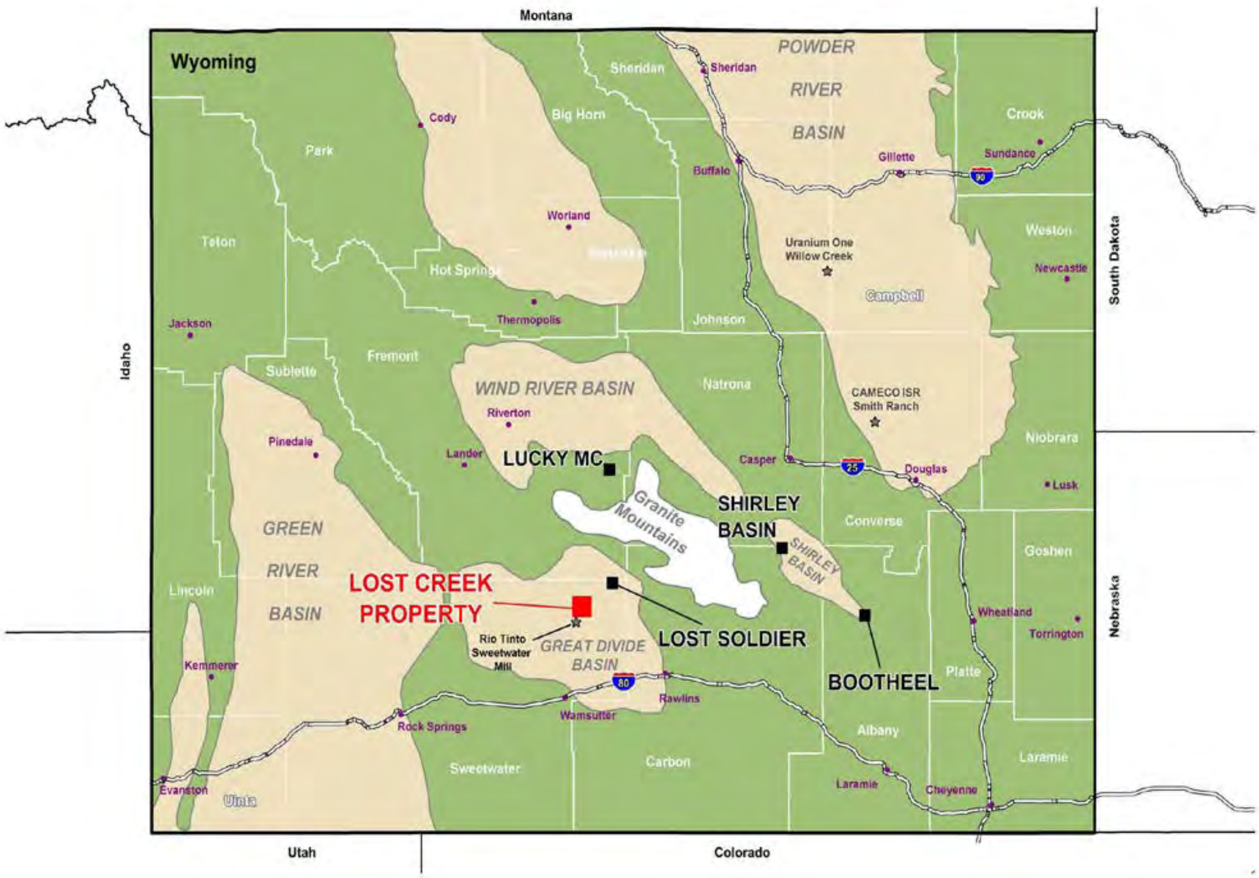
Our Lost Creek processing facility was constructed during 2012 – 2013, with production operations commencing in August 2013. Our first sales were made in December 2013. Nameplate design and NRC-licensed capacity of our Lost Creek processing plant is two million pounds per year, of which approximately one million pounds per year may be produced from our wellfields. The Lost Creek plant and the allocation of resources to mine units and resource areas were designed to generate approximately one million pounds of production per year at certain flow rates and uranium concentrations subject to regulatory and license conditions. Production of refined yellowcake was 727,245 pounds in 2015; in 2016, we controlled production at lower rates due to the depressed uranium market prices and produced 561,094 pounds to deliver into our term contracts. We currently estimate that our 2017 production, controlled at lower rates due to the continued depressed uranium market, will be in the range of 250,000 to 300,000. The excess capacity in the design of the processing circuits of the plant is intended, first, to facilitate routine (and, non-routine) maintenance on any particular circuit without hindering production operational schedules. The capacity was also designed to permit us to process uranium from other of our mineral projects in proximity to Lost Creek if circumstances warrant in the future (*e.g.,* Shirley Basin Project), or, alternatively to be able to contract to toll mill/process product from other in situ uranium mine sites in the region. This design would permit us to conduct either of these activities while Lost Creek is producing and processing uranium and/or in years following Lost Creek production from wellfields during final restoration activities.

Our Mineral Properties

Our current land portfolio includes 13 projects in Wyoming. Ten of these projects are in the Great Divide Basin, Wyoming, including our flagship project, Lost Creek Project. Currently we control more than 1,900 unpatented mining claims and three State of Wyoming mineral leases for a total of more than 37,500 acres (~15,500 hectares) in the area of the Lost Creek Property, including the Lost Creek permit area and certain adjoining properties which we refer to as LC East, LC West, LC North, LC South and EN project areas (collectively, with the Lost Creek Project, the "Lost Creek Property"). Five of the projects at the Lost Creek Property contain NI 43-101 compliant mineral resources: Lost Creek, LC East, LC West, LC South and LC North, as described below. These five projects are collectively referred to as the Adjoining Projects; they were acquired by the Company as exploration targets to provide resources supplemental to those recognized at the Lost Creek Project. Most were initially viewed as stand-alone projects, but expanded over time such that collectively they represent a contiguous block of land along with the Lost Creek Project.

Our Wyoming properties together total more than 55,000 acres (approximately 22,250 hectares) and include two properties, Shirley Basin and Lucky Mc, obtained through our acquisition of Pathfinder Mines Corporation in 2013.

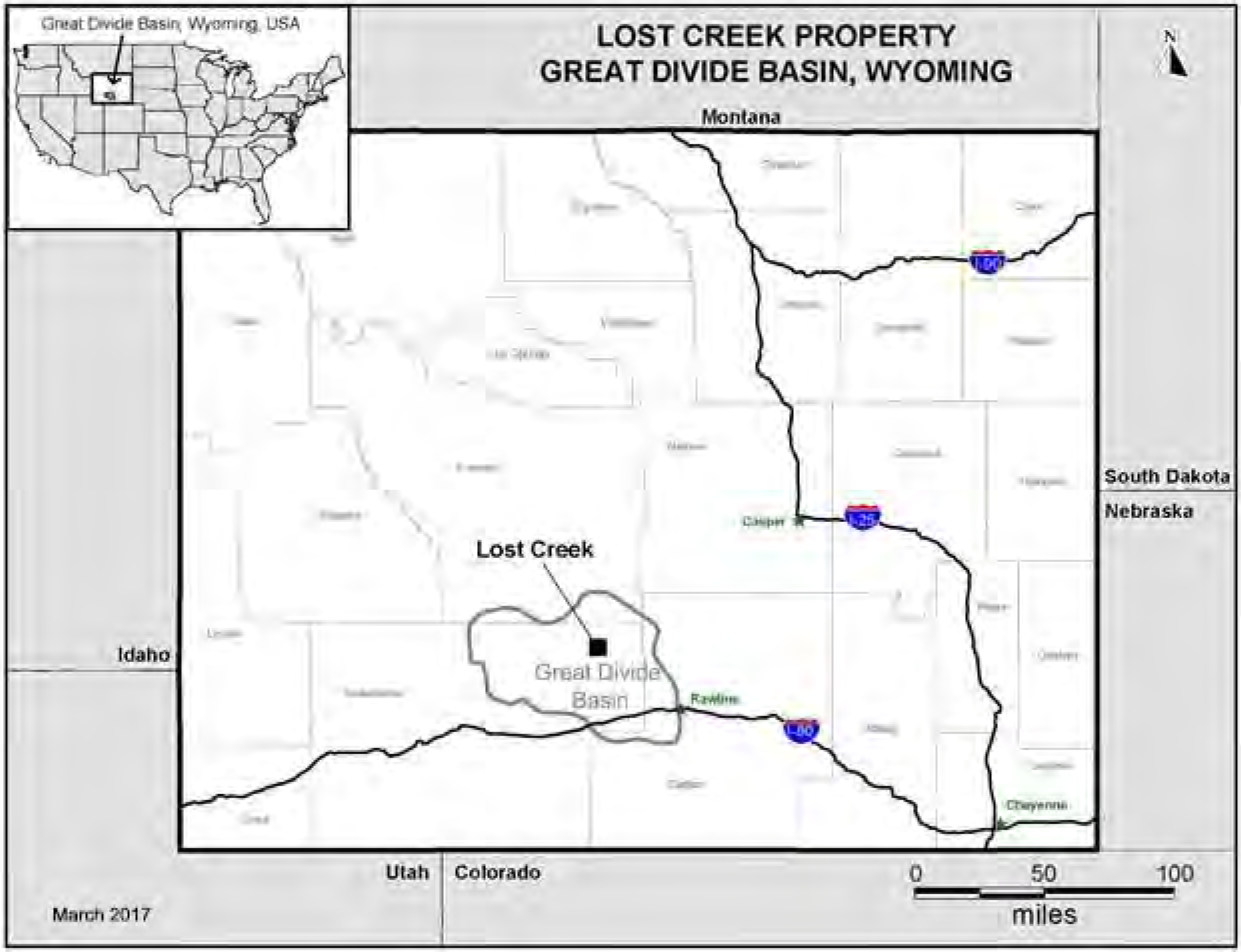
Below is a map showing our Wyoming projects and the geologic basins in which they are located.



Operating Properties

Lost Creek Project – Great Divide Basin, Wyoming

The Lost Creek Project area was acquired in 2005, and is located in the Great Divide Basin, Wyoming. The Main Mineral Trend of the Lost Creek uranium deposit (the "MMT") is located within the Lost Creek Project. The permit area of the Lost Creek Project covers 4,254 acres (1,722 hectares), comprising 201 lode mining claims and one State of Wyoming mineral lease section. Regional access relies almost exclusively on existing public roads and highways. The local and regional transportation network consists of primary, secondary, local and unimproved roads. Direct access to Lost Creek is mainly on two crown-and-ditched gravel paved access roads to the processing plant. One road enters from the west off Sweetwater County Road 23N (Wamsutter-Crooks Gap Road); the other enters from the east off U.S. Bureau of Land Management ("BLM") Sooner Road. On a wider basis, from population centers, the Property area is served by an Interstate Highway (Interstate 80), a US Highway (US 287), Wyoming state routes (SR 220 and 73 to Bairoil), local county roads, and BLM roads. The Lost Creek Property is located as shown here:



The basic infrastructure (power, water, and transportation) necessary to support our ISR operation is located within reasonable proximity. Generally, the proximity of Lost Creek to paved roads is beneficial with respect to transportation of equipment, supplies, personnel and product to and from the property. Existing regional overhead electrical service is aligned in a north-to-south direction along the western boundary of the Lost Creek Project. A new overhead power line, approximately two miles in length, was constructed to bring power from the existing Pacific Power line to the Lost Creek plant. Power drops have been made to the property and distributed to the plant, offices, wellfields, and other facilities. Additional power drops will be installed as we expand the wellfield operations.

There are no royalties at the Lost Creek Project, except for the royalty on the State of Wyoming section mineral lease as provided by law. Currently, there is only limited production planned from the State lease section. There is a production royalty of one percent on certain claims of the LC East Project, and other royalties on other claims within the other adjoining projects (LC South and EN projects) as well as the other State sections on which we maintain mineral leases (LC West and EN projects).

Production Operations

Following receipt of the final regulatory authorization in October 2012, we commenced construction at Lost Creek. Construction included the plant facility and office building, installation of all process equipment, installation of two access roads, additional power lines and drop lines, deep disposal wells, construction of two holding ponds, warehouse building, and drill shed building. In August 2013, we were given operational approval by the NRC and commenced production operation activities.

All the wells to support the originally-planned 13 header houses (“HHs”) in the first mine unit (“MU1”) have been completed. HHs 1-1 through 1-11 were operational as of the effective date of the Lost Creek PEA, October 15, 2015. Subsequently, the last two of the originally-planned header houses were brought online (HH 1-12 (November 2015) and HH 1-13 (May 2016)). All monitor ring wells have been installed and pump-tested in Mine Unit 2 (“MU2”). As of October 15, 2015, the effective date for the Lost Creek PEA, 138 pattern wells have been piloted within HHs 2-1, 2-2 and 2-3. Today, all wells to support the design of HHs 2-1, 2-1, and 2-3 are complete, and the first of these header houses is operational.

Additionally, two applications for amendments to the license and permits have been submitted. The two applications seek to authorize production in the KM Horizon within the Lost Creek Project and to authorize production in the HJ and KM Horizons within the EMT in the LC East Project.

During 2016, 538,004 pounds of U_3O_8 were captured within the Lost Creek plant; 561,094 pounds U_3O_8 were packaged in drums; and 579,179 pounds U_3O_8 of drummed inventory were shipped from the Lost Creek processing plant to the converter. At December 31, 2016 inventory at the conversion facility was approximately 84,689 pounds U_3O_8.

From production, Lost Creek sold 562,000 pounds U_3O_8 during calendar 2016 at an average price of $39.49 per pound. After assigning two contract deliveries to a third-party trader as a part of our cash management strategy to offset sales which were rescheduled to the end of the year by one of our customers, contract sales were as expected (462,000 pounds at an average price of $41.38 per pound); however, spot sales were lower than expected (100,000 pounds at an average price of $30.75) due to the continuing low spot price environment.

After more than three years of operations, the 2016 average plant head grade remained at 58 ppm despite having somewhat lower head grades for the fourth quarter. The lower head grade during this period of operation, as well as varying month-to-month grades, is a typical result as the mine matures and older operating patterns remain in the flow regime while newer patterns are brought online.

Thus far in 2017, we have controlled our production at lower rates at Lost Creek due to the depressed market, and, at the end of Q3, have captured 197,410 pounds; drummed and packaged 193,551 pounds and sold 261,000 pounds of Lost Creek production into our term contracts.

Updated Preliminary Economic Assessment for Lost Creek Property

In January 2016, we issued an updated Preliminary Economic Assessment for the Lost Creek Property Sweetwater County Wyoming (January 19, 2016 (TREC, Inc.)), which was then amended February 8, 2016 to include two additional tables to supplement the Cash Flow and OPEX tables as set forth in the prior document (as amended, the “Lost Creek PEA”). The Lost Creek PEA was prepared for the Company and its subsidiary, Lost Creek ISR, LLC, by Douglass H. Graves, P.E., TREC, Inc. (“TREC”) and James A. Bonner, C.P.G., Vice President Geology of the Company in accordance with NI 43-101.

According to the Lost Creek PEA, the mineral resources at the Lost Creek Property are as follows:

Lost Creek Property - Resource Summary

	MEASURED			INDICATED			INFERRED		
PROJECT	**AVG GRADE**	**SHORT TONS**	**POUNDS**	**AVG GRADE**	**SHORT TONS**	**POUNDS**	**AVG GRADE**	**SHORT TONS**	**POUNDS**
	% eU_3O_8	(X 1000)	(X 1000)	% eU_3O_8	(X 1000)	(X 1000)	% eU_3O_8	(X 1000)	(X 1000)
LOST CREEK	0.048	8,339	7,937	0.046	3,831	3,491	0.046	3,116	2,844
MU1 production through 9/30/15	(0.048)	(1,415)	(1,358)						
LC EAST	0.052	1,392	1,449	0.041	1,891	1,567	0.042	2,954	2,484
LC NORTH	-----	-----	-----	-----	-----	-----	0.045	645	581
LC SOUTH	-----	-----	-----	0.037	220	165	0.039	637	496
LC WEST	-----	-----	-----	-----	-----	-----	0.109	16	34
EN	-----	-----	-----	-----	-----	-----	-----	-----	-----
GRAND TOTAL	0.048	8,316	8,028	0.044	5,942	5,223	0.044	7,368	6,439

MEASURED+ INDICATED = 14,258 *13,251*

Notes:

1. Sum of Measured and Indicated tons and pounds may not add to the reported total due to rounding.
2. % eU_3O_8 is a measure of gamma intensity from a decay product of uranium and is not a direct measurement of uranium. Numerous comparisons of eU_3O_8 and chemical assays of Lost Creek rock samples, as well as PFN logging, indicate that eU_3O_8 is a reasonable indicator of the chemical concentration of uranium.
3. Table shows resources based on grade cutoff of 0.02 % eU_3O_8 and a grade x thickness cutoff of 0.20 GT.
4. Measured, Indicated, and Inferred Mineral Resources as defined in Section 1.2 of NI 43-101 (the CIM Definition Standards (CIM Council, 2014)).
5. Resources are reported through October 15, 2015.
6. All reported resources occur below the static water table.
7. 1,358,407 lbs. of uranium have been produced from the HJ Horizon in MU1 (Lost Creek Project) as of September 30, 2015.
8. Mineral resources that are not mineral reserves do not have demonstrated economic viability.
9. Information shown in the table above differs from the disclosure requirements of the SEC.

The Lost Creek PEA discloses changes for the Lost Creek Property which come in the form of an updated mineral resource estimate prompted by recent drilling within Lost Creek's MU2, exploratory drilling at the Lost Creek and LC East Projects, and the re-estimation of all previously-identified resources for the Property at a revised 0.20 grade-thickness (GT) cut-off. The economic analyses within the Lost Creek PEA have been revised to evaluate the impact of additional identified resources with information and data acquired through two years of ISR operations at Lost Creek. The Lost Creek PEA therefore serves to replace the last economic analyses for the Lost Creek Property from December 2013 and the most recent NI 43-101 Technical Report on the Lost Creek Property, dated June 17, 2015. The Lost Creek PEA covers production through September 30, 2015 and drilling and other exploration and operational activities conducted through October 15, 2015.

On June 17, 2015, the Company published an independent Technical Report for the Lost Creek Property to report increased resources for its operating MU1 and from exploration drilling conducted early in 2015. In order to reconcile higher-than-expected uranium recoveries from production operations in this mine unit, the grade thickness ("GT") cutoff for uranium intercepts used in resource estimation was lowered from 0.30 to 0.20. Employing these revised guidelines, resources for MU1 were re-mapped and re-evaluated, increasing the MU1 Measured Resources by 55% (after subtraction of MU1 production). Through the monitoring of continued production from MU1, the authors believe the 0.20 GT better represents the uranium resources for the Lost Creek Property. Accordingly, for the Lost Creek PEA, all resource estimations for Lost Creek Property have used the new 0.20 GT cutoff, again, following re-mapping and re-evaluation. Since the June 17, 2015 Technical Report, our activities have resulted in a cumulative increase of mineral resources at the Lost Creek Property of 31% in the Measured and Indicated categories and 28% in the Inferred category.

The Lost Creek PEA mineral resource estimate includes drill data and analyses of approximately 3,200 historic and current holes and over 1.8 million feet of drilling at the Lost Creek Project alone. With the acquisition of the Lost Creek project, we acquired logs and analyses from 569 historic holes representing 366,268 feet of data. Since our acquisition of the project we have drilled 2,629 holes and wells including the construction and development drilling during 2013-2016 for MU1 and initial work in MU2 at Lost Creek. Drilling at Lost Creek through October 15, 2015 was included in the PEA. Additionally, drilling from the other five projects at the Lost Creek Property, both historic and our drill programs, is included in the mineral resource estimate. Collectively, this represents an additional 2,387 drill holes (1,306,331 feet).

Regulatory Authorizations and Land Title of Lost Creek

Beginning in 2007, we completed all necessary applications and related processes to obtain the required permitting and licenses for the Lost Creek Project, of which the three most significant are: a Source and Byproduct Materials License from the NRC (received August 2011); a Plan of Operations with the BLM (through its Record of Decision ("ROD") received October 2012; affirmed by U.S. District Court for the District of Wyoming, September 2013); and a Permit and License to Mine from the WDEQ (October 2011). The WDEQ License to Mine was issued following determinations in favor of the project by the Wyoming Environmental Quality Council ("WEQC") with respect to a third-party objection, which included a WEQC direction that the WDEQ Permit be approved by the WDEQ. The WDEQ Permit includes the approval of the first mine unit, as well as the Wildlife Management Plan, including a positive determination of the protective measures at the project for the greater sage-grouse species.

Potential risks to the accessibility of the estimated mineral resource may include changes in the designation of the sage grouse as an endangered species by the USFWS because the Lost Creek Property lies within a sage grouse core area as defined by the state of Wyoming. In September 2015, the USFWS issued its finding that the greater sage grouse does not warrant protection under the Endangered Species Act (ESA). The USFWS reached this determination after evaluating the species' population status, along with the collective efforts by the BLM and U.S. Forest Service, state agencies, private landowners and other partners to conserve its habitat.

After a thorough analysis of the best available scientific information and taking into account ongoing key conservation efforts and their projected benefits, the USFWS determined the species does not face the risk of extinction now or in the foreseeable future and therefore does not need protection under the ESA. Should future decisions vary, or state or federal agencies alter their management of the species, there could potentially be an impact on future expansion operations. However, the Company continues to work closely with the Wyoming Game and Fish Department ("WGFD") and the BLM to mitigate impacts to the sage grouse.

The State of Wyoming has developed a "core-area strategy" to help protect the greater sage-grouse species within certain core areas of the state. Exploration areas of our Lost Creek property are all within a designated core area and are thus subject to work activity restrictions from March 1 to July 15 of each year. The timing restriction precludes exploration drilling and other non-operational based activities which may disturb the sage-grouse. The sage-grouse timing restrictions relevant to ISR production and operational activities at the Lost Creek Project are somewhat different because the State has recognized that mining projects within core areas must be allowed to operate year-round. Therefore, there are no timing restrictions on drilling, construction, or operational activities within pre-approved disturbed areas within our permit to mine.

Additional authorizations from federal, state and local agencies for the Lost Creek project include: WDEQ-Air Quality Division Air Quality Permit and WDEQ-Water Quality Division Class I Underground Injection Control ("UIC") Permit. The latter permit allows Lost Creek to operate up to five Class I injection wells to meet the anticipated disposal requirements for the life of the Lost Creek Project. The Environmental Protection Agency ("EPA") issued an aquifer exemption for the Lost Creek project. The WDEQ's separate approval of the aquifer reclassification is a part of the WDEQ Permit. We also received approval from the EPA and the Wyoming State Engineer's Office for the construction and operation of two holding ponds at Lost Creek.

In 2014, two applications for amendments to the primary authorizations to mine at Lost Creek were submitted to federal regulatory agencies, NRC and BLM, for the development and mining of LC East Project and the KM Horizon at Lost Creek. In 2015, the BLM issued a notice of intent to complete an environmental impact statement for the application. The NRC will participate in this review as a cooperating agency. A permit amendment requesting approval to mine at the LC East Project and within the KM Horizon at the Lost Creek Project was also submitted to the WDEQ for review and approval. Approval will include an aquifer exemption. The air quality permit will be revised to account for additional surface disturbance. An application will be submitted to Sweetwater County to re-zone the land at LC East. A subsequent Development Plan will also have to be submitted for review and approval. Numerous well permits from the State Engineer's Office will be required.

During 2016, we received all authorizations for the operation of Underground Injection Control (UIC) Class V wells at Lost Creek. These approvals allow for the onsite recirculation of fresh permeate (*i.e.,* clean water) into relatively shallow Class V wells. Site operators will use the RO circuits, which were installed during initial construction of the plant, to treat process waste water into brine and permeate streams. The brine stream will continue to be disposed of in the UIC Class I deep wells while the clean, permeate stream will be injected into the UIC Class V wells. It is expected that these operational procedures will significantly enhance waste water capacity at the site.

Through certain of our subsidiaries, we control the federal unpatented lode mining claims and State of Wyoming mineral leases which make up the Lost Creek Property. Title to the mining claims is subject to rights of *pedis possessio* against all third-party claimants as long as the claims are maintained. The mining claims do not have an expiration date. Affidavits have been timely filed with the BLM and recorded with the Sweetwater County Recorder attesting to the payment of annual maintenance fees to the BLM as established by law from time to time. The state leases have a ten-year term, subject to renewal for successive ten-year terms.

The surface of all the mining claims is controlled by the BLM, and we have the right to use as much of the surface as is necessary for exploration and mining of the claims, subject to compliance with all federal, state and local laws and regulations. Surface use on BLM lands is administered under federal regulations. Similarly, access to state-controlled land is largely inherent within the State of Wyoming mineral lease. The state lease at the Lost Creek Project requires a nominal surface impact fee to be paid. The other state mineral leases currently do not have surface impact payment obligations.

<u>Lost Creek Exploration and Development Properties</u>

Our Five Adjoining Projects at Lost Creek

The LC East and LC West Projects (currently, approximately 5,710 acres (2,310 hectares) and 3,840 acres (1,554 hectares), respectively) were added to the Lost Creek Property in 2012. The two projects were formed through location of new unpatented lode mining claims and an asset exchange completed in 2012, through which we acquired 175 unpatented mining claims and related data. In 2012, all baseline studies at LC East were initiated. As discussed above, in 2014, we submitted applications for amendments of the Lost Creek licenses and permits to include development of LC East. We also located additional lode mining claims to secure the lands in what will be the LC East permit area. The East Mineral Trend (the "EMT") is a second mineral trend of significance, in addition to the MMT at Lost Creek, identified by historic drilling on the lands forming LC East. Although geologically similar, it appears to be a separate and independent trend from the MMT. The Lost Creek PEA contains a recommendation that delineation drilling of identified resources in the EMT continue, together with progressing all necessary permit and license amendment to permit future production.

The LC North Project (approximately 7,730 acres (3,120 hectares)) is located to the north and to the west of the Lost Creek Project. Historical wide-spaced exploration drilling on this project consisted of 175 drill holes. The Company has conducted two drilling programs at the project. Exploration drilling at LC North is recommended by Company staff to pursue the potential of an extension of the MMT in the HJ and KM horizons.

The LC South Project (approximately 10,775 acres (4,360 hectares)) is located to the south and southeast of the Lost Creek Project. Historical drilling on the LC South Project consisted of 488 drill holes. In 2010, the Company drilled 159 exploration holes (total, 101,270 feet (30,867 meters)) which confirmed numerous individual roll front systems occurring within several stratigraphic horizons correlative to mineralized horizons in the Lost Creek Project. Also, a series of wide-spaced drill holes were part of this exploration program which identified deep oxidation (alteration) that represents the potential for several additional roll front horizons. Staff also recommend that the HJ and KM horizons should be further explored, and suggest that additional drilling be conducted to further evaluate the potential of deeper mineralization.

The EN Project (approximately 5,500 acres (~ 2,200 hectares)) is adjacent to and east of LC South. Ur-Energy has over 50 historical drill logs from the EN project. Some minimal, deep, exploration drilling has been conducted at the project. Although no mineral resource is yet reported due to the limited nature of the data, Company geologists continue to recommend that the EN project should be explored further with wide spaced framework drilling to assess regional alteration and stratigraphic relationships. During 2016, in an effort to contain costs, we reduced the number of federal mining claims and state mineral leases held at the EN project.

History and Geology of the Lost Creek Property

Uranium was discovered in the Great Divide Basin (GDB), where Lost Creek is located, in 1936. Exploration activity increased in the early 1950s after the Gas Hills District discoveries, and continued to increase in the 1960s, with the discovery of numerous additional occurrences of uranium. Wolf Land and Exploration (which later became Inexco), Climax (Amax) and Conoco Minerals were the earliest operators in the Lost Creek area and made the initial discoveries of low-grade uranium mineralization in 1968. Kerr-McGee, Humble Oil, and Valley Development, Inc. were also active in the area. Drilling within the current Lost Creek Project area from 1966 to 1976 consisted of approximately 115 wide-spaced exploration holes by several companies including Conoco, Climax (Amax), and Inexco.

Texasgulf acquired the western half of what is now the Lost Creek Project in 1976 through a joint venture with Climax and identified what is now referred to as the Main Mineral Trend (MMT). In 1978, Texasgulf optioned into a 50% interest in the adjoining Conoco ground to the east and continued drilling, fully identifying the MMT eastward to the current project boundary; Texasgulf drilled approximately 412 exploration holes within what is now the Lost Creek Project. During this period Minerals Exploration Company (a subsidiary of Union Oil Company of California) drilled approximately 8 exploration holes in what is currently the western portion of the Lost Creek Project. Texasgulf dropped the project in 1983 due to declining market conditions. The ground was subsequently picked up by Cherokee Exploration, Inc. which conducted no field activities.

In 1987, Power Nuclear Corporation (also known as PNC Exploration) acquired 100% interest in the project from Cherokee Exploration, Inc. PNC Exploration conducted a limited exploration program and geologic investigation, as well as an evaluation of previous in situ leach testing by Texasgulf. PNC Exploration drilled a total of 36 holes within the current project area.

In 2000, New Frontiers Uranium, LLC acquired the property and database from PNC Exploration, but conducted no drilling or geologic studies. New Frontiers Uranium, LLC later transferred the Lost Creek Project-area property along with its other Wyoming properties to its successor NFU Wyoming, LLC. In June 2005, Ur-Energy USA purchased 100% ownership of NFU Wyoming, LLC.

The Lost Creek Property is situated in the northeastern part of the GDB which is underlain by up to 25,000 ft. of Paleozoic to Quaternary sediments. The GDB lies within a unique divergence of the Continental Divide and is bounded by structural uplifts or fault displaced Precambrian rocks, resulting in internal drainage and an independent hydrogeologic system. The surficial geology in the GDB is dominated by the Battle Spring Formation of Eocene age. The dominant lithology in the Battle Spring Formation is coarse arkosic sandstone, interbedded with intermittent mudstone, claystone and siltstone. Deposition occurred as alluvial-fluvial fan deposits within a south-southwest flowing paleodrainage. The sedimentary source is considered to be the Granite Mountains, approximately 30 miles to the north. Maximum thickness of the Battle Spring Formation sediments within the GDB is 6,000 ft.

Uranium deposits in the GDB are found principally in the Battle Spring Formation, which hosts the Lost Creek Project deposit. Lithology within the Lost Creek deposit consists of approximately 60% to 80% poorly consolidated, medium to coarse arkosic sands up to 50 ft. thick, and 20% to 40% interbedded mudstone, siltstone, claystone and fine sandstone, each generally less than 25 ft. thick. This lithological assemblage remains consistent throughout the entire vertical section of interest in the Battle Spring Formation.

Outcrop at Lost Creek is exclusively that of the Battle Spring Formation. Due to the soft nature of the formation, the Battle Spring Formation occurs largely as sub-crop beneath the soil. The alluvial fan origin of the formation yields a complex stratigraphic regime which has been subdivided throughout Lost Creek into several thick horizons dominated by sands, with intervening named mudstones. Lost Creek is currently licensed and permitted to produce from the HJ horizon; we are currently seeking amendment of the licenses to be able to produce from the typically lower KM horizon.

The Company occasionally performs leach testing on various samples from the Lost Creek Project. In 2010, we performed leach testing on samples from the KM Horizon of the Lost Creek Project (currently in the permit-licensing stage). Seven samples obtained from one-foot sections of core were tested for mineral recovery using the same test methods as in prior tests from the HJ Horizon (currently licensed for production at Lost Creek, and being recovered in MU1). Twenty-five pore volumes of various bicarbonate leach solutions were passed through the samples. Uranium recovery ranged from 54.1 to 93.0% with an average uranium recovery of 80.6%. These results are similar to earlier leaching and recovery tests conducted on behalf of the Company on samples from the HJ Horizon, which returned results consistently averaging 82 – 83%. We believe these results are consistent with industry experience.

Pathfinder Mines Corporation: Shirley Basin Mine Site (Shirley Basin, Wyoming) and Lucky Mc Mine Site (Gas Hills Mine District, Wyoming)

As a part of the Pathfinder acquisition, we now own the Shirley Basin and Lucky Mc mine sites in the Shirley Basin and Gas Hills mining districts of Wyoming, respectively, from which Pathfinder and its predecessors historically produced more than 71,000,000 pounds of uranium, primarily from the 1960s through the 1990s. Pathfinder's predecessors included COGEMA, Lucky Mc Uranium Corporation, and Utah Construction/Utah International.

Both Lucky Mc and Shirley Basin conventional mine operations were suspended in the 1990s due to low uranium pricing, and facility reclamation was substantially completed. We assumed the remaining reclamation responsibilities including financial surety for reclamation, at Shirley Basin and at the Lucky Mc mine site. The Lucky Mc tailings site was fully reclaimed and, at the time of our acquisition, was in the process of being transferred to the U.S. Department of Energy. Therefore, we assumed no obligations with respect to the Lucky Mc tailings site, which were retained by the seller upon closing, or the NRC license at the site. We do not have plans for the further exploration or development of the Lucky Mc property at this time.

Together with property holdings of patented lands, unpatented mining claims, and State of Wyoming and private leases totalling more than 5,500 acres (nearly 3,700 acres at Shirley Basin (approximately 1,500 hectares); approximately 1,800 at Lucky Mc (approximately 750 hectares)), we also acquired all historic geologic, engineering and operational data related to the two mine areas. Our project at Shirley Basin (the "Shirley Basin Project") is in Carbon County, Wyoming, approximately 40 miles south of Casper, Wyoming. The project is accessed by travelling west from Casper, on Highway 220. After travelling 18 miles, turn south on Highway 487 and travel an additional 35 miles; the entrance to Shirley Basin Mine is to the east.

In addition to the two projects and related data, we acquired an extensive U.S. exploration and development database estimated to comprise hundreds of project descriptions in more than 20 states, including thousands of drill logs and geologic reports. Our geology team continues with its evaluation of this database, assessing opportunities for monetizing this additional asset.

The tailings facility at the Shirley Basin site is one of the few remaining facilities in the United States that is licensed by the NRC to receive and dispose of byproduct waste material from other in situ uranium mines. We assumed the operation of the byproduct disposal site and have accepted deliveries throughout 2016 and 2017 under several existing contracts.

Preliminary Economic Assessment for Shirley Basin Uranium Project

In 2014, we issued a Technical Report on Resources for the Shirley Basin Uranium Project Carbon County Wyoming (August 27, 2014). Subsequently, in January 2015, we issued a Preliminary Economic Assessment for the Shirley Basin Uranium Project Carbon County Wyoming, January 27, 2015 (the

"Shirley Basin PEA"). The Shirley Basin PEA was prepared under the supervision of WWC Engineering. The current mineral resources at the Shirley Basin Project are estimated as follows:

Shirley Basin Uranium Project - Resource Summary

RESOURCE AREA	MEASURED			INDICATED		
	AVG GRADE % eU_3O_8	SHORT TONS (X 1000)	POUNDS (X 1000)	AVG GRADE (X 1000)	SHORT TONS (X 1000)	POUNDS (X 1000)
FAB TREND	0.280	1,172	6,574	0.119	456	1,081
AREA 5	0.243	195	947	0.115	93	214
TOTAL	**0.275**	**1,367**	**7,521**	**0.118**	**549**	**1,295**
			MEASURED & INDICATED	**0.230**	**1,915**	***8,816***

Notes:
1. Sum of Measured and Indicated tons and pounds may not add to the reported total due to rounding.
2. Mineral resources that are not mineral reserves do not have demonstrated economic viability.
3. Based on grade cutoff of 0.020 percent eU_3O_8 and a grade x thickness cutoff of 0.25 GT.
4. Measured, Indicated, and Inferred Mineral Resources as defined in Section 1.2 of NI 43-101 (the CIM Definition Standards (CIM Council, 2014)).
5. Resources are reported through July 2014.
6. All reported resources occur below the historical, pre-mining static water table.
7. Sandstone density is 16.0 cu. ft./ton.
8. Information shown in the table above differs from the disclosure requirements of the SEC.

The Shirley Basin mineral resource estimate includes drill data and analyses of approximately 3,200 holes and nearly 1.2 million feet of historic drilling at the Shirley Basin Project which were acquired with the acquisition of Pathfinder. We drilled 14 confirmation holes representing approximately 6,600 feet which were included in the mineral resource estimate.

Shirley Basin History and Geology

The Shirley Basin property lies in the northern half of the historic Shirley Basin uranium mining district (the "District"), which is the second most prolific uranium mining district in Wyoming. Earliest discoveries were made in 1954 by Teton Exploration. This was followed by an extensive claim staking and drilling rush by several companies in 1957. Several important discoveries were made and the first mining was started in 1959 by Utah Construction Corp. (predecessor to Pathfinder). Underground mining methods were initially employed but encountered severe groundwater removal problems, so in 1961 Utah Construction switched to solution mining methods. This was the first commercially successful application of in situ solution mining recovery for uranium in the United States. In 1968 market and production needs caused Utah Construction to move to open-pit mining and a conventional mill. All production within the district since that time has been by open-pit methods.

Several companies operated uranium mines within the District, however three companies were dominant. Utah Construction/Pathfinder's efforts were focused in the northern portions of the District, while Getty was largely in the central portions, and Kerr-McGee was in the southern portions. In 1960, Getty and Kerr-McGee joined together as Petrotomics Company to build a mill for joint processing of their production. The last mining in the District ended in 1992 when Pathfinder shut down production due to market conditions. Total production from Shirley Basin was 51.3 million pounds of uranium, of which 28.3 million pounds came from the Utah Construction/Pathfinder operations which we now own.

Resources which we are currently targeting for ISR production represent unmined extensions of mineral trends addressed in past open-pit mines. These extensions had been targeted for mining but were abandoned with shut-down of the mining operations in 1992.

The Shirley Basin mining district lies in the north-central portions of the Shirley Basin geologic province, which is one of several inter-montane basins in Wyoming created 35-70 million years ago (mya) during the Laramide mountain building event. The Basin is floored by folded sedimentary formations of Cretaceous age (35-145 mya). These units were tilted by Laramide tectonic forces and subsequently exposed to erosion, creating a “paleo-topographic” surface. In the northern half of the Basin the Cretaceous units were later covered by stream sediments of the Wind River Formation of Eocene age (34-56 mya) which filled paleo-drainages cut into a paleo-topographic surface. The source of the Wind River sediments is granitic terrain within the nearby Laramie Range to the east and the Shirley Mountains to the southwest. The Wind River Formation was subsequently covered by younger volcanic ash-choked stream sediments of the White River and Arikaree Formations of Oligocene age (23-34 mya) and Miocene age (5-23 mya), respectively.

The Wind River Formation is the host of all uranium mineralization mined within the Shirley Basin mining district. The lithology of the Wind River Formation is characterized by multiple thick, medium to coarse grained sandstones separated by thick claystone shale units. The individual sandstones and shales are typically 20 to 50 feet thick. Total thickness of the Wind River Formation ranges from approximately 400 to 500 feet. The two most dominant sandstones are named the Main and Lower Sands. The Lower Sand represents the basal sand unit of the Wind River Formation and in places lies directly above the underlying Cretaceous formations.

Uranium occurs as roll front type deposits along the edge of large regional alteration systems within sandstone units of the Wind River Formation. The source of the uranium is considered to be the volcanic ash content within the overlying White River Formation and also granitic content within the Wind River Formation itself. The Main and Lower Sands are the primary hosts to mineralization which we are currently targeting for ISR development. Studies we conducted in 2014, as well as previous studies by Pathfinder in the late 1990s, indicate that this mineralization is amenable to ISR extraction. The primary target is called the FAB Trend which represents the connecting mineral trend between two past-produced open-pits. A secondary target called Area 5 was also an ISR target for Pathfinder prior to shut-down of their mining operations in 1992.

Exhibit 5

Exhibit 5
Energy Fuels Resources (USA) Inc. Background

Energy Fuels Resources (USA) Inc. is a Delaware corporation that was incorporated on January 3, 1996 under the name "International Uranium (USA) Corporation", and changed its name to Denison Mines (USA) Corp. on December 13, 2006 and to Energy Fuels Resources (USA) Inc. on July 25, 2012. Energy Fuels' principal place of business and corporate office is at 225 Union Blvd., Suite 600, Lakewood, Colorado 80228, USA. (Energy Fuels Resources (USA) Inc., together with its U.S. affiliates, is referred to herein as "**Energy Fuels**" or the "**Company**").

Energy Fuels is a wholly owned subsidiary of Energy Fuels Inc. ("EFI"), an Ontario corporation. The registered office of EFI is located at 82 Richmond Street East; Suite 308 Toronto, Ontario, M5C 1P1, Canada. All of EFI's and the Company's business and assets are located in the United States and are owned and operated by Energy Fuels.

The primary trading market for EFI's common shares is the NYSE American under the trading symbol "UUUU", and EFI's common shares are also listed on the Toronto Stock Exchange under the trading symbol "EFR". A large majority of EFI's shareholders are residents of the United States and, as a result of this U.S. ownership, EFI is classified as a U.S. domestic issuer for SEC reporting purposes. All of EFI's officers and employees are residents of the United States.

Business Overview

Energy Fuels is engaged in conventional and *in situ* ("**ISR**") uranium extraction and recovery, along with the exploration, permitting, and evaluation of uranium properties in the United States. Energy Fuels owns the Nichols Ranch Uranium Recovery Facility in Wyoming (the **"Nichols Ranch Project"**), which is one of the newest uranium recovery facilities operating in the United States, and the Alta Mesa Project in Texas (the "**Alta Mesa Project**"), which is an ISR production center currently on care and maintenance. In addition, Energy Fuels owns the White Mesa Mill in Utah (the **"White Mesa Mill"** or **"Mill"**), which is the only conventional uranium recovery facility operating in the United States. The Company also owns uranium and uranium/vanadium properties and projects in various stages of exploration, permitting, and evaluation, as well as fully-permitted uranium and uranium/vanadium projects on standby. The White Mesa Mill can also recover vanadium as a co-product of mineralized material produced from certain of its projects in Colorado and Utah. In addition, Energy Fuels recovers uranium from other uranium-bearing materials not derived from conventional material, referred to as "alternate feed materials," at its White Mesa Mill.

<u>ISR Properties</u>

The Company conducts its ISR activities through its Nichols Ranch Project in northeast Wyoming, which it acquired in June 2015 through its acquisition of Uranerz Energy Corporation, and its Alta Mesa Project in south Texas, which it acquired in June 2016 through its acquisition of Mesteña Uranium, LLC.

The Nichols Ranch Project includes: (i) a licensed and operating ISR processing facility (the "**Nichols Ranch Plant**"); (ii) licensed and operating ISR wellfields (the "**Nichols Ranch Wellfields**"); (iii) planned ISR wellfields (the "**Jane Dough Property**"), and; (iv) a licensed ISR uranium project (the **"Hank Project"**), which will include an ISR satellite plant (the **"Hank Satellite Plant"**) that, when constructed, will produce loaded-resin, and associated planned wellfields (the **"Hank Property"**). Also through the acquisition of Uranerz, the Company acquired the Reno Creek property, which the Company is currently in the process of selling, the West North Butte property, and the North Rolling Pin property, as well as the Arkose Mining Venture, which is a joint venture of Wyoming ISR properties held 81% by Energy Fuels.

The Nichols Ranch Project is an operating ISR facility that recovers uranium through a series of injection and recovery wells. Using groundwater fortified with oxygen and sodium bicarbonate, uranium is dissolved within a deposit. The groundwater is then collected in a series of recovery wells and pumped to the Nichols Ranch Plant. The Nichols Ranch Plant creates a yellowcake slurry that is transported by truck to the White Mesa Mill, where it is dried and packaged into drums that are shipped to uranium conversion facilities.

Construction of the Nichols Ranch Plant, other than the elution, drying and packaging circuits, was completed in 2013, and it commenced uranium recovery activities in the second quarter of 2014. In September of 2015, the Company commenced construction of an elution circuit at the Nichols Ranch Plant, which was completed and began operations in February 2016. During 2016, a total of 335,000 pounds of U_3O_8 were recovered from the Nichols Ranch Project.

The Alta Mesa Project is a fully licensed, permitted and constructed ISR processing facility that has an operating capacity of 1.5 million pounds of uranium per year and comprises 195,501 contiguous acres of land. The Alta Mesa Project is currently on standby and ready to resume production as market conditions warrant; Alta Mesa can reach commercial production levels with limited required capital within six months of a production decision.

Conventional Properties

The Company conducts its conventional uranium extraction and recovery activities through its White Mesa Mill, which is the only operating conventional uranium mill in the United States. The White Mesa Mill, located near Blanding Utah, is centrally located such that it can be fed by a number of the Company's uranium and uranium/vanadium projects in Colorado, Utah, Arizona and New Mexico, as well as by ore purchases or toll milling arrangements with third party miners in the region as market conditions warrant.

The White Mesa Mill is a 2,000 ton per day uranium recovery facility, which can also process vanadium as a co-product of mineralized material extracted from certain uranium/vanadium properties. In addition, the Mill can recycle other uranium-bearing materials not derived from conventional ore, referred to as "alternate feed materials", for the recovery of uranium, alone or in combination with other metals.

The White Mesa Mill has historically operated on a campaign basis, whereby mineral processing occurs as mill feed, contract requirements, and market conditions warrant. Over the years, the

Company's own, and third-party owned, conventional uranium properties in Utah, Colorado, Arizona and New Mexico have been both active and on standby, from time-to-time, in response to changing market conditions. From 2007 through 2014, running on a campaign basis, the White Mesa Mill recovered on average over 1 million pounds of U_3O_8 per year from conventional sources, including its La Sal Project, Daneros Project, and Tony M property in Utah; its Arizona 1 and Pinenut Projects in Arizona; and alternate feed materials. During 2015, the Mill recovered a total of 296,000 lbs. of U_3O_8, of which 25,000 pounds were recovered from conventional materials and the remainder from processing alternate feed materials (including 72,000 pounds for the account of a third party). During 2016, the Mill recovered a total of 680,000 lbs. of U_3O_8, of which 432,816 pounds were recovered from conventional materials from the Company's Pinenut Project and 248,492 pounds from processing alternate feed materials.

The Company's Pinenut Project, where mineral extraction activities occurred until September 2015, is now depleted, and reclamation activities have commenced. The Company continues to receive and process alternate feed materials at the White Mesa Mill. At the Company's permitted Canyon Project, shaft-sinking activities and an underground drilling program are substantially complete. The timing to extract and process mineralized material from the Canyon Project will be based on the evaluation of this underground drilling program, along with market conditions, available financing, and sales requirements. All of the Company's other conventional properties and projects are currently in the permitting process or on standby pending improvements in market conditions. No third party conventional properties are active at this time.

The Company also owns the Sheep Mountain Project (the **"Sheep Mountain Project"**), which is a conventional uranium project located in Wyoming. Due to its distance from the White Mesa Mill, the Sheep Mountain Project is not expected to be a source of feed material for the Mill. The Sheep Mountain Project consists of a permitted mine where uranium ores will be extracted by open pit and underground extraction methods and a planned processing facility to process uranium bearing ores, which has not yet been permitted.

The Company's principal conventional properties include the following:

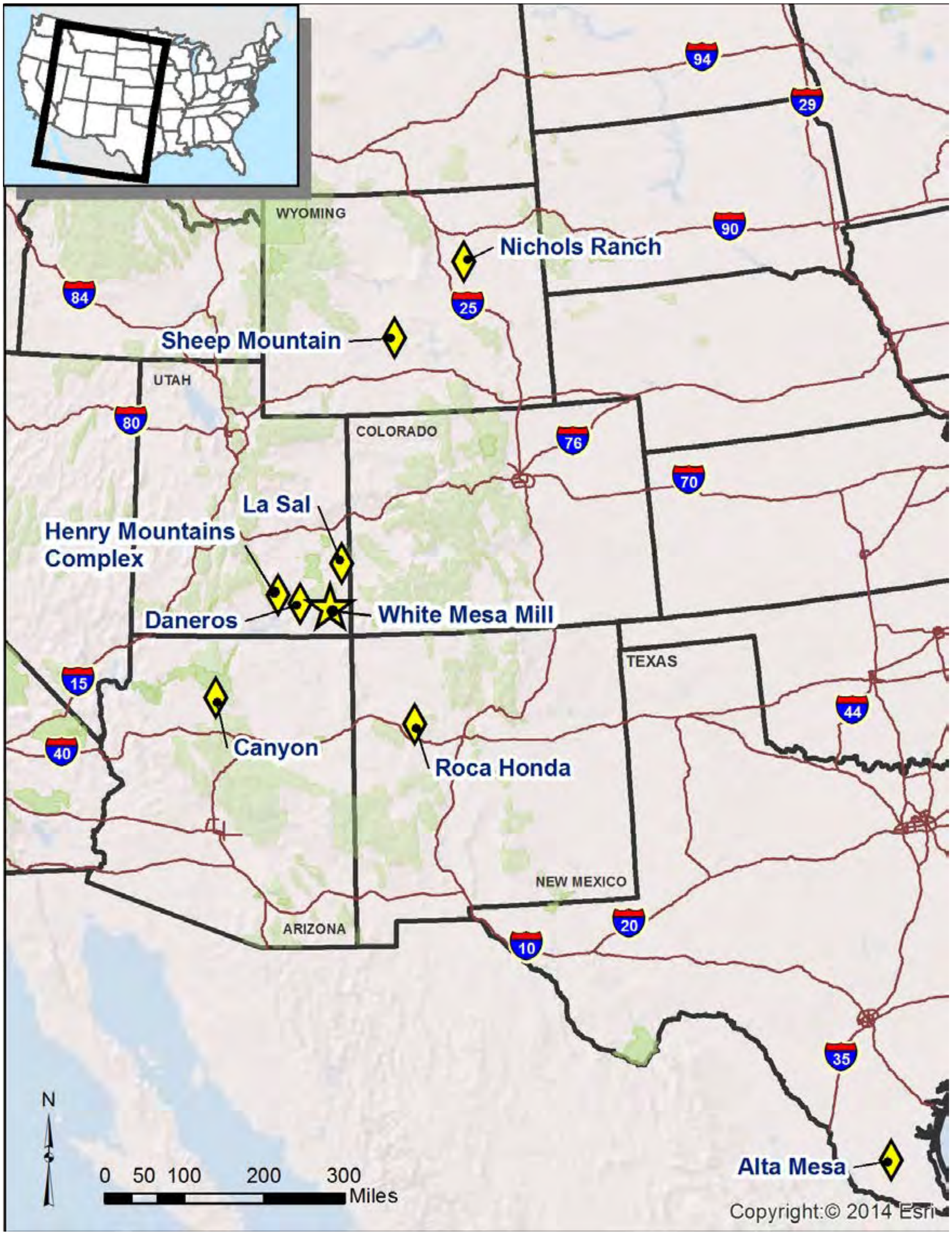
- the White Mesa Mill, a 2,000 ton per day uranium and vanadium processing facility located near Blanding, Utah;
- the Arizona Strip uranium properties located in north central Arizona, including: the Canyon Project, which is a fully-permitted uranium project with all surface facilities in place and shaft-sinking underway; the Wate project, which is a uranium deposit in the permitting stage; the Arizona 1 project, which is a fully-permitted uranium project on standby; the Pinenut Project which is a depleted uranium deposit in reclamation; and the EZ properties, which are uranium deposits in the exploration and evaluation stage;
- the Roca Honda uranium project, which is located near the town of Grants, New Mexico;
- the Sheep Mountain Project, which is a uranium project located near Jeffrey City, Wyoming, including permitted open pit and underground components;
- the Henry Mountains complex of uranium projects, located in south central Utah near the town of Ticaboo, which is comprised of the Tony M property and the Bullfrog property;

- the La Sal complex of uranium and uranium/vanadium projects, the Whirlwind uranium/vanadium project, and the Sage Plain uranium/vanadium project, all of which are located near the Colorado/Utah border;
- the Daneros uranium project located in the White Canyon district in southeastern Utah; and
- a number of additional uranium properties.

Mineral Exploration

Energy Fuels holds a number of exploration properties in the Colorado Plateau, White Canyon, Grants, Arizona Strip, and Powder River Basin Districts. Energy Fuels has conducted intermittent exploration drilling on numerous projects in the period from February 2007 through December 2013. Several of those projects have been abandoned or sold. No surface exploration drilling was performed in 2014, 2015, 2016 or 2017.

The following map shows the locations of Energy Fuels' material properties:


WYOMING
Nichols Ranch
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29
90
84
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Sheep Mountain
UTAH
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COLORADO
76
70
La Sal
Henry Mountains
Complex
Daneros
White Mesa Mill
TEXAS
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Canyon
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40
Roca Honda
NEW MEXICO
ARIZONA
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Additional Information

Additional information relating to Energy Fuels can be found in in the Company's Annual Report on Form 10-K dated March 9, 2017, which is available for review on EDGAR at www.sec.gov/edgar.shtml, on SEDAR at www.sedar.com, and on the Company's website at www.energyfuels.com.

Exhibit 6

Independent Statistics & Analysis
U.S. Energy Information Administration

2016 Uranium Marketing Annual Report

June 2017

Contacts

This report was prepared by the staff of the Power and Uranium Operations Team, Office of Electricity, Renewables, and Uranium Statistics. Questions about the preparation and content of this report may be directed to InfoNuclearData@eia.gov.

Preface

The U.S. Energy Information Administration (EIA) reports detailed data spanning 2012 through 2016 and summary data back to 1994 on uranium marketing activities in the United States in this report, *2016 Uranium Marketing Annual Report*.

Data in this report are based on information reported on Form EIA-858, "Uranium Marketing Annual Survey." Form EIA-858 survey collects data on contracts, deliveries (during the report year and projected for the next ten years), enrichment services purchased, inventories, use in fuel assemblies, feed deliveries to enrichers (during the report year and projected for the next ten years), and unfilled market requirements for the next ten years.

Prior editions of this report may be found on the EIA website at http://www.eia.gov/nuclear/reports.cfm.

Definitions for terms used in this report can be found in EIA's Energy Glossary: http://www.eia.gov/tools/glossary/.

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Uranium purchases and prices

Owners and operators of U.S. civilian nuclear power reactors ("civilian owner/operators" or "COOs") purchased a total of 50.6 million pounds U_3O_8e (equivalent[1]) of deliveries from U.S. suppliers and foreign suppliers during 2016, at a weighted-average price of $42.43 per pound U_3O_8e. The 2016 total of 50.6 million pounds U_3O_8e decreased 10% compared with the 2015 total of 56.5 million pounds U_3O_8e. The 2016 weighted-average price of $42.43 per pound U_3O_8e decreased 4% compared with the 2015 weighted-average price of $44.13 per pound U_3O_8e (Table 1).

Eleven percent of the 50.6 million pounds U_3O_8e delivered in 2016 was U.S.-origin uranium at a weighted-average price of $43.92 per pound. Foreign-origin uranium accounted for the remaining 89% of deliveries at a weighted-average price of $42.26 per pound (Table 2). Uranium originating in Kazakhstan, Russia and Uzbekistan accounted for 38% of the 50.6 million pounds. Australian-origin and Canadian-origin uranium together accounted for 40%. The remaining 22% originated from Brazil, Bulgaria, China, Czech Republic, Germany, Malawi, Namibia, Niger, South Africa and Ukraine (Table 3).

COOs purchased uranium of three material types for 2016 deliveries from 36 sellers, the same number of sellers as in 2015 (Table 4, Table 24). Uranium concentrate was 54% of the 50.6 million pounds U_3O_8e delivered in 2016. Natural UF_6 was 29% and enriched UF_6 was 17% (Table 4). During 2016, 22% of the uranium delivered was purchased under spot contracts at a weighted-average price of $29.62 per pound. The remaining 78% was purchased under long-term contracts at a weighted-average price of $46.11 per pound (Table 7). Spot contracts are contracts with a one-time uranium delivery (usually) for the entire contract and the delivery typically occurs within one year of contract execution (signed date). Long-term contracts are contracts with one or more uranium deliveries to occur after a year following the contract execution (signed date) and as such may reflect some agreements of short and medium terms as well as longer term.

New and future uranium contracts

In 2016, COOs signed 50 new purchase contracts with deliveries in 2016 of 8.7 million pounds U_3O_8e at a weighted-average price of $24.86 per pound. Five new contracts were long-term contracts with 28% of the 2016 deliveries and 45 new contracts were spot contracts with 72% of the deliveries in 2016 (Table 8).

COOs report minimum and maximum quantities of future deliveries under contract, to allow for the option of either decreasing or increasing quantities. As of the end of 2016, the maximum uranium deliveries for 2017 through 2026 under existing purchase contracts for COOs totaled 175 million pounds U_3O_8e (Table 10). Also as of the end of 2016, unfilled uranium market requirements for 2017 through 2026 totaled 233 million pounds U_3O_8e (Table 11). These contracted deliveries and unfilled market requirements combined represent the maximum anticipated market requirements of 408 million pounds U_3O_8e over the ten-year period for COOs.

[1]Uranium quantities are expressed in the unit of measure U_3O_8e (equivalent). U_3O_8e is uranium oxide (or uranium concentrate) and the equivalent uranium-component of uranium hexafluoride (UF_6) and enriched uranium.

Uranium feed, enrichment services, uranium loaded

In 2016, COOs delivered 43 million pounds U_3O_8e of natural uranium feed to U.S. and foreign enrichers. Fifty three percent of the feed was delivered to U.S. enrichment suppliers and the remaining 47% was delivered to foreign enrichment suppliers (Table 13). Fourteen million separative work units (SWU)[2] were purchased under enrichment services contracts from 12 sellers in 2016, the same number of sellers as in 2015 (Table 16, Table 25). The average price paid by the COOs for the 14 million SWU was $131 per SWU in 2016, compared with the 2015 average price of $136.88 per SWU. In 2016, the U.S.-origin SWU share was 33% and foreign-origin SWU accounted for the remaining 67%. Russian-origin SWU was 22% of the total, 18% from the Netherlands, 11% from Germany and 7% from the United Kingdom (Table 16).

Uranium in fuel assemblies loaded into U.S. civilian nuclear power reactors during 2016 contained 43 million pounds U_3O_8e, compared with 47 million pounds U_3O_8e loaded during 2015. Eight percent of the uranium loaded during 2016 was U.S.-origin uranium, and 92% was foreign-origin uranium (Table 18).

Uranium foreign purchases/sales and inventories

U.S. suppliers (brokers, converters, enrichers, fabricators, producers, and traders) and COOs purchase uranium each year from foreign suppliers. Together, foreign purchases totaled 51 million pounds U_3O_8e in 2016, and the weighted-average price was $40.45 per pound U_3O_8e (Table 19). Also, U.S. suppliers and COOs sold uranium to foreign suppliers. Together, foreign sales totaled 17 million pounds U_3O_8e in 2016, and the weighted-average price was $33.66 per pound U_3O_8e (Table 21).

Year-end commercial uranium inventories represent ownership of uranium in different stages of the nuclear fuel cycle (in-process for conversion, enrichment, or fabrication) at domestic or foreign nuclear fuel facilities. Total U.S. commercial inventories (including inventories owned by COOs, U.S. brokers, converter, enrichers, fabricators, producers, and traders) was 144 million pounds U_3O_8e as of the end of 2016. Commercial uranium inventories owned at the end of 2016 by COOs totaled 129 million pounds U_3O_8e, an increase of 6% from year-end 2015. Uranium inventories owned by U.S. brokers and traders were 8 million pounds U_3O_8e. U.S. converter, enrichers, fabricators and producers owned 8 million pounds U_3O_8e of inventories at the end of 2016 (Table 22).

[2] Separative work unit (SWU): The standard measure of enrichment services. The effort expended in separating a mass F of feed of assay x_f into a mass P of product assay x_p and waste of mass W and assay x_w is expressed in terms of the number of separative work units needed, given by the expression $SWU = WV(x_w) + PV(x_p) - FV(x_f)$, where V(x) is the "value function," defined as $V(x) = (1 - 2x)\ 1n((1 - x)/x)$.

Table S1a. Uranium purchased by owners and operators of U.S. civilian nuclear power reactors, 1994-2016

million pounds U_3O_8 equivalent

Delivery year	Total purchased	Purchased from U.S. producers	Purchased from U.S. brokers and traders	Purchased from other owners and operators of U.S. civilian nuclear power reactors, other U.S. suppliers, (and U.S. government for 2007) [1]	Purchased from foreign suppliers	U.S.-origin uranium	Foreign-origin uranium	Spot contracts [2]	Short, medium, and long-term contracts [3]
1994	**38.3**	5.4	15.3	1.1	16.5	**7.7**	**30.6**	**8.5**	**29.8**
1995	**43.4**	5.3	16.2	0.6	21.4	**5.2**	**38.2**	**13.6**	**29.8**
1996	**47.3**	5.8	13.3	1.9	26.4	**8.3**	**39.0**	**9.1**	**38.3**
1997	**42.0**	5.7	9.9	3.0	23.4	**8.1**	**33.9**	**5.5**	**36.5**
1998	**42.7**	6.5	10.5	4.5	21.3	**7.2**	**35.6**	**7.8**	**34.9**
1999	**47.9**	5.2	10.4	5.6	26.8	**11.4**	**36.5**	**8.0**	**40.0**
2000	**51.8**	3.6	9.1	8.8	30.4	**13.3**	**38.6**	**10.4**	**39.1**
2001	**55.4**	2.3	11.7	11.4	30.0	**13.2**	**42.2**	**14.4**	**40.0**
2002	**52.7**	1.5	13.4	5.7	32.2	**6.2**	**46.5**	**8.6**	**41.4**
2003	**56.6**	0.6	10.5	8.3	37.2	**10.2**	**46.4**	**8.2**	**46.7**
2004	**64.1**	0	13.2	12.2	38.7	**12.3**	**51.8**	**9.2**	**53.3**
2005	**65.7**	W	10.4	W	39.4	**11.0**	**54.7**	**6.9**	**58.8**
2006	**66.5**	0	13.9	12.6	40.0	**10.8**	**55.7**	**6.3**	**59.4**
2007	**51.0**	0	9.8	7.6	33.5	**4.0**	**47.0**	**6.6**	**43.7**
2008	**53.4**	0.6	9.4	6.3	37.2	**7.7**	**45.6**	**8.7**	**42.8**
2009	**49.8**	W	11.1	W	36.8	**7.1**	**42.8**	**8.1**	**41.0**
2010	**46.6**	0.4	11.7	1.9	32.6	**3.7**	**42.9**	**8.2**	**37.9**
2011	**54.8**	0.6	14.8	1.1	38.4	**5.2**	**49.6**	**12.0**	**42.3**
2012	**57.5**	W	11.5	W	37.6	**9.8**	**47.7**	**8.1**	**48.9**
2013	**57.4**	W	12.8	W	37.4	**9.5**	**47.9**	**11.3**	**46.1**
2014	**53.3**	W	17.1	W	34.4	**3.3**	**50.0**	**14.5**	**38.8**
2015	**56.5**	W	13.9	W	38.2	**3.4**	**53.1**	**11.3**	**43.2**
2016	**50.6**	W	7.9	W	39.5	**5.4**	**45.2**	**10.6**	**37.0**

- - = Not applicable. W = Data withheld to avoid disclosure of individual company data. NA = Not available.

[1] Includes purchases between owners and operators of U.S. civilian nuclear power reactors along with purchases from other U.S. suppliers which are U.S. converters, enrichers, and fabricators.

[2] Spot Contract: A one-time delivery (usually) of the entire contract to occur within one year of contract execution (signed date).

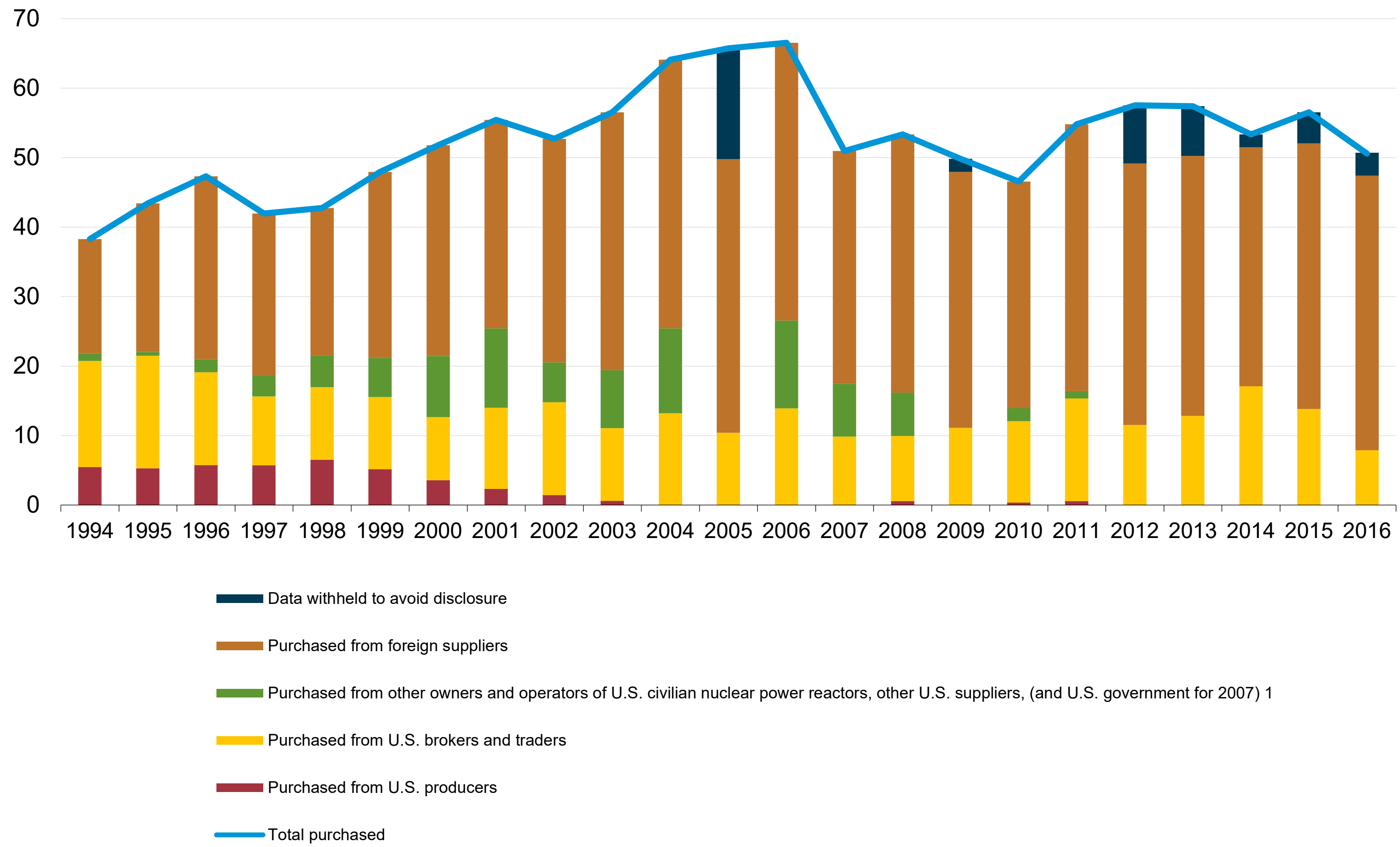
[3] Short, Medium, and Long-Term Contracts: One or more deliveries to occur after a year following contract execution (signed date).

Notes: "Other U.S. Suppliers" are U.S. converters, enrichers, and fabricators. Totals may not equal sum of components because of independent rounding.

Sources: U.S. Energy Information Administration: 1994-2002-Uranium Industry Annual, Tables 10, 11 and 16. 2003-16-Form EIA-858, "Uranium Marketing Annual Survey".

Figure S1. Uranium purchased by owners and operators of U.S. civilian nuclear power reactors, 1994-2016 deliveries

million pounds U_3O_8 equivalent



[1] Includes purchases between owners and operators of U.S. civilian nuclear power reactors along with purchases from other U.S. suppliers which are U.S. converters, enrichers, and fabricators.
Sources: U.S. Energy Information Administration: 1994-2002-Uranium Industry Annual reports. 2003-16-Form EIA-858, "Uranium Marketing Annual Survey".

Table S1b. Weighted-average price of uranium purchased by owners and operators of U.S. civilian nuclear power reactors, 1994-2016

dollars per pound U_3O_8 equivalent

Delivery year	Total purchased (weighted-average price)	Purchased from U.S. producers	Purchased from U.S. brokers and traders	Purchased from other owners and operators of U.S. civilian nuclear power reactors, other U.S. suppliers, (and U.S. government for 2007) [1]	Purchased from foreign suppliers	U.S.-origin uranium (weighted-average price)	Foreign-origin uranium (weighted-average price)	Spot contracts [2] (weighted-average price)	Short, medium, and long-term contracts [3] (weighted-average price)
1994	**10.40**	13.72	9.34	8.04	10.43	**12.08**	**9.97**	**9.01**	**NA**
1995	**11.25**	14.84	9.83	12.52	11.40	**14.20**	**10.84**	**10.30**	**NA**
1996	**14.12**	14.20	13.36	14.98	14.45	**14.62**	**14.02**	**14.22**	**NA**
1997	**12.88**	13.60	12.31	W	12.91	**13.36**	**12.78**	**11.61**	**NA**
1998	**12.14**	13.61	11.95	W	11.97	**13.37**	**11.90**	**10.56**	**NA**
1999	**11.63**	13.93	11.54	W	11.47	**12.24**	**11.47**	**9.52**	**NA**
2000	**11.04**	14.81	11.28	10.45	10.65	**11.52**	**10.88**	**8.54**	**11.70**
2001	**10.15**	13.26	10.44	9.98	9.86	**10.50**	**10.05**	**7.92**	**10.96**
2002	**10.36**	13.03	10.21	W	10.37	**10.89**	**10.29**	**9.29**	**10.58**
2003	**10.81**	14.17	11.05	10.16	10.82	**10.81**	**10.81**	**10.10**	**10.94**
2004	**12.61**	- -	12.08	11.30	13.15	**11.87**	**12.76**	**14.77**	**12.24**
2005	**14.36**	W	13.76	W	14.70	**15.11**	**14.21**	**20.04**	**13.70**
2006	**18.61**	- -	20.49	W	18.62	**17.85**	**18.75**	**39.48**	**16.38**
2007	**32.78**	- -	34.10	W	32.36	**28.89**	**33.05**	**88.25**	**24.45**
2008	**45.88**	75.16	39.62	W	48.49	**59.55**	**43.47**	**66.95**	**41.59**
2009	**45.86**	W	41.88	W	46.68	**48.92**	**45.35**	**46.45**	**45.74**
2010	**49.29**	47.13	44.98	42.24	51.30	**45.25**	**49.64**	**43.99**	**50.43**
2011	**55.64**	58.12	53.29	52.50	56.60	**52.12**	**55.98**	**54.69**	**55.90**
2012	**54.99**	W	54.44	W	54.40	**59.44**	**54.07**	**51.04**	**55.65**
2013	**51.99**	W	50.44	W	51.93	**56.37**	**51.13**	**43.83**	**54.00**
2014	**46.16**	W	42.90	W	47.62	**48.11**	**46.03**	**36.64**	**49.73**
2015	**44.13**	52.35	44.67	W	44.66	**43.86**	**44.14**	**36.80**	**46.04**
2016	**42.43**	48.86	50.56	W	44.85	**43.92**	**42.26**	**29.62**	**46.11**

- - = Not applicable. W = Data withheld to avoid disclosure of individual company data. NA = Not available.

[1] Includes purchases between owners and operators of U.S. civilian nuclear power reactors along with purchases from other U.S. suppliers which are U.S. converters, enrichers, and fabricators.

[2] Spot Contract: A one-time delivery (usually) of the entire contract to occur within one year of contract execution (signed date).

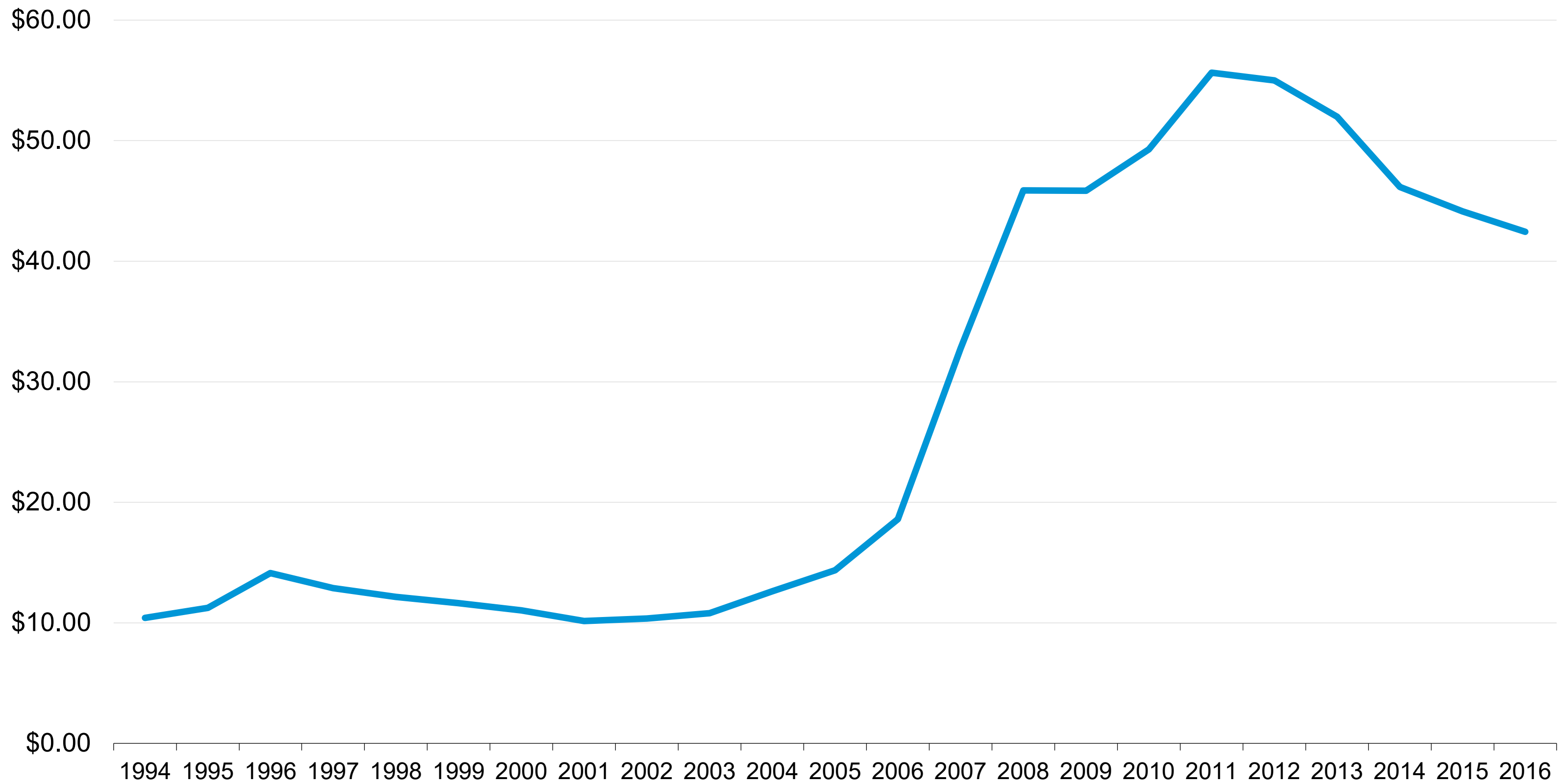
[3] Short, Medium, and Long-Term Contracts: One or more deliveries to occur after a year following contract execution (signed date).

Notes: "Other U.S. Suppliers" are U.S. converters, enrichers, and fabricators. Totals may not equal sum of components because of independent rounding. Weighted-average prices are not adjusted for inflation.

Sources: U.S. Energy Information Administration: 1994-2002-Uranium Industry Annual, Tables 10, 11 and 16. 2003-16-Form EIA-858, "Uranium Marketing Annual Survey".

Figure S2. Weighted-average price of uranium purchased by owners and operators of U.S. civilian nuclear power reactors, 1994-2016 deliveries

dollars per pound U_3O_8 equivalent



Sources: U.S. Energy Information Administration: 1994-2002-Uranium Industry Annual reports. 2003-16-Form EIA-858, "Uranium Marketing Annual Survey".

Table S2. Uranium feed deliveries, enrichment services, and uranium loaded by owners and operators of U.S. civilian nuclear power reactors, 1994-2016

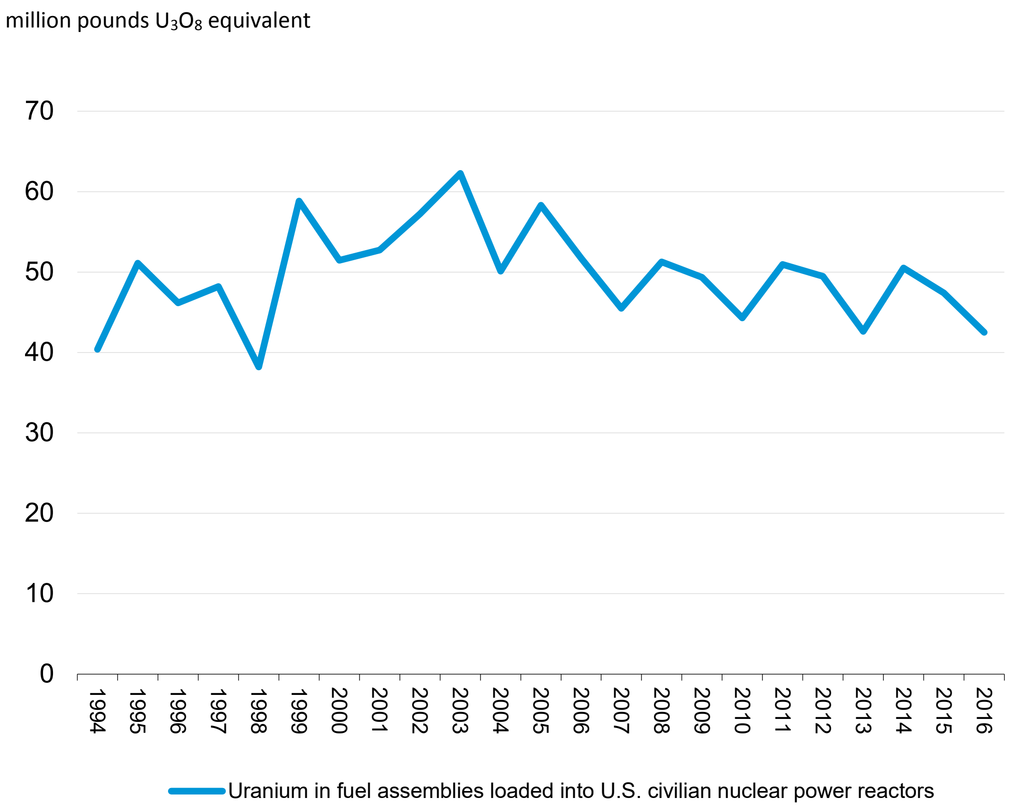
	Million pounds U_3O_8 equivalent		Million separative work units (SWU)			
Year	Feed deliveries by owners and operators of U.S. civilian nuclear power reactors	Uranium in fuel assemblies loaded into U.S. civilian nuclear power reactors	U.S.-origin enrichment services purchased	Foreign-origin enrichment services purchased	Total purchased enrichment services	Average price (US$ per SWU)
1994	37.6	40.4	7.5	1.7	**9.2**	-
1995	44.3	51.1	6.7	2.8	**9.5**	-
1996	49.1	46.2	8.0	3.2	**11.2**	-
1997	40.3	48.2	6.0	2.9	**8.9**	-
1998	40.6	38.2	5.7	4.4	**10.1**	-
1999	43.9	58.8	4.6	5.4	**10.0**	-
2000	47.8	51.5	5.2	6.6	**11.8**	-
2001	47.3	52.7	1.3	9.1	**10.4**	-
2002	54.7	57.2	1.7	9.8	**11.5**	-
2003	49.3	62.3	1.7	10.3	**12.0**	-
2004	53.4	50.1	1.4	10.4	**11.8**	-
2005	52.9	58.3	1.1	10.3	**11.4**	-
2006	56.6	51.7	1.6	11.8	**13.4**	**106.57**
2007	49.0	45.5	1.5	12.7	**14.2**	**114.58**
2008	43.4	51.3	1.9	10.7	**12.6**	**121.33**
2009	51.9	49.4	4.1	13.1	**17.2**	**130.78**
2010	45.5	44.3	2.3	11.5	**13.8**	**136.14**
2011	51.3	50.9	2.4	12.4	**14.8**	**136.12**
2012	52.1	49.5	3.3	12.3	**15.6**	**141.36**
2013	47.4	42.6	3.9	8.5	**12.3**	**142.22**
2014	41.9	50.5	3.8	9.2	**12.9**	**140.75**
2015	41.4	47.4	4.1	8.8	**12.9**	**136.88**
2016	43.1	42.5	4.8	9.5	**14.3**	**131.00**

- = No data reported.

Notes: Totals may not equal sum of components because of independent rounding. Average prices are not adjusted for inflation.

Sources: U.S. Energy Information Administration: 1994-2002-Uranium Industry Annual, Tables 22, 23, 25, and 27. 2003-16-Form EIA-858, "Uranium Marketing Annual Survey".

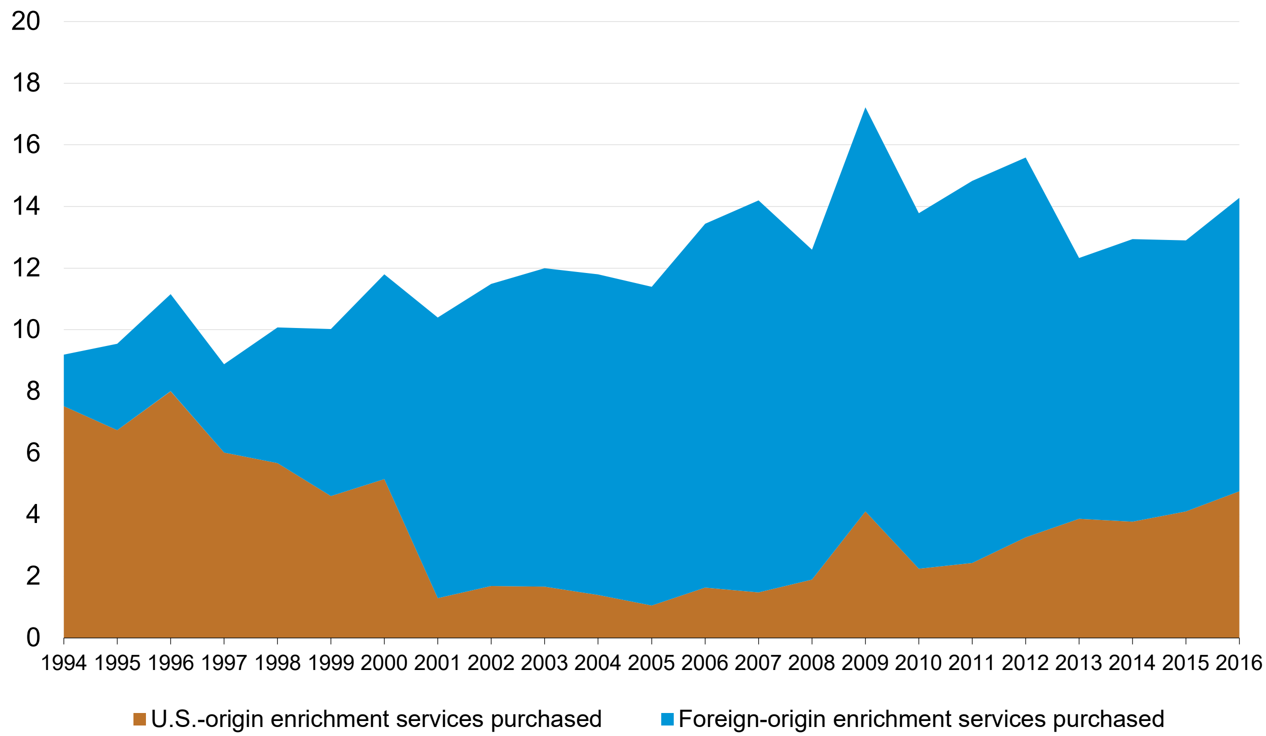
Figure S3. Uranium loaded into U.S. civilian nuclear power reactors, 1994-2016



Sources: U.S. Energy Information Administration: 1994-2002-Uranium Industry Annual reports. 2003-16-Form EIA-858, "Uranium Marketing Annual Survey".

Figure S4. Uranium enrichment services purchased by owners and operators of U.S. civilian nuclear power reactors, 1994-2016

million separative work units (SWU)



Sources: U.S. Energy Information Administration: 1994-2002-Uranium Industry Annual reports.
2003-16-Form EIA-858, "Uranium Marketing Annual Survey".

Table S3a. Foreign purchases, foreign sales, and uranium inventories owned by U.S. suppliers and owners and operators of U.S. civilian nuclear power reactors, 1994-2016

million pounds U_3O_8 equivalent

Delivery year	Foreign purchases by U.S. suppliers	Foreign purchases by owners and operators of U.S. civilian nuclear power reactors	Total foreign purchases	U.S. broker and trader purchases from foreign suppliers	Foreign sales	U.S. supplier owned uranium inventories	Owners and operators of U.S. civilian nuclear power reactors owned uranium inventories	Total commercial uranium inventories
1994	21.1	15.5	**36.6**	**22.3**	**17.7**	21.5	65.4	**86.9**
1995	20.2	21.1	**41.3**	**18.3**	**9.8**	13.7	58.7	**72.5**
1996	21.7	23.7	**45.4**	**17.8**	**11.5**	13.9	66.1	**80.0**
1997	20.4	22.5	**43.0**	**15.7**	**17.0**	40.4	65.9	**106.2**
1998	22.6	21.1	**43.7**	**21.7**	**15.1**	70.7	65.8	**136.5**
1999	21.0	26.6	**47.6**	**19.2**	**8.5**	68.8	58.3	**127.1**
2000	17.4	27.5	**44.9**	**15.8**	**13.6**	56.5	54.8	**111.3**
2001	18.7	28.0	**46.7**	**18.3**	**11.7**	48.1	55.6	**103.8**
2002	22.7	30.0	**52.7**	**18.6**	**15.4**	48.7	53.5	**102.1**
2003	18.2	34.9	**53.0**	**15.8**	**13.2**	39.9	45.6	**85.5**
2004	30.2	35.9	**66.1**	**26.4**	**13.2**	37.5	57.7	**95.2**
2005	27.0	38.5	**65.5**	**24.0**	**20.5**	29.1	64.7	**93.8**
2006	26.1	38.7	**64.8**	**24.0**	**18.7**	29.1	77.5	**106.6**
2007	21.6	32.5	**54.1**	**18.9**	**14.8**	31.2	81.2	**112.4**
2008	24.1	32.9	**57.1**	**21.3**	**17.2**	27.0	83.0	**110.0**
2009	26.7	32.2	**58.9**	**26.8**	**23.5**	26.8	84.8	**111.5**
2010	25.0	30.4	**55.3**	**24.7**	**23.1**	24.7	86.5	**111.3**
2011	19.3	35.1	**54.4**	**19.6**	**16.7**	22.3	89.8	**112.1**
2012	20.2	36.0	**56.2**	**20.2**	**18.0**	23.3	97.6	**120.9**
2013	23.2	34.1	**57.3**	**W**	**18.9**	21.3	113.1	**134.4**
2014	24.2	34.4	**58.6**	**W**	**20.0**	18.7	114.0	**135.5**
2015	27.2	36.9	**64.1**	**26.1**	**25.7**	14.3	121.1	**135.5**
2016	22.1	28.5	**50.7**	**22.1**	**17.2**	15.3	128.6	**143.9**

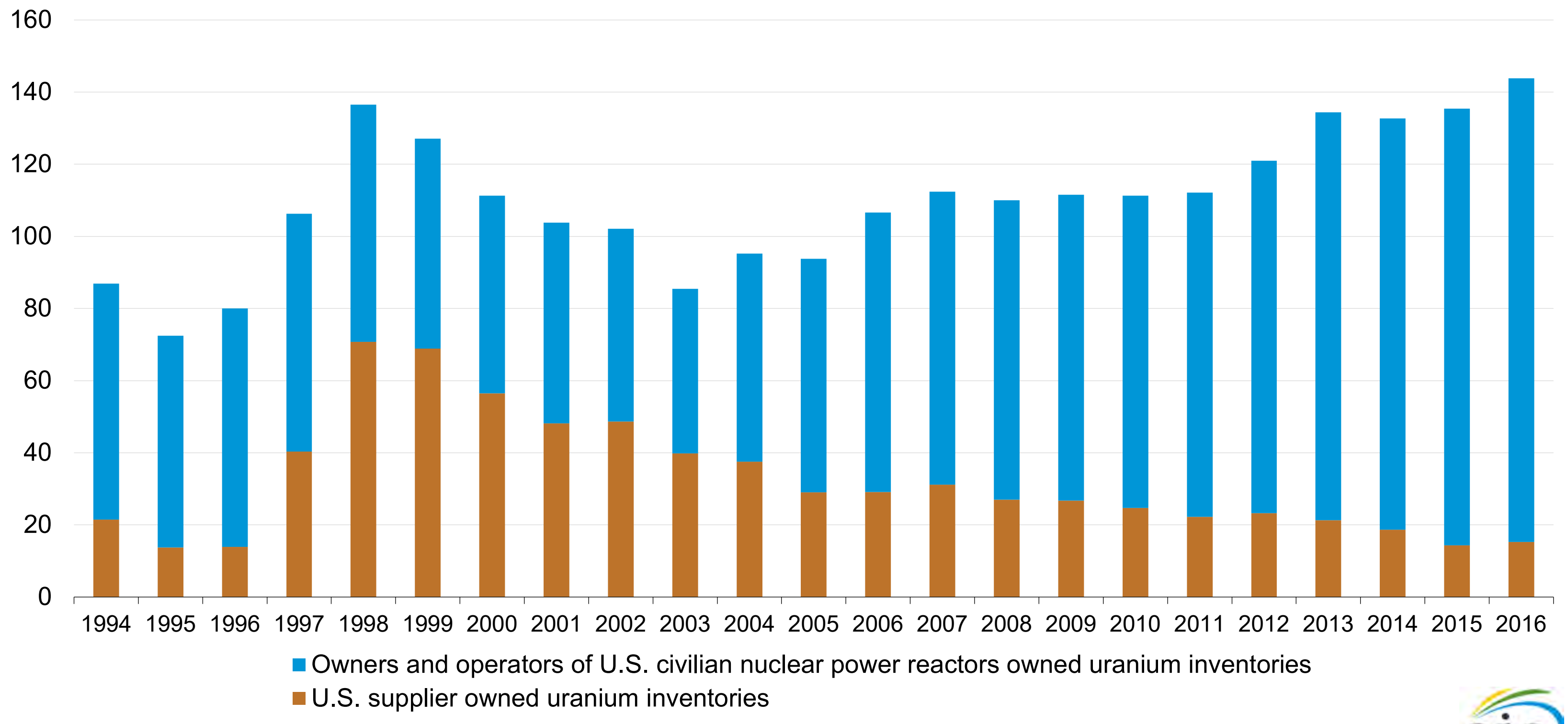
W = Data withheld to avoid disclosure of individual company data.

Notes: Totals may not equal sum of components because of independent rounding. Foreign purchase: A uranium purchase of foreign-origin uranium from a firm located outside the United States. Foreign sale: A uranium sale to a firm located outside the United States.

Sources: U.S. Energy Information Administration: 1994-2002-Uranium Industry Annual, Tables 28, 29, 30 and 31. 2003-16-Form EIA-858, "Uranium Marketing Annual Survey".

Figure S5. Total commercial uranium inventories of U.S. suppliers and owners and operators of U.S. civilian nuclear power reactors, 1994-2016

million pounds U_3O_8 equivalent



Sources: Energy Information Administration: 1994-2002-Uranium Industry Annual reports. 2003-16-Form EIA-858, "Uranium Marketing Annual Survey" .

Table S3b. Weighted-average price of foreign purchases and foreign sales by U.S. suppliers and owners and operators of U.S. civilian nuclear power reactors, 1994-2016

dollars per pound U_3O_8 equivalent

Delivery year	Foreign purchases by U.S. suppliers	Foreign purchases by owners and operators of U.S. civilian nuclear power reactors	Total foreign purchases (weighted-average price)	U.S. broker and trader purchases from foreign suppliers (weighted-average price)	Foreign sales (weighted-average price)
1994	7.78	10.53	**8.95**	**7.87**	**11.34**
1995	8.96	11.39	**10.20**	**9.02**	**13.48**
1996	11.78	14.41	**13.15**	**11.78**	**14.20**
1997	10.61	12.89	**11.81**	**10.71**	**12.39**
1998	10.50	11.96	**11.19**	**10.77**	**12.05**
1999	9.42	11.45	**10.55**	**9.60**	**11.97**
2000	8.45	10.68	**9.84**	**8.61**	**8.48**
2001	8.98	9.87	**9.51**	**8.87**	**8.79**
2002	9.65	10.37	**10.05**	**9.59**	**10.04**
2003	10.19	10.79	**10.59**	**10.19**	**10.39**
2004	11.21	13.13	**12.25**	**11.15**	**12.63**
2005	15.11	14.63	**14.83**	**15.68**	**20.70**
2006	20.28	18.66	**19.31**	**21.61**	**32.87**
2007	36.59	32.58	**34.18**	**39.88**	**55.47**
2008	33.30	47.46	**41.30**	**35.39**	**45.62**
2009	34.80	46.55	**41.23**	**34.88**	**41.48**
2010	41.30	51.69	**47.01**	**41.23**	**42.78**
2011	48.80	56.87	**54.00**	**49.27**	**49.05**
2012	46.80	54.08	**51.44**	**47.08**	**47.57**
2013	43.25	51.64	**48.24**	**W**	**42.75**
2014	39.13	47.62	**44.11**	**W**	**35.69**
2015	40.68	44.70	**42.96**	**40.77**	**35.69**
2016	36.03	44.08	**40.45**	**36.09**	**33.66**

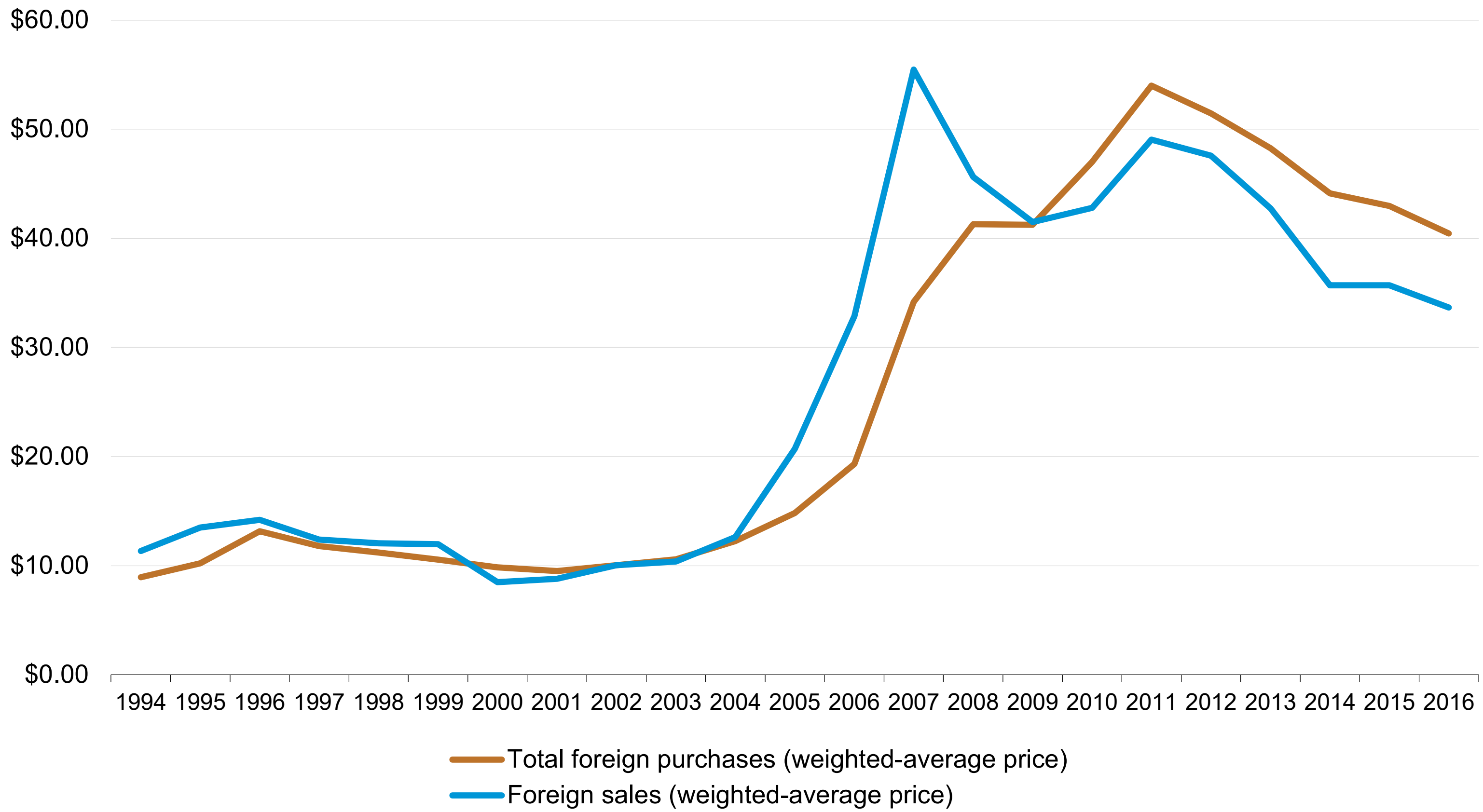
W = Data withheld to avoid disclosure of individual company data.

Notes: Totals may not equal sum of components because of independent rounding. Foreign purchase: A uranium purchase of foreign-origin uranium from a firm located outside the United States. Foreign sale: A uranium sale to a firm located outside the United States. Weighted-average prices are not adjusted for inflation.

Sources: U.S. Energy Information Administration: 1994-2002-Uranium Industry Annual, Tables 28, 29, 30 and 31. 2003-16-Form EIA-858, "Uranium Marketing Annual Survey".

Figure S6. Weighted-average price of foreign purchases and foreign sales of uranium, 1994-2016

dollars per pound U_3O_8 equivalent



Sources: U.S. Energy Information Administration: 1994-2002-Uranium Industry Annual reports. 2003-16-Form EIA-858, "Uranium Marketing Annual Survey".

Table 1. Uranium purchased by owners and operators of U.S. civilian nuclear power reactors by supplier and delivery year, 2012-16

thousand pounds U_3O_8 equivalent; dollars per pound U_3O_8 equivalent

Deliveries	2012	2013	2014	2015	2016
Purchased from U.S. producers					
Purchases of U.S.-origin and foreign-origin uranium	W	W	W	1,455	2,169
Weighted-average price	W	W	W	52.35	48.86
Purchased from U.S. brokers and traders					
Purchases of U.S.-origin and foreign-origin uranium	11,545	12,835	17,111	13,852	7,862
Weighted-average price	54.44	50.44	42.90	44.67	50.56
Purchased from other owners and operators of U.S. civilian nuclear power reactors					
Purchases	0	0	0	W	W
Weighted-average price	--	--	--	W	W
Purchased from other U.S. suppliers					
Purchases of U.S.-origin and foreign-origin uranium	W	W	W	W	W
Weighted-average price	W	W	W	W	W
Purchased from foreign suppliers					
Purchases of U.S.-origin and foreign-origin uranium	37,624	37,405	34,404	38,184	39,469
Weighted-average price	54.40	51.93	47.62	44.66	44.85
Total purchased by owners and operators of U.S. civilian nuclear power reactors					
Purchases of U.S.-origin and foreign-origin uranium	**57,520**	**57,403**	**53,349**	**56,524**	**50,595**
Weighted-average price	**54.99**	**51.99**	**46.16**	**44.13**	**42.43**

W = Data withheld to avoid disclosure of individual company data.

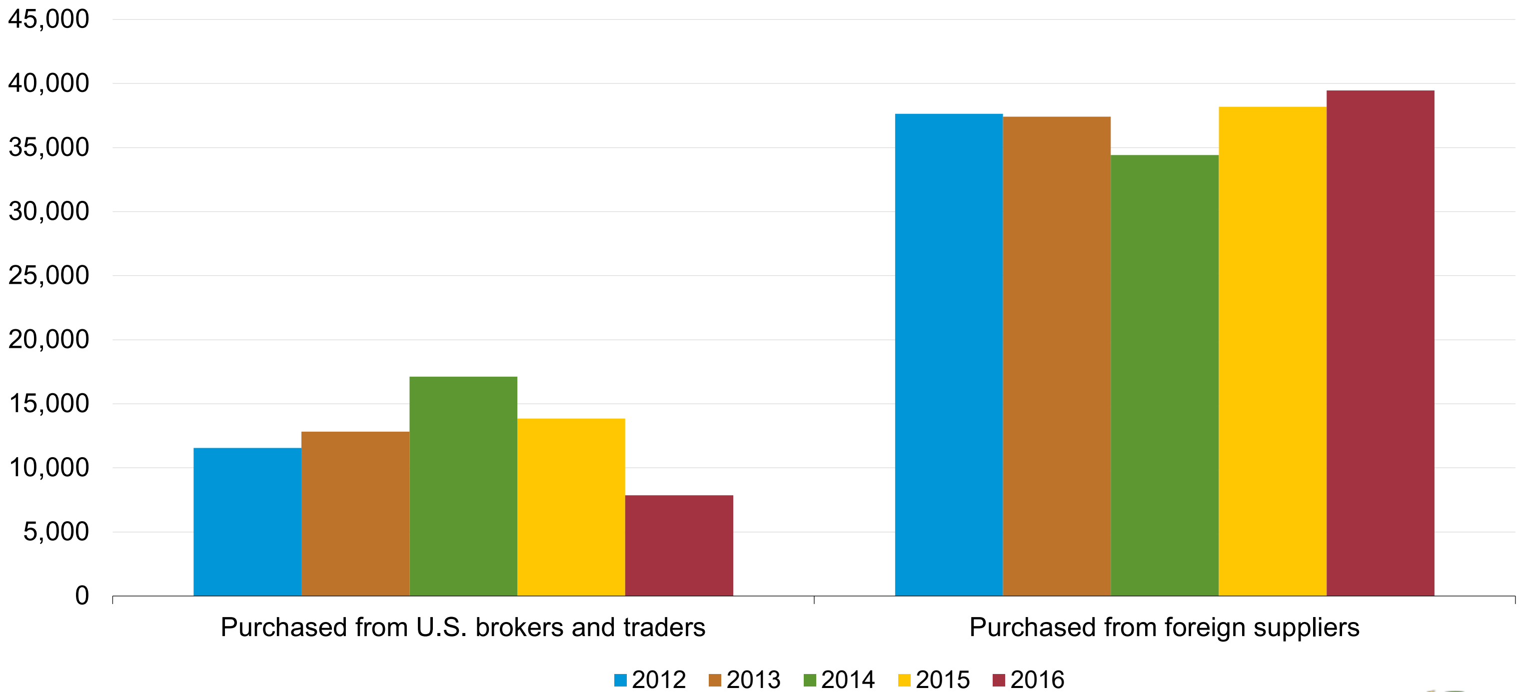
-- = Not applicable.

Notes: "Other U.S. Suppliers" are U.S. converters, enrichers, and fabricators. Totals may not equal sum of components because of independent rounding. Weighted-average prices are not adjusted for inflation.

Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2012-16).

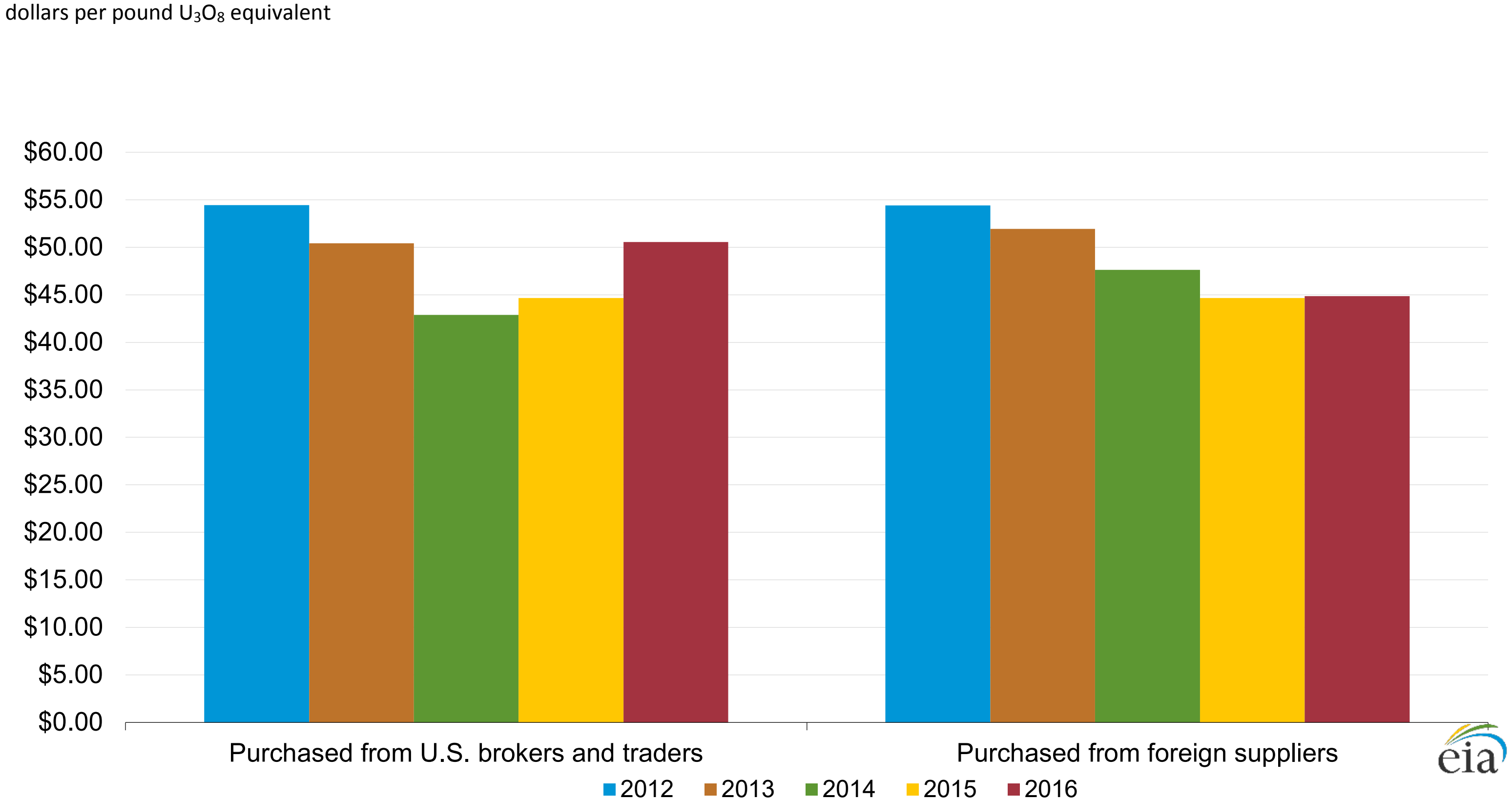
Figure 1. Uranium purchased by owners and operators of U.S. civilian nuclear power reactors by supplier and delivery year, 2012-16

thousand pounds U_3O_8 equivalent



Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2012-16).

Figure 2. Weighted-average price of uranium purchased by owners and operators of U.S. civilian nuclear power reactors by supplier and delivery year, 2012-16



Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2012-16).

Table 2. Uranium purchased by owners and operators of U.S. civilian nuclear power reactors by origin and delivery year, 2012-16

thousand pounds U3O8 equivalent; dollars per pound U3O8 equivalent

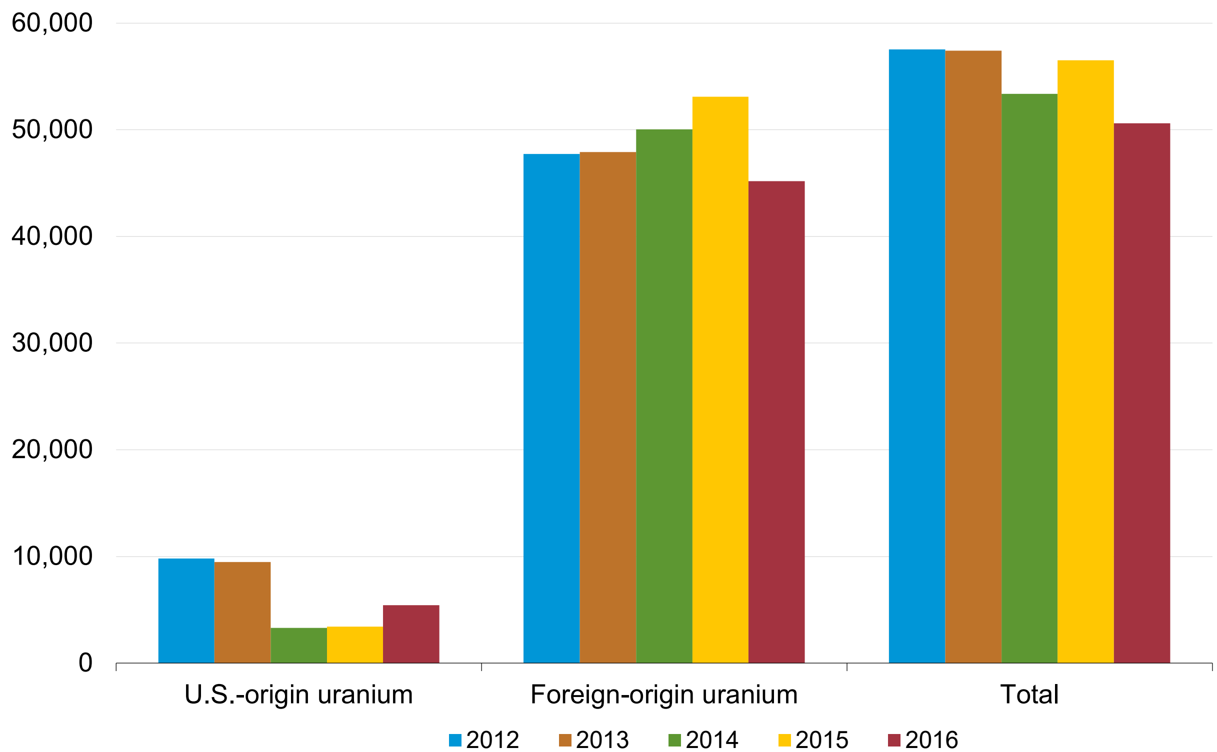
Deliveries	2012	2013	2014	2015	2016
U.S.-origin uranium					
Purchases	9,807	9,484	3,316	3,419	5,424
Weighted-average price	59.44	56.37	48.11	43.86	43.92
Foreign-origin uranium					
Purchases	47,713	47,919	50,033	53,106	45,171
Weighted-average price	54.07	51.13	46.03	44.14	42.26
Total					
Purchases	**57,520**	**57,403**	**53,349**	**56,524**	**50,595**
Weighted-average price	**54.99**	**51.99**	**46.16**	**44.13**	**42.43**

Notes: Totals may not equal sum of components because of independent rounding. Weighted-average prices are not adjusted for inflation.

Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2012-16).

Figure 3. Uranium purchased by owners and operators of U.S. civilian nuclear power reactors by origin and delivery year, 2012-16

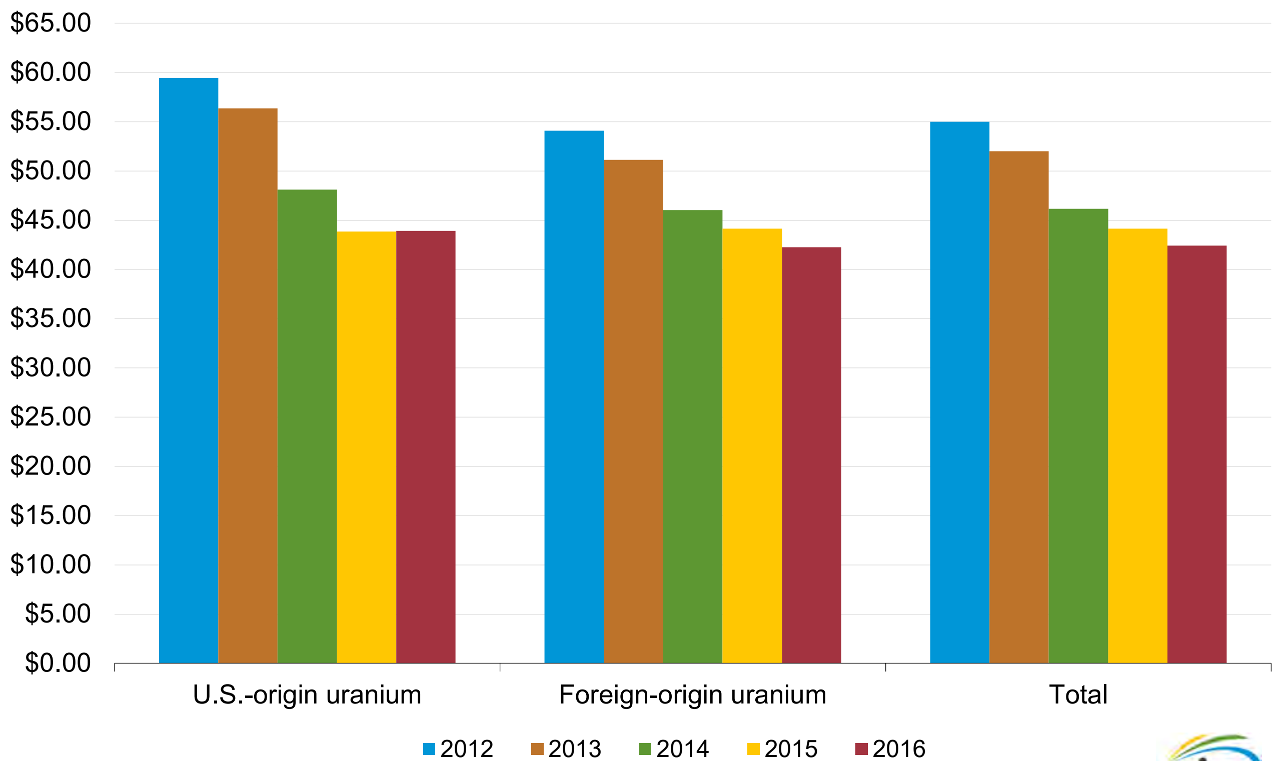
thousand pounds U_3O_8 equivalent



Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2012-16).

Figure 4. Weighted-average price of uranium purchased by owners and operators of U.S. civilian nuclear power reactors by origin and delivery year, 2012-16

dollars per pound U_3O_8 equivalent



Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2012-16).

Table 3. Uranium purchased by owners and operators of U.S. civilian nuclear power reactors by origin country and delivery year, 2012-16

thousand pounds U3O8 equivalent; dollars per pound U3O8 equivalent

	Deliveries in 2012		Deliveries in 2013		Deliveries in 2014		Deliveries in 2015		Deliveries in 2016	
Origin country	Purchases	Weighted-average price	Purchases	Weighted-average price	Purchases	Weighted-average price	Purchases	Weighted-average price	Purchases	Weighted-average price
Australia	6,724	51.17	10,741	49.92	10,511	48.03	9,678	44.16	8,963	43.05
Brazil	W	W	W	W	W	W	0	--	W	W
Bulgaria	0	--	0	--	0	--	W	W	W	W
Canada	13,584	56.75	7,808	52.61	9,789	45.87	16,876	45.84	11,119	43.22
China	W	W	W	W	W	W	0	--	W	W
Czech Republic	0	--	W	W	W	W	W	W	W	W
Germany	0	--	W	W	0	--	0	--	W	W
Hungary	0	--	W	W	0	--	0	--	0	--
Kazakhstan	6,234	51.69	6,454	46.73	12,032	44.47	10,723	42.82	10,806	39.91
Malawi	W	W	1,277	59.89	1,514	44.94	W	W	519	41.38
Namibia	5,986	54.56	5,677	49.78	4,603	45.54	3,456	48.57	1,993	44.30
Niger	2,133	50.45	1,666	51.26	1,316	42.86	922	39.74	1,032	44.12
Portugal	0	--	W	W	0	--	0	--	0	--
Russia	7,643	54.40	10,580	53.73	6,859	45.65	9,063	40.87	6,539	43.85
South Africa	1,243	56.45	186	46.72	938	43.71	826	37.64	1,169	43.75
Ukraine	W	W	0	--	W	W	0	--	W	W
United Kingdom	0	--	0	--	W	W	0	--	0	--
Uzbekistan	2,576	52.80	3,064	50.02	1,779	46.84	1,040	47.90	2,030	39.18
unknown	0	--	W	W	W	W	W	W	W	W
Foreign Total	**47,713**	**54.07**	**47,919**	**51.13**	**50,033**	**46.03**	**53,106**	**44.14**	**45,171**	**42.26**
United States	9,807	59.44	9,484	56.37	3,316	48.11	3,419	43.86	5,424	43.92
Total Purchases	**57,520**	**54.99**	**57,403**	**51.99**	**53,349**	**46.16**	**56,524**	**44.13**	**50,595**	**42.43**

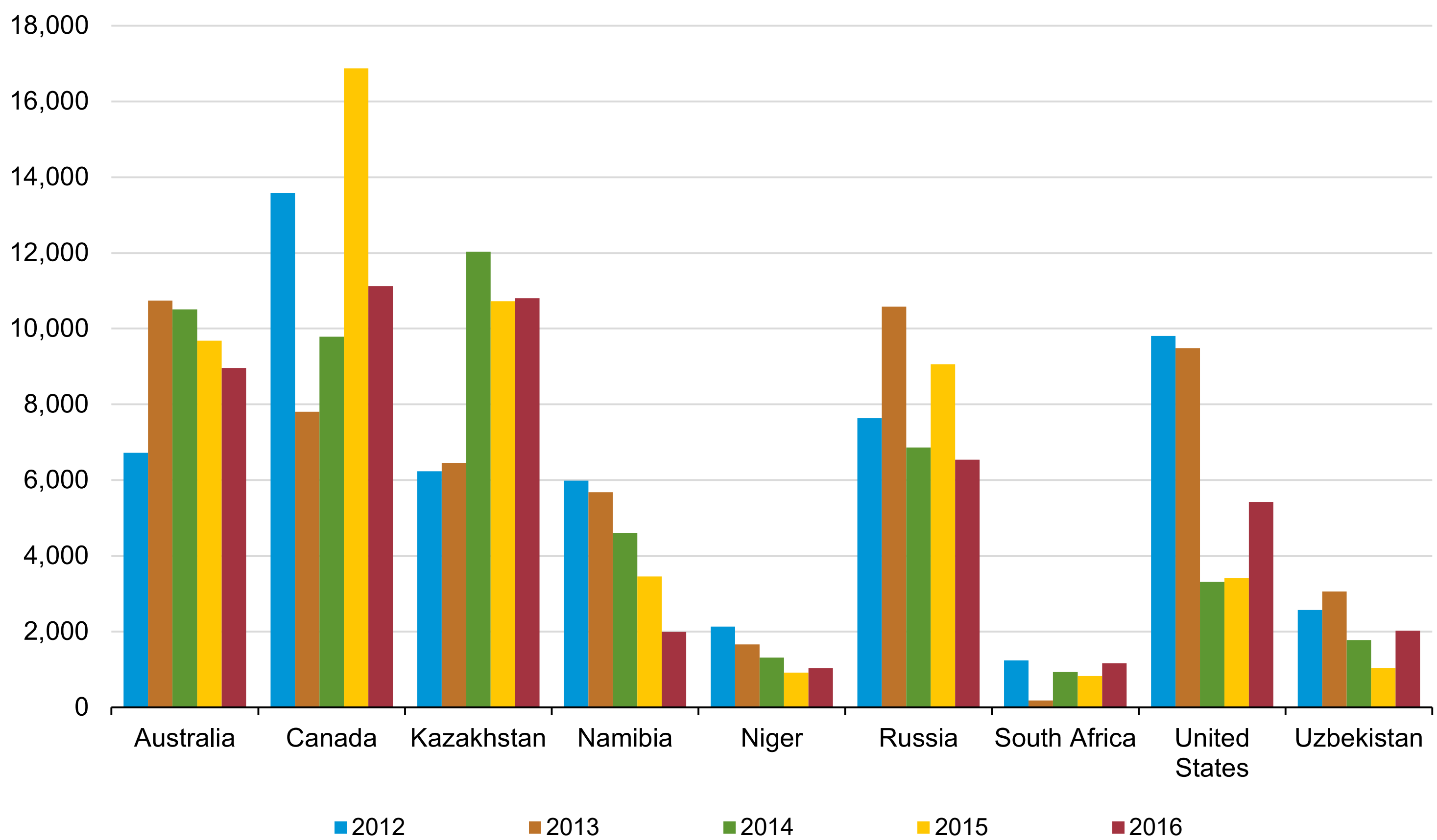
W = Data withheld to avoid disclosure of individual company data. -- = Not applicable.

Notes: Totals may not equal sum of components because of independent rounding. Weighted-average prices are not adjusted for inflation.

Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2012-16).

Figure 5. Uranium purchased by owners and operators of U.S. civilian nuclear power reactors by selected origin country and delivery year, 2012-16

thousand pounds U_3O_8 equivalent



Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2012-16).

Table 4. Uranium purchased by owners and operators of U.S. civilian nuclear power reactors by origin and material type, 2016 deliveries

thousand pounds U3O8 equivalent; dollars per pound U3O8 equivalent

Deliveries	Uranium concentrate	Natural UF_6	Enriched UF_6	Natural UF6 and Enriched UF6	Total
U.S.-origin uranium					
Purchases	2,454	W	W	2,970	5,424
Weighted-average price	44.71	W	W	43.15	43.92
Foreign-origin uranium					
Purchases	24,975	W	W	20,195	45,171
Weighted-average price	40.44	W	W	44.72	42.26
Total					
Purchases	**27,430**	**14,628**	**8,537**	**23,165**	**50,595**
Weighted-average price	**40.82**	**44.91**	**43.88**	**44.53**	**42.43**

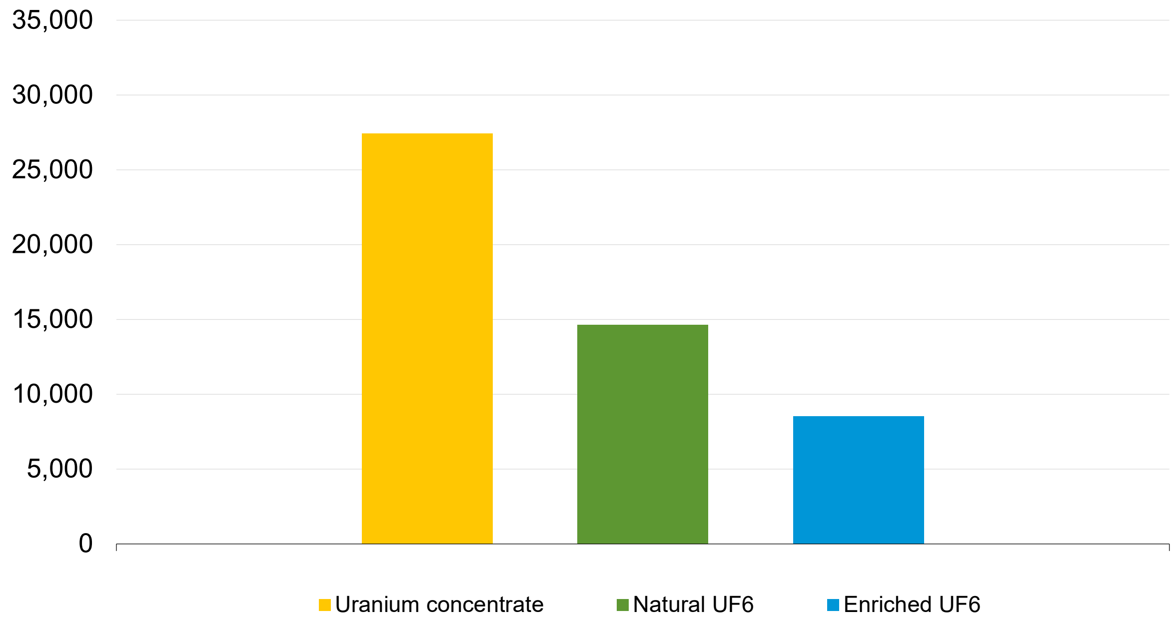
W = Data withheld to avoid disclosure of individual company data.

Notes: Totals may not equal sum of components because of independent rounding. Weighted-average prices are not adjusted for inflation. Natural UF_6 is uranium hexafluoride. The natural UF_6 and enriched UF_6 quantity represents only the U_3O_8 equivalent uranium-component quantity specified in the contract for each delivery of natural UF_6 and enriched UF_6. The natural UF_6 and enriched UF_6 weighted-average price represent only the U_3O_8 equivalent uranium-component price specified in the contract for each delivery of natural UF_6 and enriched UF_6, and does not include the conversion service and enrichment service components.

Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2016).

Figure 6. Uranium purchased by owners and operators of U.S. civilian nuclear power reactors by material type, 2016 deliveries

thousand pounds U_3O_8 equivalent



Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2016).

Table 5. Average price and quantity for uranium purchased by owners and operators of U.S. civilian nuclear power reactors by pricing mechanisms and delivery year, 2015-16

dollars per pound U3O8 equivalent; thousand pounds U3O8 equivalent

	Domestic purchases [1]		Foreign purchases [2]		Total purchases	
Pricing mechanisms	**2015**	**2016**	**2015**	**2016**	**2015**	**2016**
Contract-specified (fixed and base-escalated) pricing						
Weighted-average price	40.34	39.82	44.93	47.09	42.88	42.78
Quantity with reported price	13,862	13,917	17,241	14,439	31,104	30,344
Spot-market pricing						
Weighted-average price	38.22	26.08	35.94	34.61	36.36	31.73
Quantity with reported price	876	871	3,881	3,064	4,756	4,448
Other pricing						
Weighted-average price	53.59	52.67	46.74	42.52	48.19	45.30
Quantity with reported price	3,931	3,524	14,666	9,335	18,597	12,858
All pricing mechanisms						
Weighted-average price	**43.03**	**41.64**	**44.70**	**44.08**	**44.13**	**42.43**
Quantity with reported price	**18,669**	**18,312**	**35,788**	**26,837**	**54,457**	**47,650**
Total quantity	**19,612**	**18,797**	**36,912**	**28,512**	**56,524**	**50,595**

[1] A uranium purchase of both U.S.-origin uranium or from a firm located in the United States.

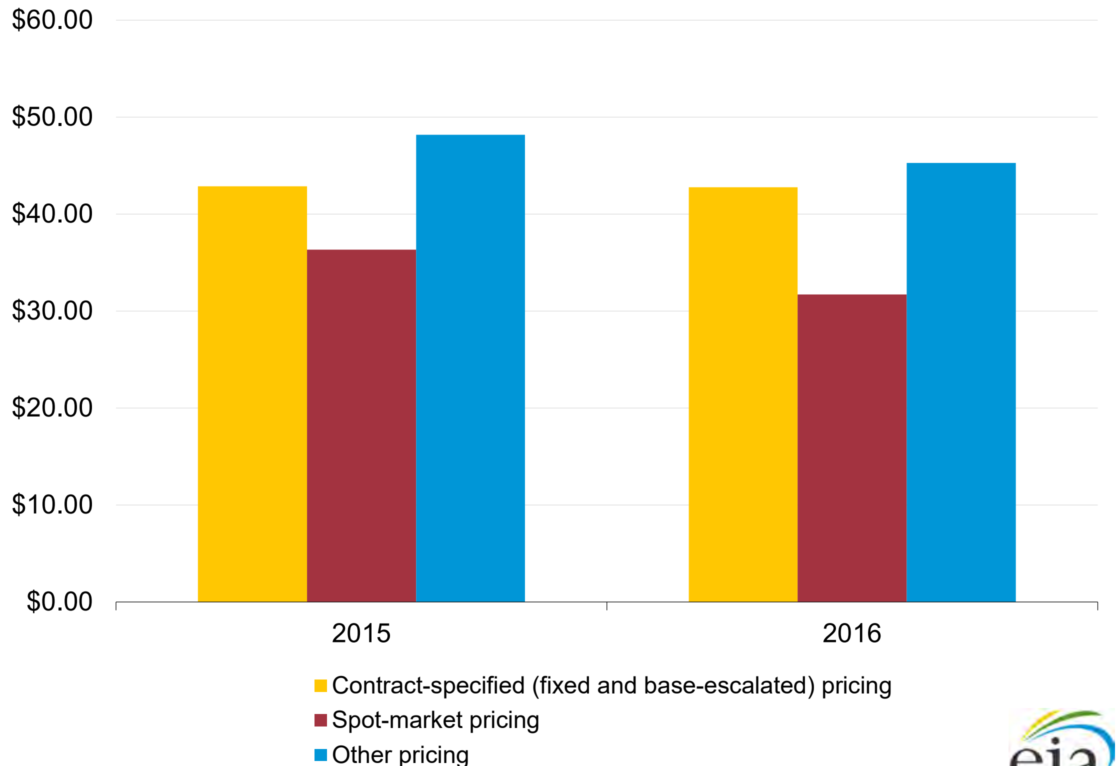
[2] A uranium purchase of foreign-origin uranium from a firm located outside of the United States.

Notes: Totals may not equal sum of components because of independent rounding or a unique procurement method using multiple or unknown sources. Weighted-average prices are not adjusted for inflation.

Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2015-16).

Figure 7. Average price for uranium purchased by owners and operators of U.S. civilian nuclear power reactors by pricing mechanisms and delivery year, 2015-16

dollars per pound U_3O_8 equivalent



Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2015-16).

Table 6a. Uranium purchased by owners and operators of U.S. civilian nuclear power reactors ranked by price and distributed by quantity, 2014-16 deliveries

thousand pounds U3O8 equivalent; dollars per pound U3O8 equivalent

	Deliveries in 2014		Deliveries in 2015		Deliveries in 2016	
Quantity distribution [1]	**Quantity with reported price**	**Weighted-average price**	**Quantity with reported price**	**Weighted-average price**	**Quantity with reported price**	**Weighted-average price**
First	6,665	30.26	6,807	29.68	5,956	21.64
Second	6,665	35.11	6,807	36.03	5,956	28.18
Third	6,665	39.29	6,807	38.63	5,956	34.60
Fourth	6,665	43.36	6,807	41.80	5,956	39.41
Fifth	6,665	46.74	6,807	44.63	5,956	42.82
Sixth	6,665	50.65	6,807	47.84	5,956	47.59
Seventh	6,665	55.49	6,807	52.69	5,956	54.68
Eighth	6,665	68.37	6,807	61.70	5,956	70.52
Total	**53,323**	**46.16**	**54,457**	**44.13**	**47,650**	**42.43**

[1] Distribution divides total quantity of uranium delivered (with a price) into eight distributions by price (sorted from lowest to highest) and provides the quantity-weighted average price for each distribution.

Notes: Totals may not equal sum of components because of independent rounding. Weighted-average prices are not adjusted for inflation.
Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2014-16).

Table 6b. Uranium purchased by owners and operators of U.S. civilian nuclear power reactors ranked by price and distributed by purchaser, 2014-16 deliveries

thousand pounds U3O8 equivalent; dollars per pound U3O8 equivalent

	Deliveries in 2014			Deliveries in 2015			Deliveries in 2016		
Distribution of purchasers	**Number of purchasers**	**Quantity with reported price**	**Weighted-average price**	**Number of purchasers**	**Quantity with reported price**	**Weighted-average price**	**Number of purchasers**	**Quantity with reported price**	**Weighted-average price**
First	8	11,681	37.64	8	11,864	39.35	7	9,736	34.43
Second	7	8,493	42.68	7	22,481	43.16	7	7,195	39.70
Third	7	21,805	48.04	7	10,889	46.47	7	20,508	42.87
Fourth	7	11,344	53.91	7	9,222	49.86	6	10,212	51.10
Total	**29**	**53,323**	**46.16**	**29**	**54,457**	**44.13**	**27**	**47,650**	**42.43**

Notes: Totals may not equal sum of components because of independent rounding. Weighted-average prices are not adjusted for inflation.
Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2014-16).

Table 7. Uranium purchased by owners and operators of U.S. civilian nuclear power reactors by contract type and material type, 2016 deliveries

thousand pounds U3O8 equivalent; dollars per pound U3O8 equivalent

	Spot Contracts [1]		Long-Term Contracts [2]		Total	
Material Type	Quantity with reported price	Weighted-average price	Quantity with reported price	Weighted-average price	Quantity with reported price	Weighted-average price
U_3O_8	7,822	31.07	19,595	44.71	27,417	40.82
Natural UF_6	W	W	W	W	14,367	44.91
Enriched UF_6	W	W	W	W	5,866	43.88
Total	**10,636**	**29.62**	**37,014**	**46.11**	**47,650**	**42.43**

[1] A one-time delivery (usually) of the entire contract to occur within one year of contract execution (signed date).

[2] One or more deliveries to occur after a year following contract execution (signed date).

Notes: Totals may not equal sum of components because of independent rounding. Weighted-average prices are not adjusted for inflation.
UF_6 is uranium hexafluoride. The natural UF_6 and enriched UF_6 quantity represents only the U_3O_8 equivalent uranium-component quantity specified in the contract for each delivery of natural UF_6 and enriched UF_6. The natural UF_6 and enriched UF_6 weighted-average price represent only the U_3O_8 equivalent uranium-component price specified in the contract for each delivery of natural UF_6 and enriched UF_6, and does not include the conversion service and enrichment service components.

Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2016).

Table 8. Contracts signed in 2016 by owners and operators of U.S. civilian nuclear power reactors by contract type

thousand pounds U3O8 equivalent; dollars per pound U3O8 equivalent

Purchase contract type (Signed in 2016)	Quantity of deliveries received in 2016	Weighted-average price	Number of purchase contracts for deliveries in 2016
Spot	6,280	24.59	45
Long-term	2,385	25.94	5
Total	**8,665**	**24.86**	**50**

Notes: Totals may not equal sum of components because of independent rounding. Weighted-average prices are not adjusted for inflation.

Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2016).

Table 9. Contracted purchases of uranium by owners and operators of U.S. civilian nuclear power reactors, signed in 2015, by delivery year, 2017-26

thousand pounds U3O8 equivalent

Year of delivery	Minimum	Maximum
2017	4,617	4,959
2018	5,196	5,952
2019	3,819	4,290
2020	2,940	3,446
2021	1,750	2,318
2022	836	994
2023	1,347	2,483
2024	W	2,063
2025	W	W
2026	0	W
Total	**21,942**	**28,172**

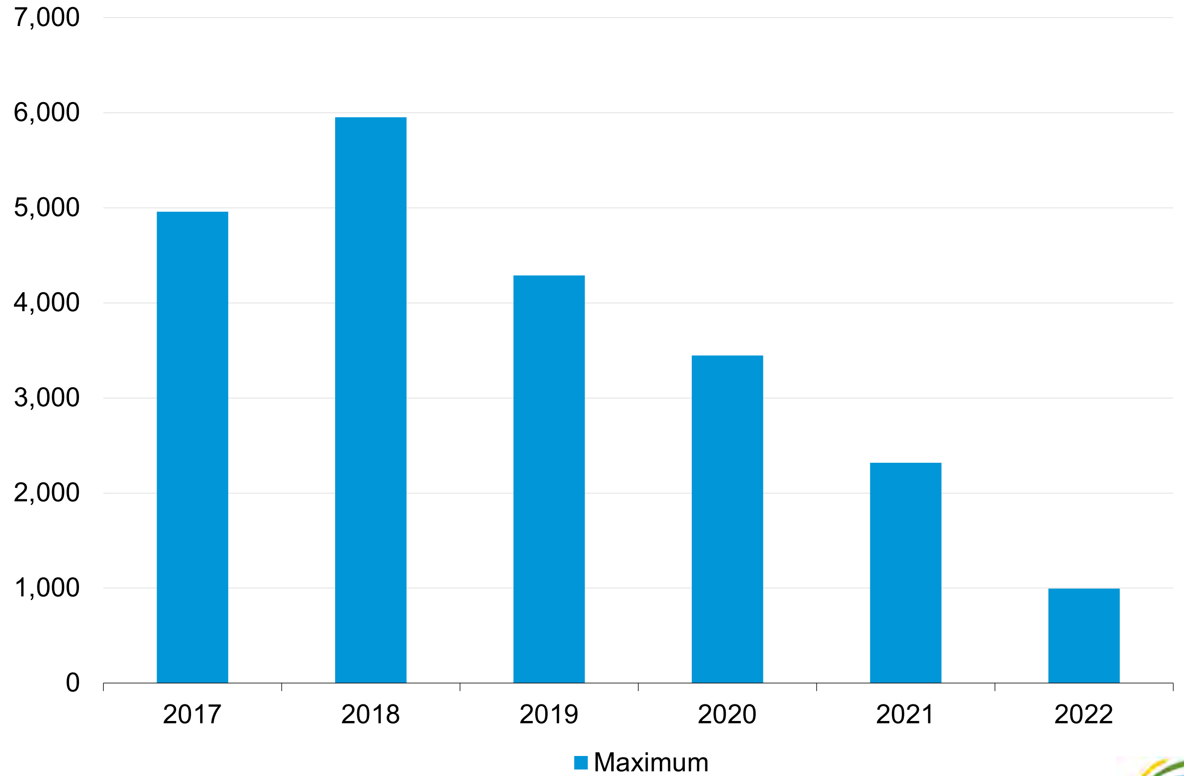
W = Data withheld to avoid disclosure of individual company data.

Note: Totals may not equal sum of components because of independent rounding.

Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2016).

Figure 8. Contracted purchases of uranium by owners and operators of U.S. civilian nuclear power reactors, signed in in 2015, by delivery year, 2017-22

thousand pounds U_3O_8 equivalent



Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2016).

Table 10. Contracted purchases of uranium from suppliers by owners and operators of U.S. civilian nuclear power reactors, in effect at the end of 2016, by delivery year, 2017-26

thousand pounds U3O8 equivalent

	Contracted purchases from U.S. suppliers		Contracted purchases from foreign suppliers		Contracted purchases from all suppliers	
Year of delivery	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
2017	7,931	9,182	28,906	30,911	36,837	40,093
2018	7,081	7,619	25,678	28,180	32,759	35,799
2019	7,903	8,694	17,735	19,880	25,638	28,574
2020	4,429	6,234	13,637	16,040	18,066	22,274
2021	3,915	5,691	8,675	9,710	12,590	15,401
2022	1,718	2,238	6,554	7,037	8,272	9,274
2023	1,741	2,267	5,859	7,319	7,600	9,586
2024	W	1,352	W	6,178	W	7,530
2025	W	1,642	W	3,428	W	5,069
2026	0	0	W	1,153	W	1,153
Total	**36,885**	**44,917**	**115,231**	**129,836**	**152,115**	**174,753**

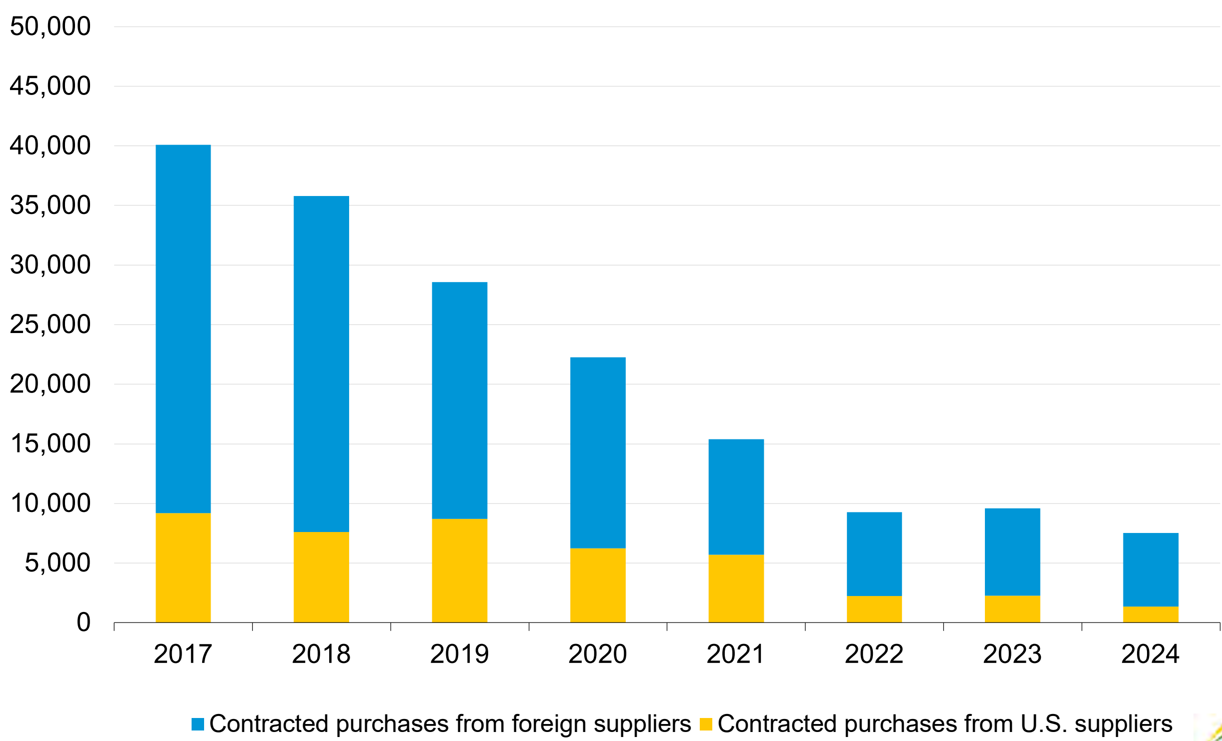
W = Data withheld to avoid disclosure of individual company data.

Note: Totals may not equal sum of components because of independent rounding.

Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2016).

Figure 9. Maximum contracted purchases of uranium from suppliers by owners and operators of U.S. civilian nuclear power reactors, in effect at the end of 2015, by delivery year, 2017-24

thousand pounds U_3O_8 equivalent



Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2016).

Table 11. Unfilled uranium market requirements of owners and operators of U.S. civilian nuclear power reactors, 2016-26

thousand pounds U3O8 equivalent

	As of December 31, 2015		As of December 31, 2016	
Year	Annual	Cumulative	Annual	Cumulative
2016	3,152	3,152	-	--
2017	4,656	7,807	3,290	3,290
2018	9,943	17,750	6,255	9,544
2019	12,204	29,954	8,330	17,874
2020	21,404	51,358	10,662	28,536
2021	35,154	86,513	18,895	47,430
2022	41,497	128,010	32,171	79,601
2023	40,790	168,799	33,634	113,235
2024	47,313	216,112	38,125	151,360
2025	42,750	258,862	41,243	192,603
2026	-	--	40,691	233,294

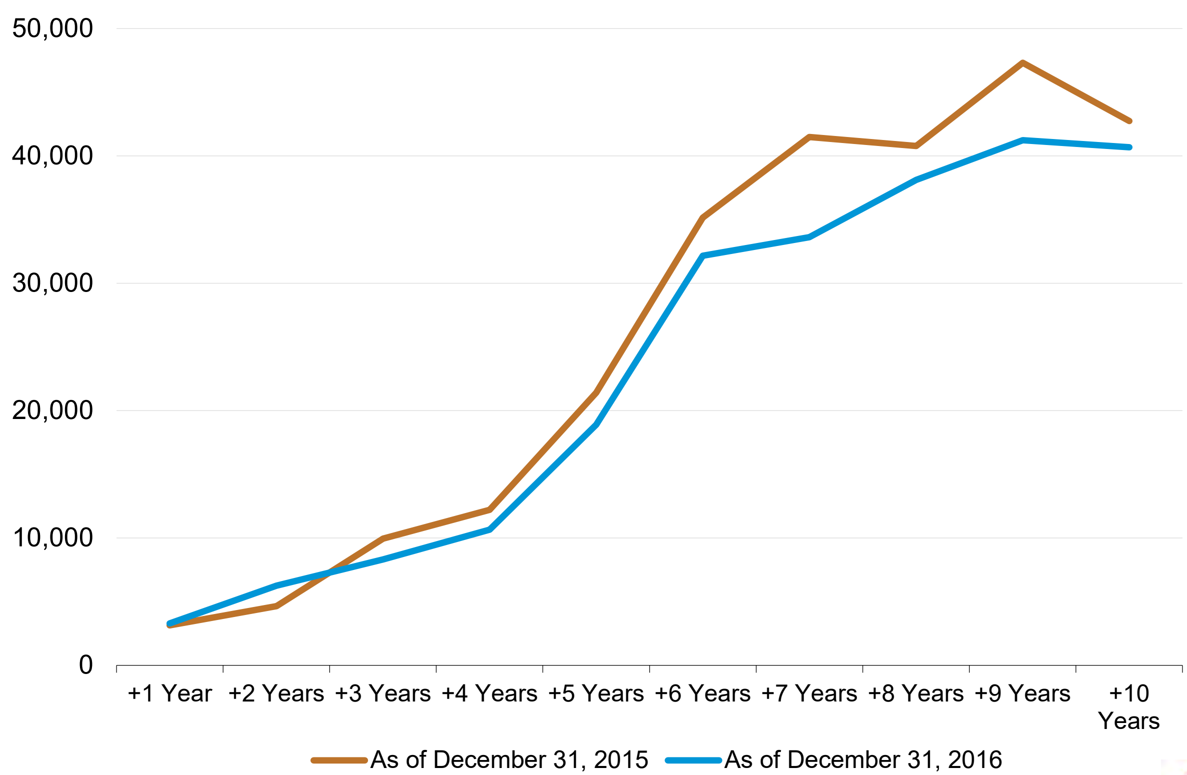
- = No data reported. -- = Not applicable.

Note: Totals may not equal sum of components because of independent rounding.

Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2015-16).

Figure 10. Annual unfilled uranium market requirements of owners and operators of U.S. civilian nuclear power reactors, as of 12/31/2015 and 12/31/2016

thousand pounds U_3O_8 equivalent



Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2015-16).

Table 12. Maximum anticipated uranium market requirements of owners and operators of U.S. civilian nuclear power reactors, 2017-26, as of December 31, 2016

thousand pounds U3O8 equivalent

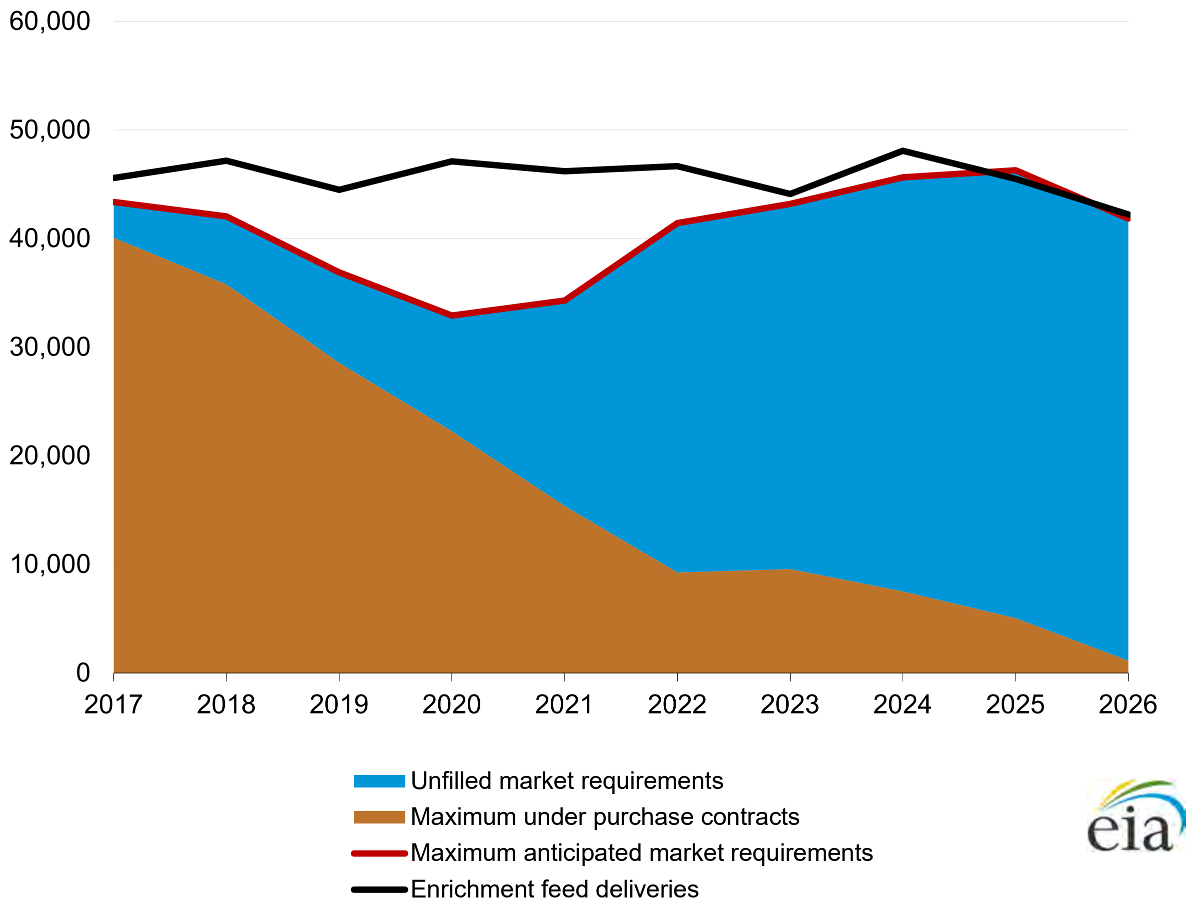
Year	Maximum under purchase contracts	Unfilled market requirements	Maximum anticipated market requirements	Enrichment feed deliveries
2017	40,093	3,290	43,383	45,591
2018	35,799	6,255	42,053	47,193
2019	28,574	8,330	36,904	44,489
2020	22,274	10,662	32,936	47,127
2021	15,401	18,895	34,295	46,208
2022	9,274	32,171	41,445	46,690
2023	9,586	33,634	43,219	44,110
2024	7,530	38,125	45,655	48,108
2025	5,069	41,243	46,312	45,514
2026	1,153	40,691	41,844	42,228
Total	**174,753**	**233,294**	**408,047**	**457,259**

Note: Totals may not equal sum of components because of independent rounding.

Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2016).

Figure 11. Maximum anticipated uranium market requirements of owners and operators of U.S. civilian nuclear power reactors, 2016-25, as of December 31, 2015

thousand pounds U_3O_8 equivalent



Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2016).

Table 13. Deliveries of uranium feed by owners and operators of U.S. civilian nuclear power reactors by enrichment country and delivery year, 2014-16

thousand pounds U3O8 equivalent

	Feed deliveries in 2014			Feed deliveries in 2015			Feed deliveries in 2016		
Enrichment country	**U.S.-origin**	**Foreign-origin**	**Total**	**U.S.-origin**	**Foreign-origin**	**Total**	**U.S.-origin**	**Foreign-origin**	**Total**
China	W	W	W	0	W	W	0	0	-
France	0	3,055	3,055	W	W	3,299	W	W	2,555
Germany	W	W	2140	W	W	W	W	W	W
Netherlands	0	3,115	3,115	W	W	4,180	666	2,832	3,498
Russia	0	W	W	0	2089	2089	W	W	3,974
United Kingdom	W	W	2,975	W	W	3,460	0	W	W
Europe [1]	W	W	6,750	0	8297	8,297	721	7,773	8,494
unknown [2]	0	0	0	0	W	W	0	0	-
Foreign total	**826**	**21,248**	**22,074**	**1,056**	**22,437**	**23,493**	**2,334**	**18,106**	**20,440**
United States	1,893	17,961	19,854	1,485	16,407	17,892	2,463	20,207	22,670
Total	**2,719**	**39,209**	**41,928**	**2,541**	**38,844**	**41,385**	**4,798**	**38,313**	**43,110**

W = Data withheld to avoid disclosure of individual company data.

[1] Specific country in Europe was not reported.

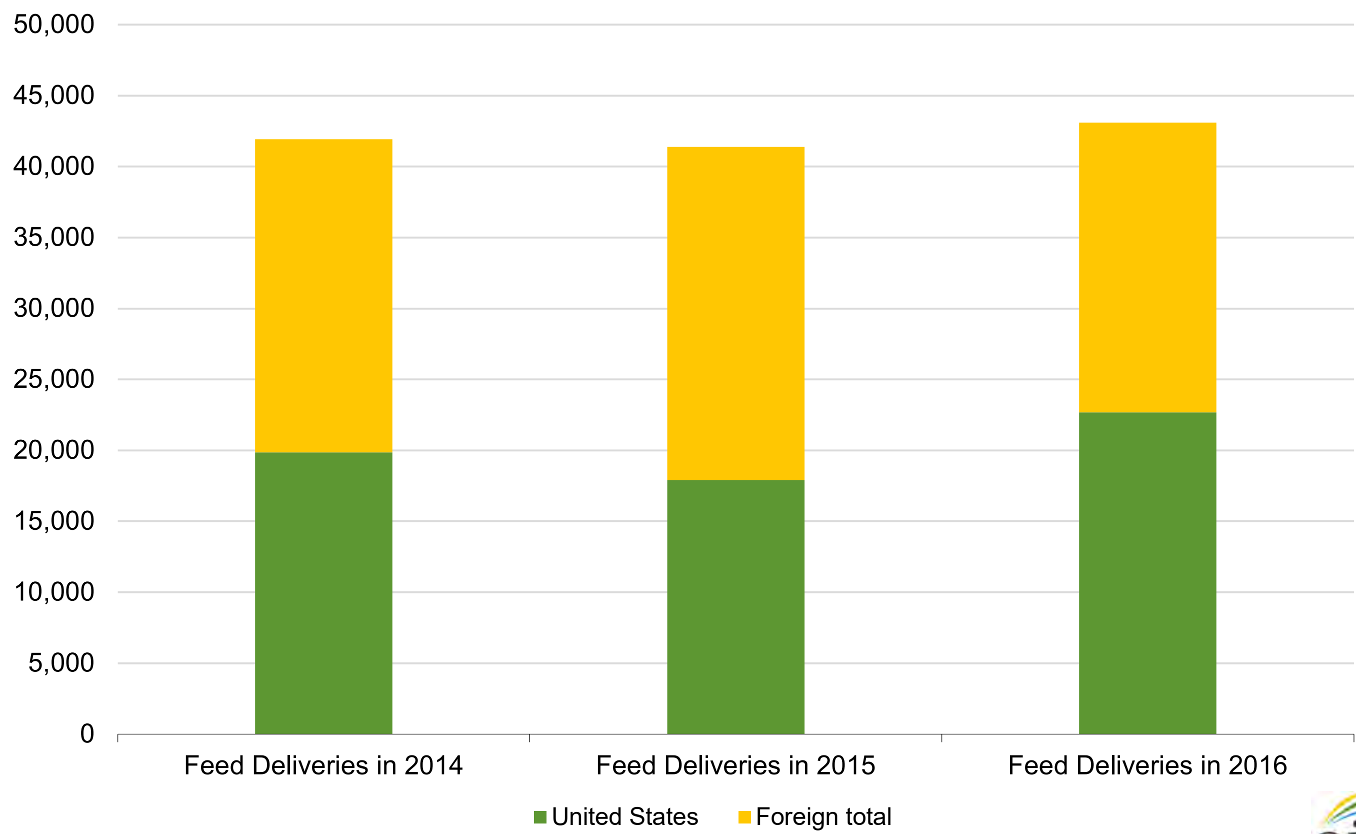
[2] Specific country was not reported.

Note: Totals may not equal sum of components because of independent rounding.

Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2014-16).

Figure 12. Deliveries of uranium feed for U.S. and foreign enrichment by owners and operators of U.S. civilian nuclear power reactors by delivery year, 2014-16

thousand pounds U_3O_8 equivalent



Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2014-16).

Table 14. Deliveries of uranium feed for enrichment by owners and operators of U.S. civilian nuclear power reactors by origin country and delivery year, 2014-16

thousand pounds U3O8 equivalent

	Deliveries in 2014			Deliveries in 2015			Deliveries in 2016		
Origin country of feed	**U.S. enrichment**	**Foreign enrichment**	**Total**	**U.S. enrichment**	**Foreign enrichment**	**Total**	**U.S. enrichment**	**Foreign enrichment**	**Total**
Australia	910	4,467	5,377	1,673	3,797	5,470	6,524	3,098	9,622
Brazil	0	W	W	0	W	W	W	W	W
Canada	5,424	4,315	9,738	6,212	9,698	15,910	6,635	6,912	13,546
China	0	W	W	0	W	W	0	0	0
Czech Republic	0	0	0	0	W	W	W	W	W
Kazakhstan	W	W	3,868	3,490	4,173	7,662	2,658	5,027	7,685
Malawi	W	W	745	W	W	347	W	W	W
Namibia	1,143	1,798	2,941	963	1,588	2,551	1,033	698	1,731
Niger	W	W	1,322	0	W	W	W	W	W
Portugal	0	0	0	0	0	0	0	0	0
Russia	8,313	4,174	12,486	4,019	1,490	5,509	W	W	4,163
South Africa	109	322	431	W	W	445	W	W	296
Ukraine	0	W	W	0	0	0	0	0	0
United Kingdom	W	0	W	0	0	0	0	0	0
Uzbekistan	W	W	823	W	W	108	W	W	581
unknown	0	0	0	0	W	W	W	W	W
Foreign total	**17,961**	**21,248**	**39,209**	**16,407**	**22,437**	**38,844**	**20,207**	**18,106**	**38,313**
United States	1,893	826	2,719	1,485	1,056	2,541	2,463	2,334	4,798
Total	**19,854**	**22,074**	**41,928**	**17,892**	**23,493**	**41,385**	**22,670**	**20,440**	**43,110**

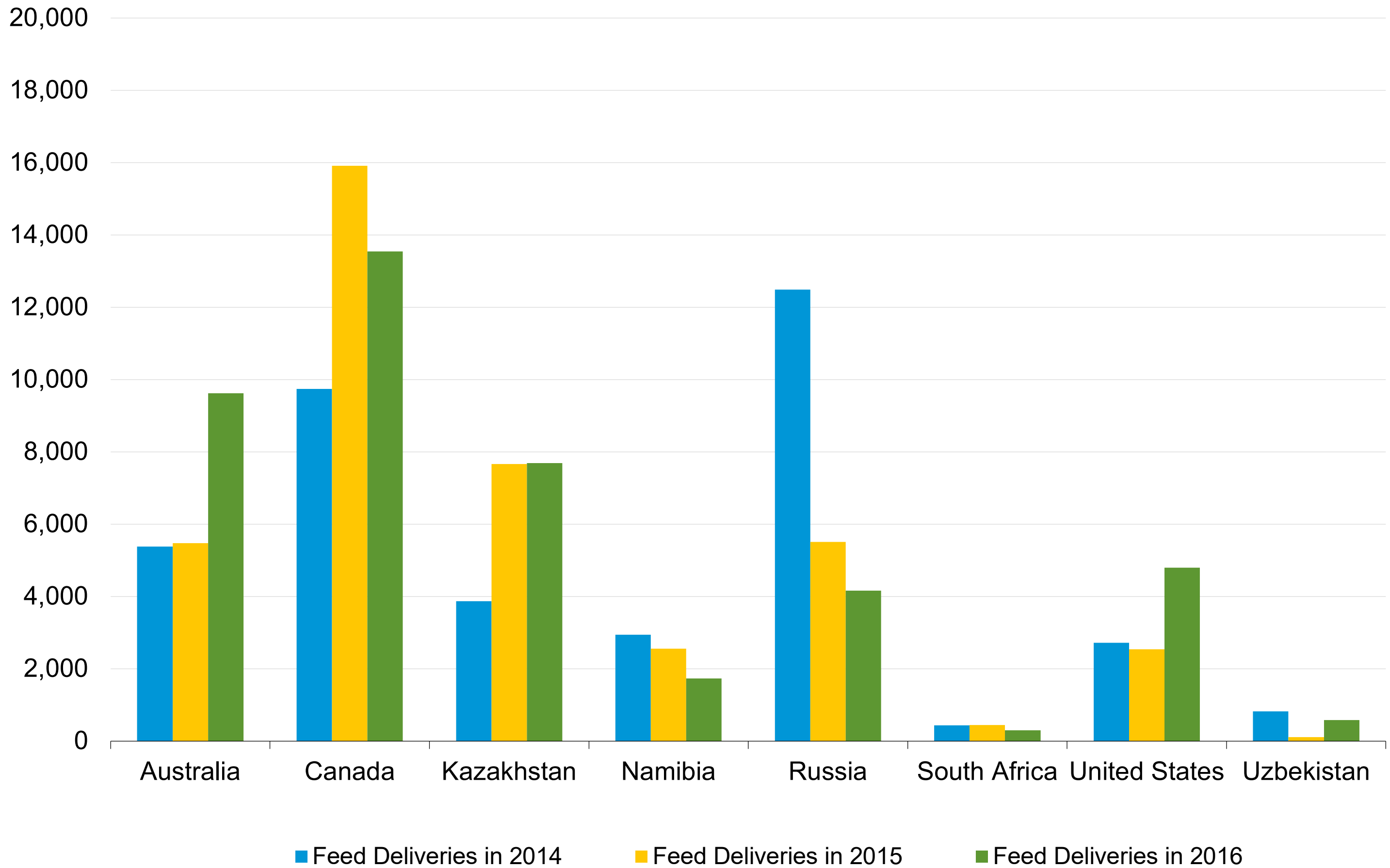
W = Data withheld to avoid disclosure of individual company data.

Note: Totals may not equal sum of components because of independent rounding.

Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2013-16).

Figure 13. Deliveries of uranium feed for enrichment by owners and operators of U.S. civilian nuclear power reactors by selected origin country of feed and delivery year, 2014-16

thousand pounds U_3O_8 equivalent



Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2014-16).

Table 15. Shipments of uranium feed by owners and operators of U.S. civilian nuclear power reactors to domestic and foreign enrichment suppliers, 2016-25

thousand pounds U3O8 equivalent

	Amount of feed to be shipped		Change from 2015 to 2016	
Year of shipment	As of December 31, 2015	As of December 31, 2016	Annual	Cumulative
2017	43,576	45,591	2,015	2,015
2018	41,579	47,193	5,614	7,629
2019	40,326	44,489	4,163	11,792
2020	45,243	47,127	1,884	13,676
2021	47,024	46,208	-816	12,860
2022	47,139	46,690	-449	12,411
2023	45,242	44,110	-1,132	11,279
2024	51,712	48,108	-3,604	7,675
2025	45,224	45,514	290	7,965
2026	-	42,228	--	--

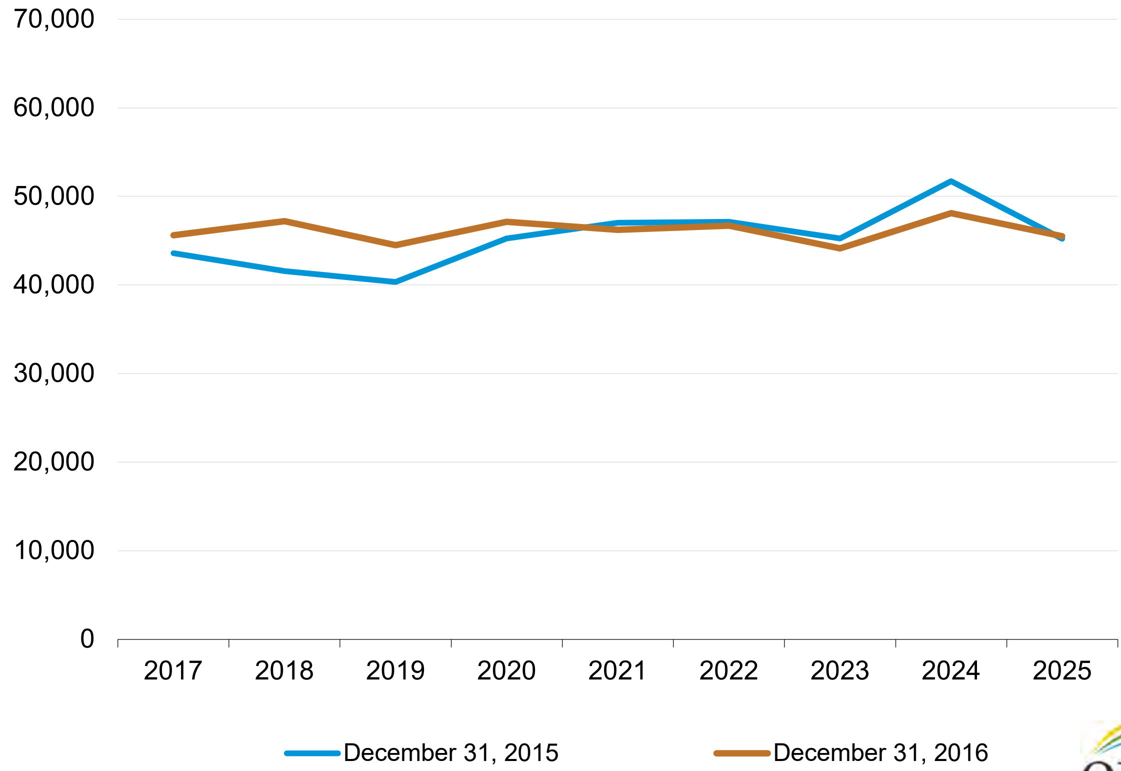
- = No data reported.   -- = Not applicable.

Note: Totals may not equal sum of components because of independent rounding.

Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2014-15).

Figure 14. Shipments of uranium feed by owners and operators of U.S. civilian nuclear power reactors to domestic and foreign enrichment suppliers, 2017-25

thousand pounds U_3O_8 equivalent



Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2015-16).

Table 16. Purchases of enrichment services by owners and operators of U.S. civilian nuclear power reactors by origin country and year, 2012-16

thousand separative work units (SWU)

Country of enrichment service (SWU-origin)	2012	2013	2014	2015	2016
China	W	W	636	W	W
France	0	0	0	0	0
Germany	1,075	753	1,005	1,281	1,636
Netherlands	1,496	2,112	1,801	2,385	2,546
Russia	6,560	2,491	3,083	2,234	3,188
United Kingdom	2,648	2,674	2,435	2,522	1,003
Europe [1]	W	0	W	0	W
Other [2]	W	W	W	W	501
Foreign total	**12,330**	**8,464**	**9,165**	**8,769**	**9,524**
United States	3,261	3,867	3,773	4,146	4,756
Total	**15,590**	**12,331**	**12,939**	**12,914**	**14,280**
Average price (US$ per SWU)	**141.36**	**142.22**	**140.75**	**136.88**	**131.00**

W = Data withheld to avoid disclosure of individual company data.

[1] Specific country in Europe was not reported.

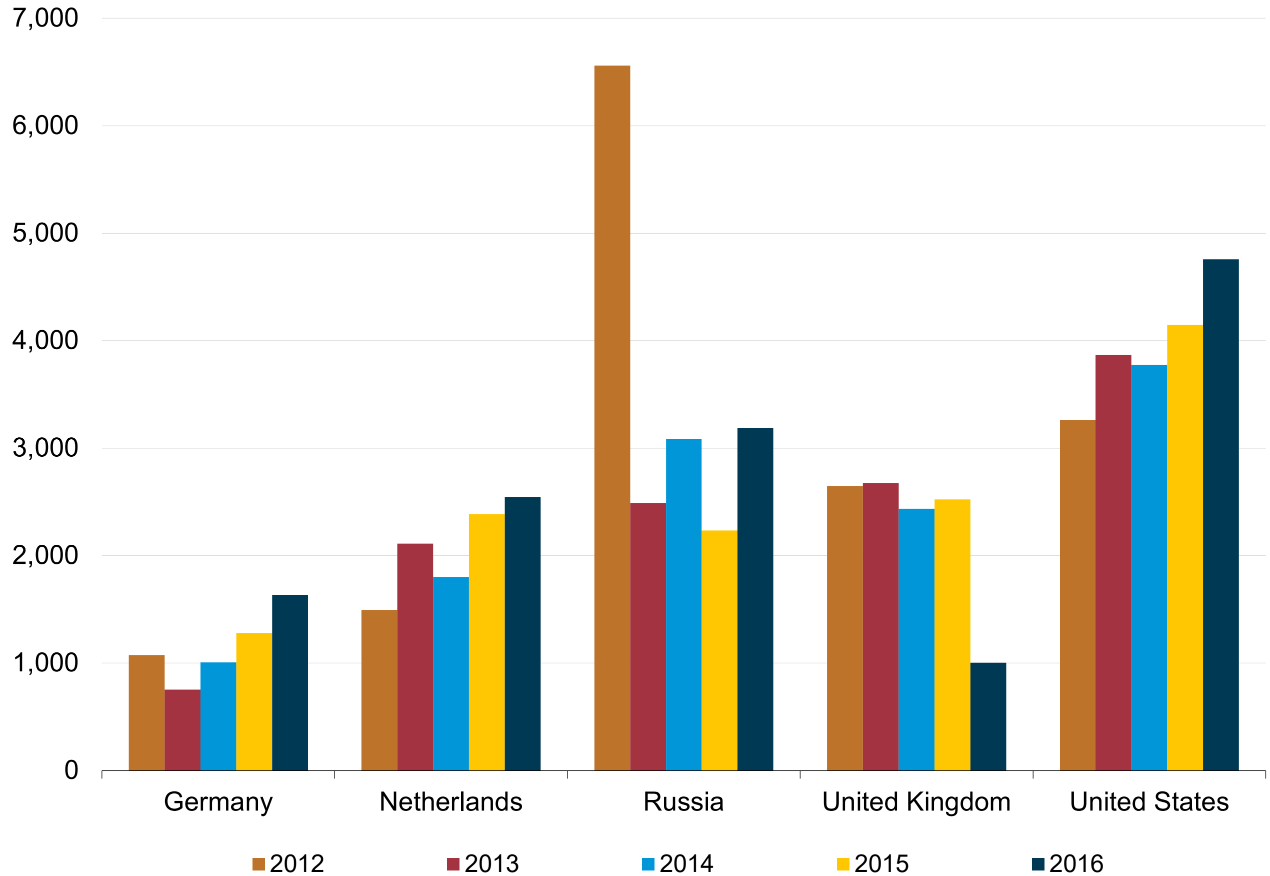
[2] Specific country was not reported.

Notes: Totals may not equal sum of components because of independent rounding. Average prices are not adjusted for inflation.

Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2012-16).

Figure 15. Purchases of enrichment services by owners and operators of U.S. civilian nuclear power reactors by selected origin country and year, 2012-16

thousand separative work units (SWU)



Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2012-16).

Table 17. Purchases of enrichment services by owners and operators of U.S. civilian nuclear power reactors by contract type in delivery year, 2016

thousand separative work units (SWU)

Enrichment service contract type	U.S. enrichment	Foreign enrichment	Total
Spot	W	W	116
Long-term	W	W	14,164
Total	**4,756**	**9,524**	**14,280**

W = Data withheld to avoid disclosure of individual company data.

Note: Totals may not equal sum of components because of independent rounding.

Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2016).

Table 18. Uranium in fuel assemblies loaded into U.S. civilian nuclear power reactors by year, 2012-16

thousand pounds U3O8 equivalent

Origin of uranium	2012	2013	2014	2015	P2016
Domestic-origin uranium	4,825	3,643	3,251	4,050	3,204
Foreign-origin uranium	44,657	39,000	47,281	43,381	39,291
Total	**49,483**	**42,642**	**50,532**	**47,431**	**42,495**

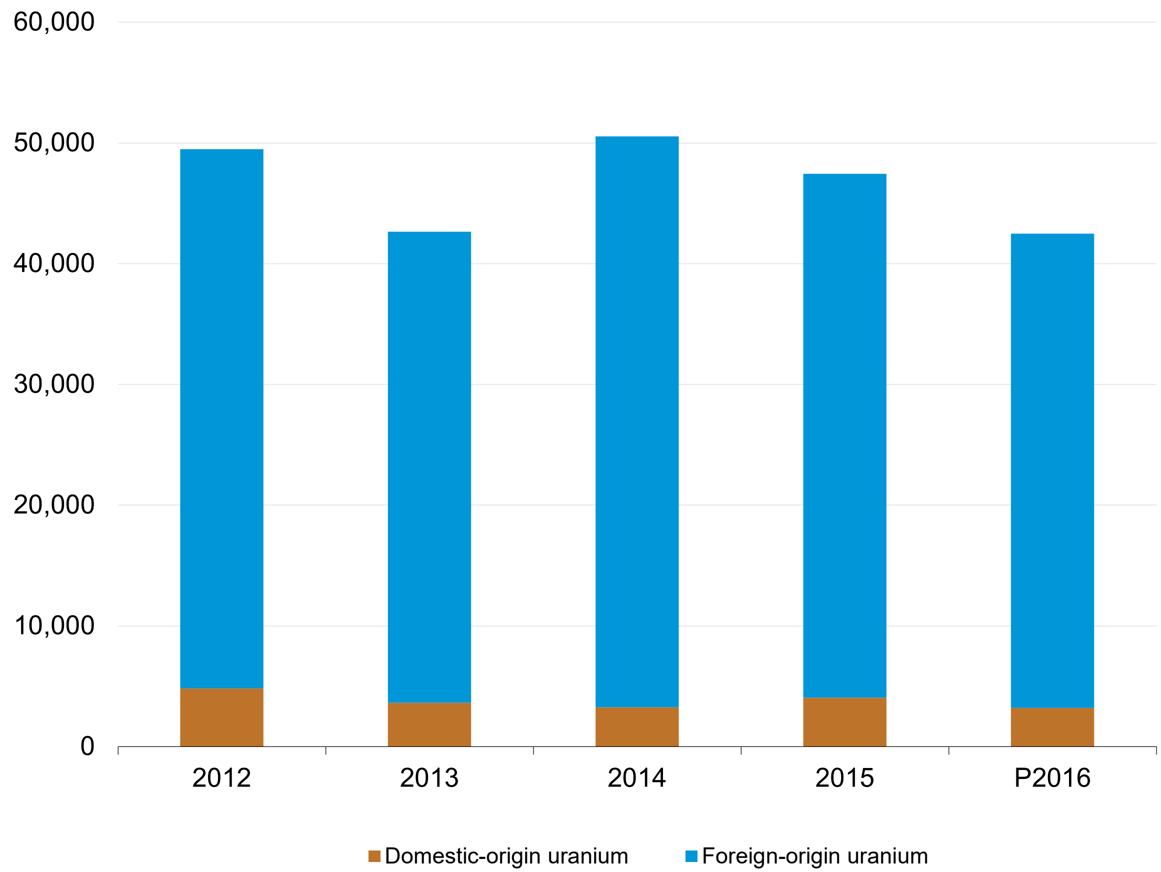
P = Preliminary data. Final 2015 fuel assembly data reported in the 2016 survey.

Notes: Includes only unirradiated uranium in new fuel assemblies loaded into reactors during the year. Does not include uranium removed from reactors that subsequently will be reloaded. Totals may not equal sum of components because of independent rounding.

Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2013-16).

Figure 16. Uranium in fuel assemblies loaded into U.S. civilian nuclear power reactors by year, 2012-16

thousand pounds U_3O_8 equivalent



P = Preliminary data. Final 2014 fuel assembly data reported in the 2015 survey.
Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2013-16).

Table 19. Foreign purchases of uranium by U.S. suppliers and owners and operators of U.S. civilian nuclear power reactors by delivery year, 2012-16

thousand pounds U3O8 equivalent; dollars per pound U3O8 equivalent

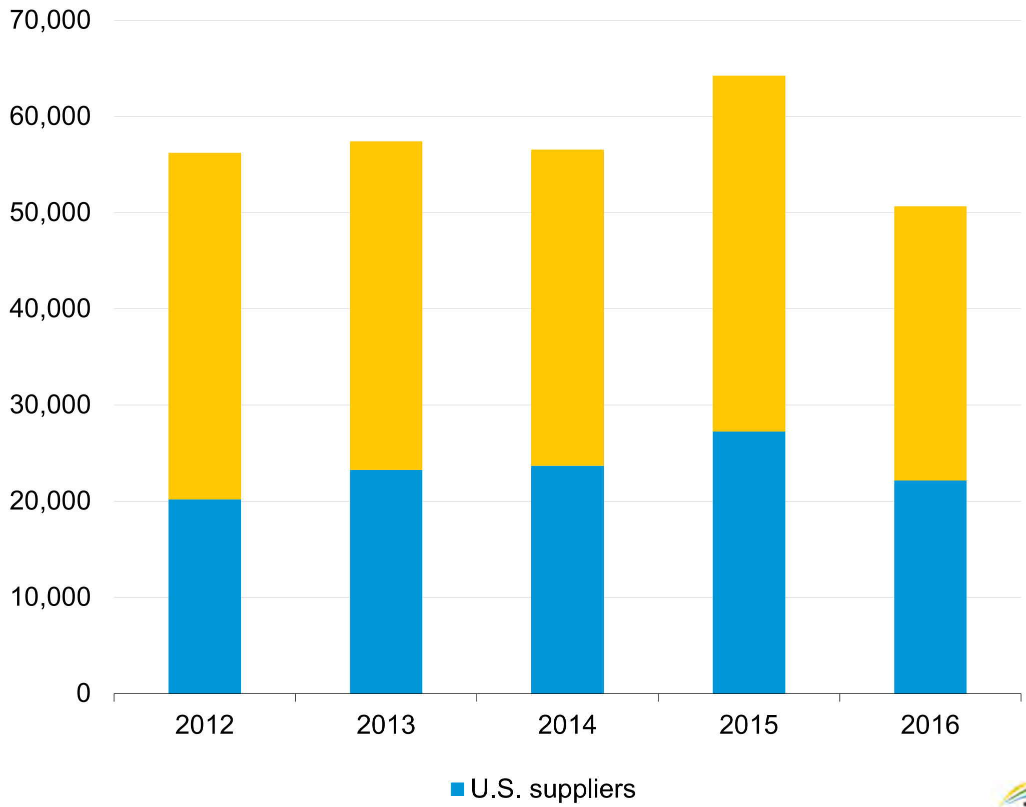
Deliveries	2012	2013	2014	2015	2016
U.S. suppliers					
Foreign purchases	20,196	23,233	23,684	27,233	22,138
Weighted-average price	46.80	43.25	39.22	40.68	36.03
Owners and operators of U.S. civilian nuclear power reactors					
Foreign purchases	36,037	34,195	32,863	37,001	28,512
Weighted-average price	54.08	51.67	47.51	44.67	44.08
Total					
Foreign purchases	56,233	57,428	56,547	64,234	50,650
Weighted-average price	51.44	48.27	44.03	42.95	40.45

Notes: Totals may not equal sum of components because of independent rounding. Foreign Purchase: A uranium purchase of foreign-origin uranium from a firm located outside of the United States. Weighted-average prices are not adjusted for inflation.

Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2012-16).

Figure 17. Foreign purchases of uranium by U.S. suppliers and owners and operators of U.S. civilian nuclear power reactors by delivery year, 2012-16

thousand pounds U_3O_8 equivalent



Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2012-16).

Table 20. U.S. broker and trader purchases of uranium by origin, supplier, and delivery year, 2012-16

thousand pounds U3O8 equivalent; dollars per pound U3O8 equivalent

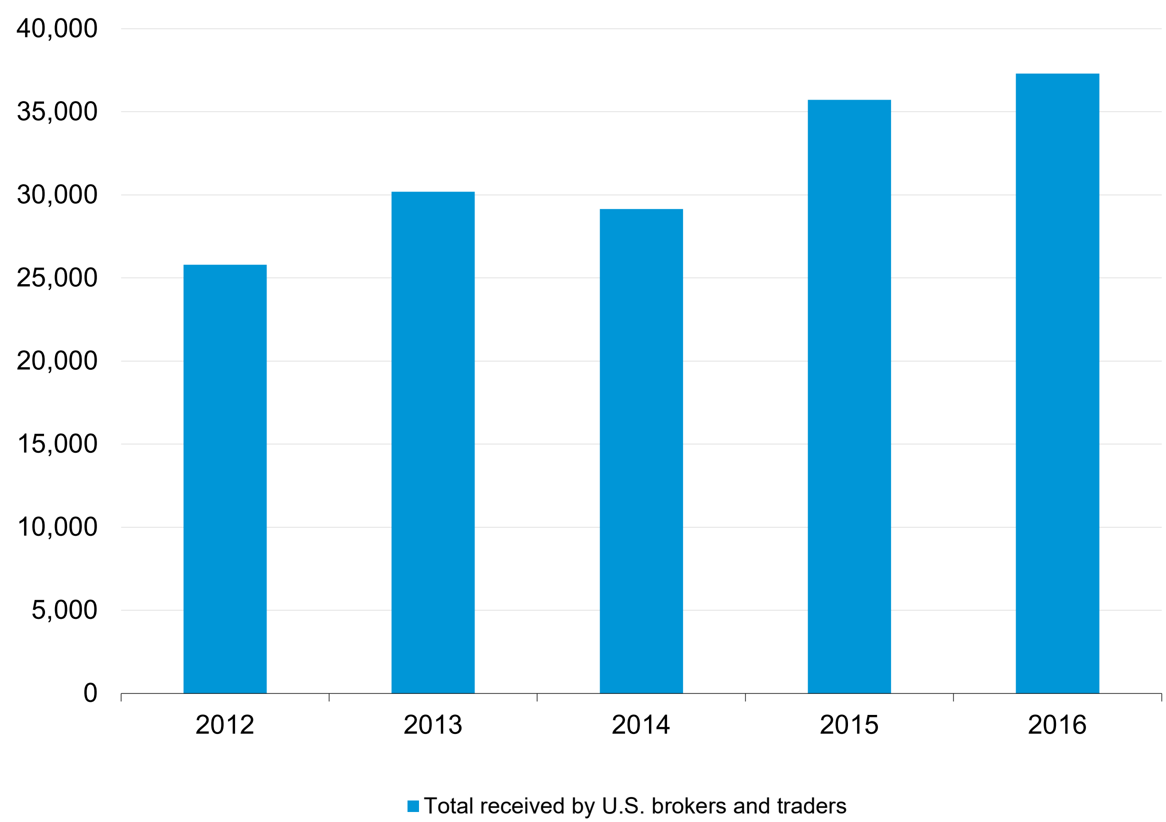
Deliveries	2012	2013	2014	2015	2016
Received U.S.-origin uranium					
Purchases	1,194	W	410	2,702	3,266
Weighted-average price	51.78	W	33.55	35.04	26.31
Received foreign-origin uranium					
Purchases	24,606	W	28,743	33,014	34,046
Weighted-average price	47.75	W	38.42	39.58	32.71
Total received by U.S. brokers and traders					
Purchases	**25,800**	**30,191**	**29,153**	**35,716**	**37,312**
Weighted-average price	**47.94**	**42.95**	**38.35**	**39.24**	**32.11**
Received from foreign suppliers					
Purchases	20,243	W	W	26,069	22,088
Weighted-average price	47.08	W	W	41	36.09

W = Data withheld to avoid disclosure of individual company data.
Notes: Totals may not equal sum of components because of independent rounding. Weighted-average prices are not adjusted for inflation.

Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2012-16).

Figure 18. U.S. broker and trader purchases of uranium by delivery year, 2012-16

thousand pounds U_3O_8 equivalent



Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2012-16).

Table 21. Foreign sales of uranium from U.S. suppliers and owners and operators of U.S. civilian nuclear power reactors by origin and delivery year, 2012-16

thousand pounds U3O8 equivalent; dollars per pound U3O8 equivalent

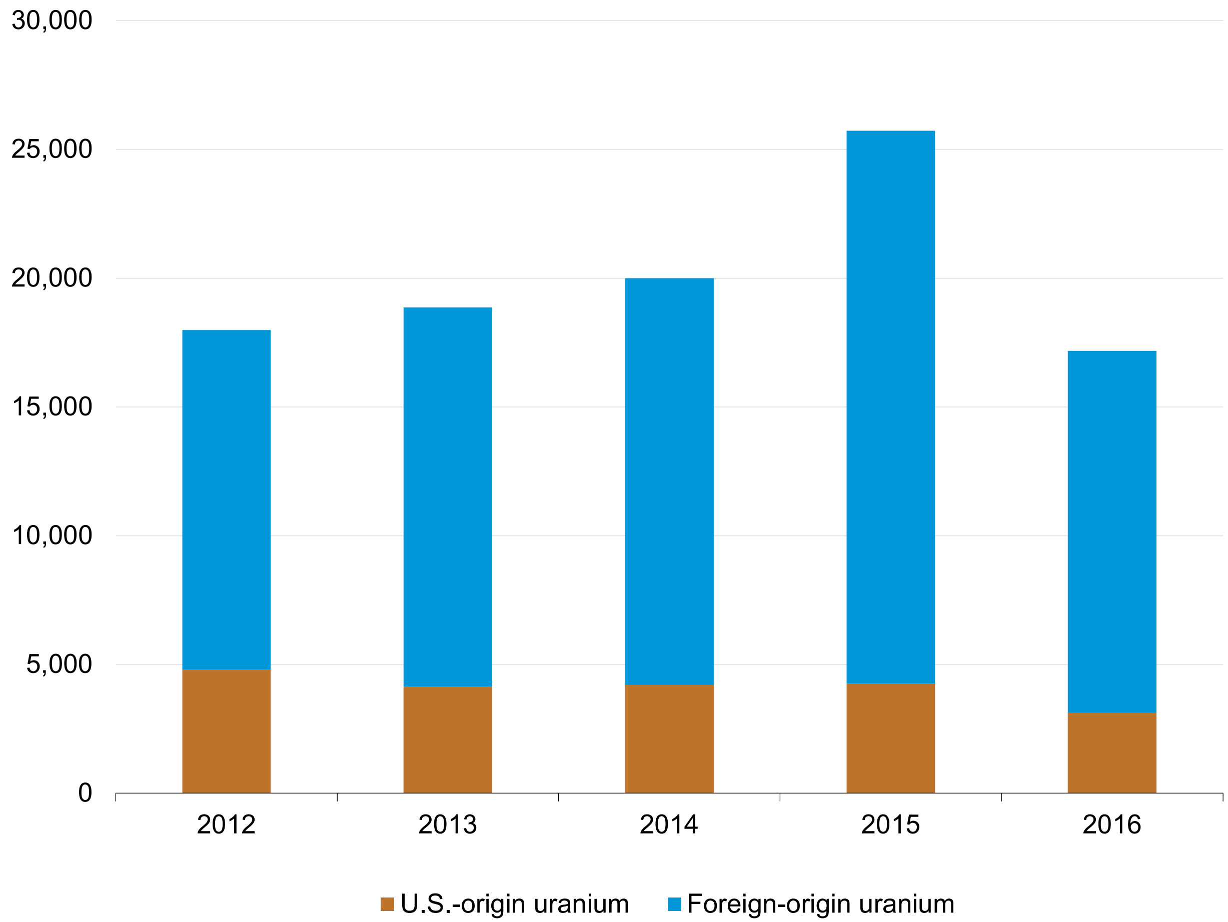
Deliveries to foreign suppliers and utilities	2012	2013	2014	2015	2016
U.S.-origin uranium					
Foreign sales	4,798	4,148	4,210	4,258	3,142
Weighted-average price	47.53	43.10	32.91	37.85	25.99
Foreign-origin uranium					
Foreign sales	13,185	14,717	15,794	21,465	14,034
Weighted-average price	47.58	42.66	36.43	39.58	35.38
Total sent:					
Foreign sales	**17,982**	**18,864**	**20,004**	**25,723**	**17,176**
Weighted-average price	**47.57**	**42.75**	**35.69**	**39.29**	**33.66**
From owners and operators of U.S. civilian nuclear power reactors, U.S. producers, and other U.S. suppliers					
Foreign sales	3,699	4,177	4,493	6,022	3,153
Weighted-average price	47.26	44.61	36.45	38.77	30.26
From U.S. brokers and traders					
Foreign sales	14,284	14,687	15,511	19,700	14,023
Weighted-average price	47.65	42.26	35.47	39.45	34.43

Notes: "Other U.S. Suppliers" are U.S. converters, enrichers, and fabricators. Totals may not equal sum of components because of independent rounding. Foreign sale: A uranium sale to a firm located outside the United States. Weighted-average prices are not adjusted for inflation.

Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2012-16).

Figure 19. Foreign sales of uranium from U.S. suppliers and owners and operators of U.S. civilian nuclear power reactors by origin and delivery year, 2012-16

thousand pounds U_3O_8 equivalent



Source: U.S. Energy Information Administration: Form EIA-858 "Uranium Marketing Annual Survey" (2012-16).

Table 22. Inventories of natural and enriched uranium by material type as of end of year, 2012-16

thousand pounds U3O8 equivalent

	Inventories at the end of the year				
Type of Uranium Inventory Owned by	**2012**	**2013**	**2014**	**2015**	**P2016**
Owners and operators of U.S. civilian nuclear power reactors inventories	**97,647**	**113,077**	**114,046**	**121,131**	**128,554**
Uranium concentrate (U_3O_8)	15,963	18,131	19,060	20,635	20,790
Natural UF_6	29,084	38,332	40,803	48,136	54,231
Enriched UF_6	38,428	40,841	43,382	41,557	43,704
Fabricated fuel (not inserted into a reactor)	14,173	15,773	10,802	10,803	9,829
U.S. supplier inventories	**23,289**	**21,342**	**18,682**	**14,340**	**15,310**
Uranium concentrate (U_3O_8)	W	7,658	6,170	6,289	7,184
Natural UF_6	W	W	W	W	W
Enriched UF_6	W	W	W	W	W
Fabricated fuel (not inserted into a reactor)	0	0	0	0	0
Total Commercial Inventories	**120,936**	**134,418**	**132,728**	**135,471**	**143,864**

P = Preliminary data. Final 2015 inventory data reported in the 2016 survey.

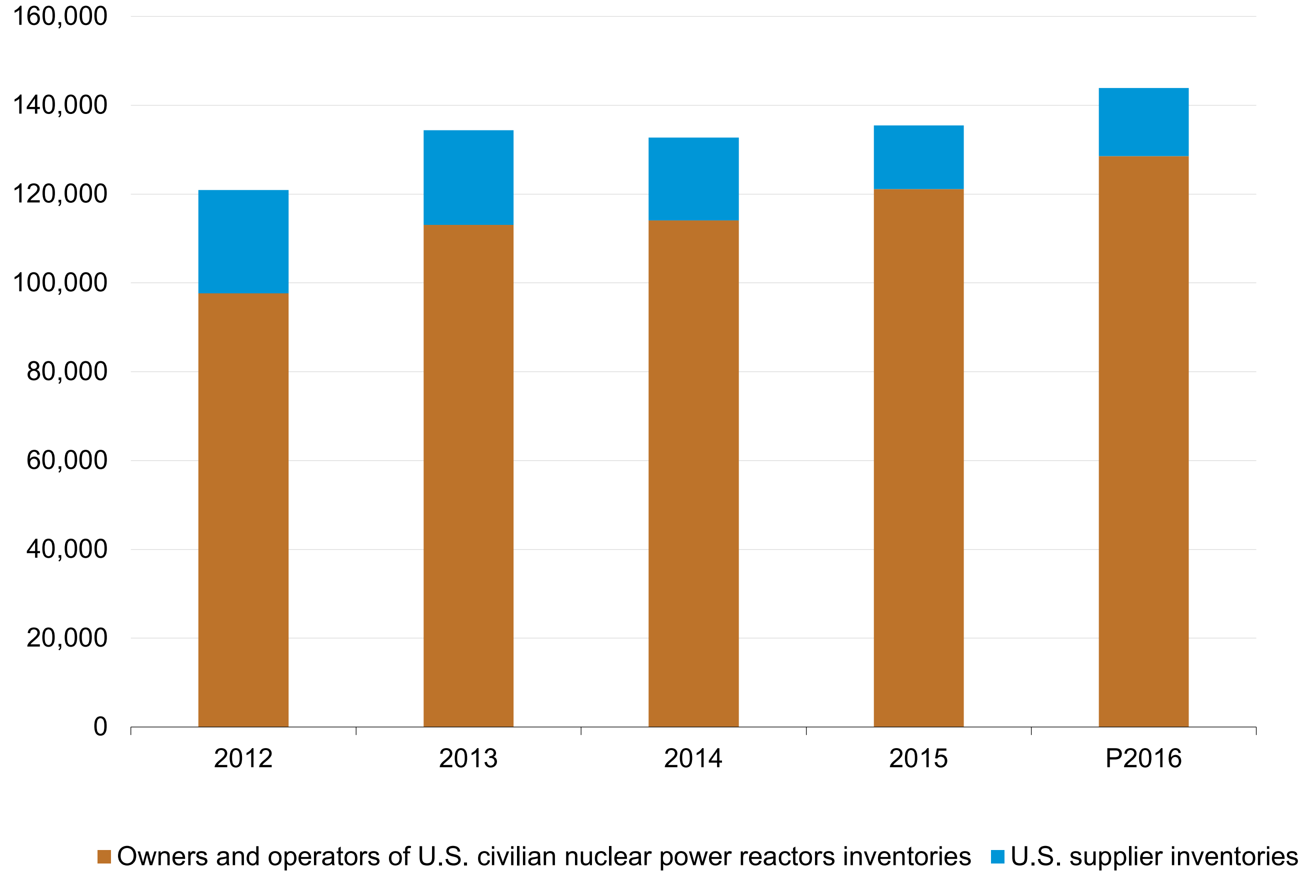
W = Data withheld to avoid disclosure of individual company data.

Note: Totals may not equal sum of components because of independent rounding.

Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2013-16).

Figure 20. Commercial inventories of natural and enriched uranium as of end of year, 2012-16

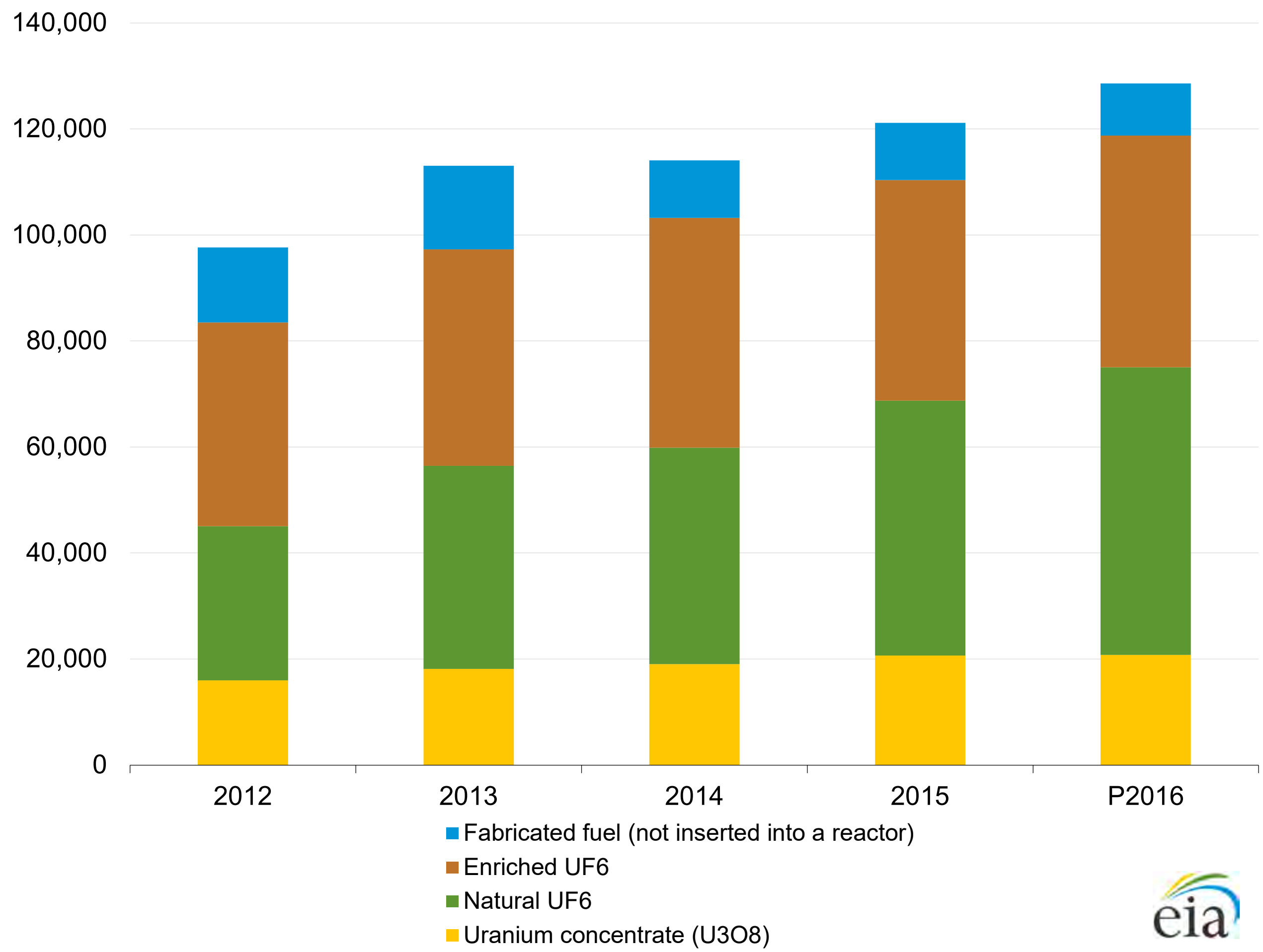
thousand pounds U_3O_8 equivalent



P = Preliminary data. Final 2015 inventory data reported in the 2016 survey.
Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2013-16).

Figure 21. Owners and operators of U.S. civilian nuclear power reactors inventories by material type as of end of year, 2012-16

thousand pounds U_3O_8 equivalent



P = Preliminary data. Final 2015 inventory data reported in the 2016 survey.
Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2013-16).

Table 23. Inventories of uranium by owner as of end of year, 2012-16

thousand pounds U_3O_8 equivalent

	Inventories at the End of Year				
Owner of uranium inventory	**2012**	**2013**	**2014**	**2015**	**P2016**
Owners and operators of U.S. civilian nuclear power reactors	97,647	113,007	114,046	121,131	128,554
U.S. brokers and traders	5,677	7,926	5,916	5,678	7,554
U.S. converter, enrichers, fabricators, and producers	17,611	13,416	12,766	8,662	7,756
Total commercial inventories	**120,936**	**134,418**	**132,728**	**135,471**	**143,864**

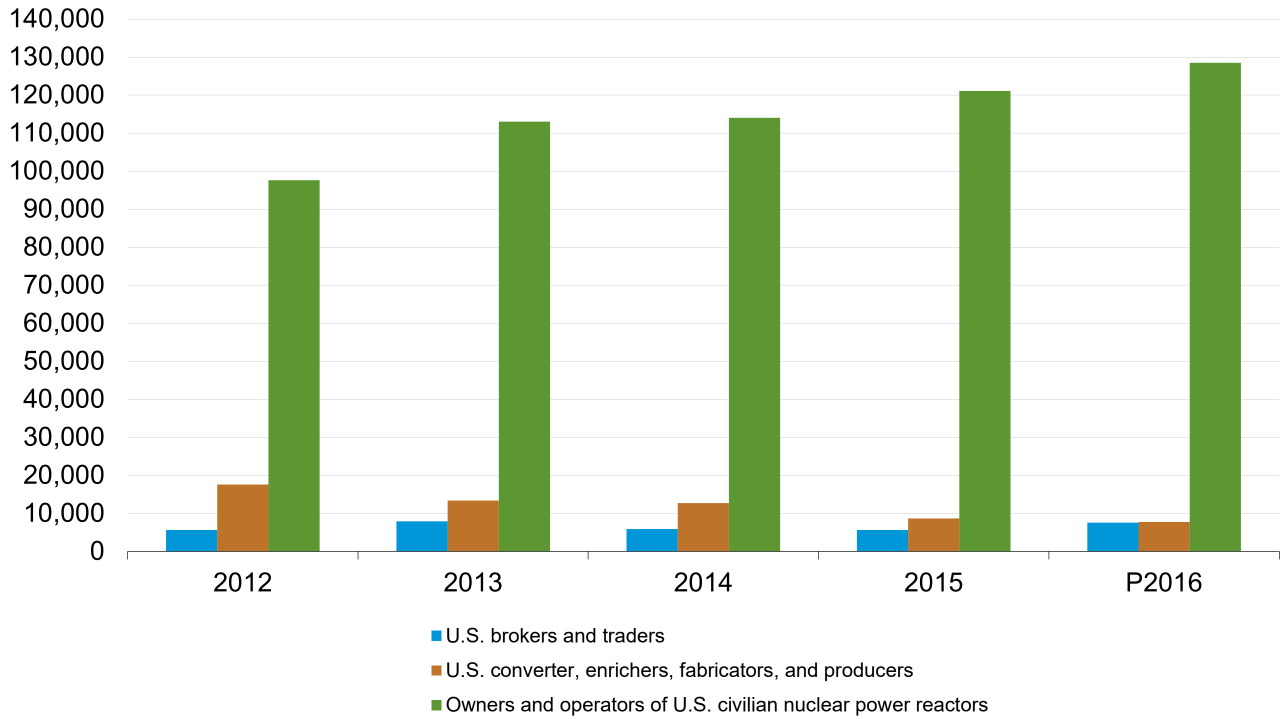
P = Preliminary data. Final 2015 inventory data reported in the 2016 survey.

Note: Totals may not equal sum of components because of independent rounding.

Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2013-16).

Figure 22. Commercial inventories of uranium by owner as of end of year, 2012-16

thousand pounds U_3O_8 equivalent



P=Preliminary data. Final 2014 inventory data reported in the 2015 survey.
Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2013-16).

Table 24. Uranium sellers to owners and operators of U.S. civilian nuclear power reactors, 2014-16

2014	2015	2016
Advance Uranium Asset Management Ltd.	AREVA / AREVA NC, Inc.	AREVA / AREVA NC, Inc.
AREVA / AREVA NC, Inc.	ARMZ (AtomRedMetZoloto)	ARMZ (AtomRedMetZoloto)
ARMZ (AtomRedMetZoloto)	BHP Billiton Olympic Dam Corporation Pty Ltd	BHP Billiton Olympic Dam Corporation Pty Ltd
BHP Billiton Olympic Dam Corporation Pty Ltd	CAMECO	CAMECO
CAMECO	CGN Global Uranium Limited	CGN Global Uranium Limited
Deutsche Bank	ConverDyn	ConverDyn
Energy Fuels Resources	Deutsche Bank	Deutsche Bank
Energy Resources of Australia Ltd.	Duke Energy Florida, Inc.	Duke Energy Florida, Inc.
Energy USA, Inc.	Energy Fuels Resources	Energy Fuels Resources
Itochu Corporation / Itochu International	Energy Resources of Australia Ltd.	Energy Resources of Australia Ltd.
J. Aron & Company	Energy USA, Inc.	Energy USA, Inc.
Kazatomprom	Itochu Corporation / Itochu International	Itochu Corporation / Itochu International
Langer Heinrich Uranium Ltd (Paladin Energy)	Kazatomprom	Kazatomprom
Mestena Uranium LLC	Langer Heinrich Uranium Ltd (Paladin Energy)	Langer Heinrich Uranium Ltd (Paladin Energy)
MTM Trading, LLC	Macquarie Bank	Macquarie Bank
Nufcor International Limited	Mitsui & Co.	Mitsui & Co.
NUKEM, Inc.	MTM Trading, LLC	MTM Trading, LLC
NYNCO Trading, Ltd.	Nufcor International Limited	Nufcor International Limited
Paladin Resources Limited / Paladin Energy	NUKEM, Inc.	NUKEM, Inc. / RWE Nukem
PPL Energy Plus LLC	NYNCO Trading, Ltd.	NYNCO Trading, Ltd.
Rio Tinto Uranium Limited	Paladin Resources Limited / Paladin Energy	Paladin Resources Limited / Paladin Energy
Rossing Uranium Limited	Rio Tinto Uranium Limited	Rio Tinto Uranium Limited
SOPAMIN (Société de Patrimoine des Mines du Niger "Heritage Society of Mines in Niger")	Rossing Uranium Limited	Rossing Uranium Limited
TENAM Corporation	SOPAMIN (Société de Patrimoine des Mines du Niger "Heritage Society of Mines in Niger")	SOPAMIN (Société de Patrimoine des Mines du Niger "Heritage Society of Mines in Niger")
TENEX (Techsnabexport)	Southern Cross Resources Australia Pty. Ltd.	Southern Cross Resources Australia Pty. Ltd.
Traxys North America, LLC	TENAM Corporation	TENAM Corporation
UG U.S.A., Inc.	TENEX (Techsnabexport)	TENEX (Techsnabexport)
Uranerz Energy Corporation	Traxys North America, LLC	Traxys North America, LLC
Uranium One	UG U.S.A., Inc.	UG U.S.A., Inc.
UrAsia Energy Ltd.	Uranerz Energy Corporation	Uranerz Energy Corporation
URENCO, Inc.	Uranium One	Uranium One
Ur-Energy / Ur-Energy USA Inc	UrAsia Energy Ltd.	UrAsia Energy Ltd.
USEC, Inc. (United States Enrichment Corporation)	URENCO, Inc.	URENCO, Inc.
Westinghouse Electric Company, LLC	Ur-Energy / Ur-Energy USA Inc	Ur-Energy / Ur-Energy USA Inc
	USEC, Inc. (United States Enrichment Corporation)	USEC, Inc. (United States Enrichment Corporation)
	Westinghouse Electric Company, LLC	Westinghouse Electric Company, LLC

Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2014-16).

Table 25. Enrichment service sellers to owners and operators of U.S. civilian nuclear power reactors, 2014-16

2014	2015	2016
AREVA Enrichment Services, LLC / AREVA NC, Inc.	AREVA Enrichment Services, LLC / AREVA NC, Inc.	AREVA Enrichment Services, LLC / AREVA NC, Inc.
CNEIC (China Nuclear Energy Industry Corporation)	CAMECO	CAMECO
LES, LLC (Louisiana Energy Services)	CNEIC (China Nuclear Energy Industry Corporation)	CNEIC (China Nuclear Energy Industry Corporation)
NYNCO Trading, LTD	Energy Northwest	Energy Northwest
TENAM Corporation	LES, LLC (Louisiana Energy Services)	LES, LLC (Louisiana Energy Services)
TENEX (Techsnabexport Joint Stock Company)	TENAM Corporation	TENAM Corporation
UG U.S.A., Inc.	TENEX (Techsnabexport Joint Stock Company)	TENEX (Techsnabexport Joint Stock Company)
URENCO, Inc.	UG U.S.A., Inc.	UG U.S.A., Inc.
URENCO USA, Inc.	URENCO, Inc.	URENCO, Inc.
USEC, Inc. (United States Enrichment Corporation)	URENCO USA, Inc.	URENCO USA, Inc.
Westinghouse Electric Company, LLC	USEC, Inc. (United States Enrichment Corporation)	USEC, Inc. (United States Enrichment Corporation)
	Westinghouse Electric Company, LLC	Westinghouse Electric Company, LLC

Source: U.S. Energy Information Administration, Form EIA-858 "Uranium Marketing Annual Survey" (2014-16).

Exhibit 7

Table 9.3 Uranium Overview, Selected Years, 1949-2011

Year	Domestic Concentrate Production [1]	Purchased Imports [2]	Export [2] Sales	Electric Plant Purchases From Domestic Suppliers	Loaded Into U.S. Nuclear Reactors [3]	Inventories			Average Price	
						Domestic Suppliers	Electric Plants	Total	Purchased Imports	Domestic Purchases
	Million Pounds Uranium Oxide								Dollars [4] per Pound Uranium Oxide	
1949	0.36	4.3	0.0	NA	NA	NA	NA	NA	NA	NA
1950	.92	5.5	.0	NA	NA	NA	NA	NA	NA	NA
1955	5.56	7.6	.0	NA	NA	NA	NA	NA	NA	NA
1960	35.28	36.0	.0	NA	NA	NA	NA	NA	NA	NA
1965	20.88	8.0	.0	NA	NA	NA	NA	NA	NA	NA
1970	25.81	.0	4.2	NA	NA	NA	NA	NA	– –	NA
1975	23.20	1.4	1.0	NA	NA	NA	NA	NA	NA	NA
1976	25.49	3.6	1.2	NA	NA	NA	NA	NA	NA	NA
1977	29.88	5.6	4.0	NA	NA	NA	NA	NA	NA	NA
1978	36.97	5.2	6.8	NA	NA	NA	NA	NA	NA	NA
1979	37.47	3.0	6.2	NA	NA	NA	NA	NA	NA	NA
1980	43.70	3.6	5.8	NA	NA	NA	NA	NA	NA	NA
1981	38.47	6.6	4.4	32.6	NA	NA	NA	159.2	32.90	34.65
1982	26.87	17.1	6.2	27.1	NA	NA	NA	174.8	27.23	38.37
1983	21.16	8.2	3.3	24.2	NA	NA	NA	191.8	26.16	38.21
1984	14.88	12.5	2.2	22.5	NA	25.0	160.2	185.2	21.86	32.65
1985	11.31	11.7	5.3	21.7	NA	23.7	153.2	176.9	20.08	31.43
1986	13.51	13.5	1.6	18.9	NA	27.0	144.1	171.1	20.07	30.01
1987	12.99	15.1	1.0	20.8	NA	25.4	137.8	163.2	19.14	27.37
1988	13.13	15.8	3.3	17.6	NA	19.3	125.5	144.8	19.03	26.15
1989	13.84	13.1	2.1	18.4	NA	22.2	115.8	138.1	16.75	19.56
1990	8.89	23.7	2.0	20.5	NA	26.4	102.7	129.1	12.55	15.70
1991	7.95	16.3	3.5	26.8	34.6	20.7	98.0	118.7	15.55	13.66
1992	5.65	23.3	2.8	23.4	43.0	25.2	92.1	117.3	11.34	13.45
1993	3.06	21.0	3.0	15.5	45.1	24.5	81.2	105.7	10.53	13.14
1994	3.35	36.6	17.7	22.7	40.4	21.5	65.4	86.9	8.95	10.30
1995	6.04	41.3	9.8	22.3	51.1	13.7	58.7	72.5	10.20	11.11
1996	6.32	45.4	11.5	23.7	46.2	13.9	66.1	80.0	13.15	13.81
1997	5.64	43.0	17.0	19.4	48.2	40.4	65.9	106.2	11.81	12.87
1998	4.71	43.7	15.1	21.6	38.2	70.7	65.8	136.5	11.19	12.31
1999	4.61	47.6	8.5	21.4	58.8	68.8	58.3	127.1	10.55	11.88
2000	3.96	44.9	13.6	24.3	51.5	56.5	54.8	111.3	9.84	11.45
2001	2.64	46.7	11.7	27.5	52.7	48.1	55.6	103.8	9.51	10.45
2002	2.34	52.7	15.4	22.7	57.2	48.7	53.5	102.1	10.05	10.35
2003	[5,E]2.00	53.0	13.2	21.7	62.3	39.9	45.6	85.5	10.59	10.84
2004	2.28	66.1	13.2	28.2	50.1	37.5	57.7	95.2	12.25	11.91
2005	2.69	65.5	20.5	27.3	58.3	29.1	64.7	93.8	14.83	13.98
2006	4.11	64.8	18.7	27.9	51.7	29.1	77.5	106.6	19.31	18.54
2007	4.53	54.1	14.8	18.5	45.5	31.2	81.2	112.4	34.18	33.13
2008	3.90	57.1	17.2	20.4	51.3	27.0	83.0	110.0	41.30	43.43
2009	3.71	58.9	23.5	17.6	49.4	26.8	84.8	111.5	41.23	44.53
2010	4.23	55.3	23.1	16.2	44.3	[R]24.7	86.5	[R]111.3	47.01	44.88
2011	3.99	54.4	16.7	19.8	[P]52.0	[P]24.1	[P]89.5	[P]113.6	54.00	53.41

[1] See "Uranium Concentrate" in Glossary.

[2] Import quantities through 1970 are reported for fiscal years. Prior to 1968, the Atomic Energy Commission was the sole purchaser of all imported uranium oxide. Trade data prior to 1982 were for transactions conducted by uranium suppliers only. For 1982 forward, transactions by uranium buyers (consumers) have been included. Buyer imports and exports prior to 1982 are believed to be small.

[3] Does not include any fuel rods removed from reactors and later reloaded.

[4] Prices are not adjusted for inflation. See "Nominal Dollars" in Glossary.

[5] Value has been rounded to avoid disclosure of individual company data.

R=Revised. P=Preliminary. E=Estimate. NA=Not available. – – =Not applicable.

Note: See "Uranium Oxide" in Glossary.

Web Pages: • For all data beginning in 1949, see http://www.eia.gov/totalenergy/data/annual/#nuclear. • For related information, see http://www.eia.gov/nuclear/.

Sources: • 1949-1966—U.S. Department of Energy, Grand Junction Office, *Statistical Data of the Uranium Industry,* Report No. GJO-100, annual reports. • 1967-2002—U.S. Energy Information Administration (EIA), *Uranium Industry Annual,* annual reports. • 2003-2006—EIA, "Uranium Marketing Annual Report," annual reports. • 2007 forward—EIA, "2011 Domestic Uranium Production Report" (May 2012), Table 3; EIA, "2011 Uranium Marketing Annual Report" (May 2012), Tables 5, 18, 19, 21, and 22; and EIA, Form EIA-858, "Uranium Marketing Annual Survey."

Exhibit 8

U.S. DEPARTMENT OF ENERGY

Excess Uranium Inventory Management Plan

Report to Congress
July 2013

United States Department of Energy
Washington, DC 20585

Message from the Secretary

The Department of Energy is submitting a report required by section 312(c) of the Consolidated Appropriations Act, 2012 (Public Law 112-74, div B, tit. III), concerning an update to the Department's 2008 Excess Uranium Inventory Management Plan.

This report is a revised Excess Uranium Inventory Management Plan, containing updated information regarding the Department's excess uranium inventories and its plans for the material contained in those inventories.

This report is being provided to the following members of Congress:

- **The Honorable Barbara Mikulski**
Chairwoman, Senate Committee on Appropriations

- **The Honorable Richard C. Shelby**
Ranking Member, Senate Committee on Appropriations

- **The Honorable Harold Rogers**
Chairman, House Committee on Appropriations

- **The Honorable Nita M. Lowey**
Ranking Member, House Committee on Appropriations

- **The Honorable Dianne Feinstein**
Chairman, Subcommittee on Energy and Water Development
Senate Committee on Appropriations

- **The Honorable Lamar Alexander**
Ranking Member, Subcommittee on Energy and Water Development
Senate Committee on Appropriations

- **The Honorable Rodney P. Frelinghuysen**
Chairman, Subcommittee on Energy and Water Development
House Committee on Appropriations

- **The Honorable Marcy Kaptur**
Ranking Member, Subcommittee on Energy and Water Development
House Committee on Appropriations

- **The Honorable Ron Wyden**
Chairman, Senate Committee on Energy and Natural Resources

- **The Honorable Lisa Murkowski**

Ranking Member, Senate Committee on Energy and Natural Resources

- **The Honorable Al Franken**

Chairman, Subcommittee on Energy
Senate Committee on Energy and Natural Resources

- **The Honorable James E. Risch**

Ranking Member, Subcommittee on Energy
Senate Committee on Energy and Natural Resources

- **The Honorable Fred Upton**

Chairman, House Committee on Energy and Commerce

- **The Honorable Henry Waxman**

Ranking Member, House Committee on Energy and Commerce

- **The Honorable Ed Whitfield**

Chairman, Subcommittee on Energy and Power
House Committee on Energy and Commerce

- **The Honorable Bobby L. Rush**

Ranking Member, Subcommittee on Energy and Power
House Committee on Energy and Commerce

Sincerely,

Ernest J. Moniz

Executive Summary

The Department of Energy (DOE) holds inventories of uranium in various forms and qualities, including highly enriched uranium (HEU), low-enriched uranium (LEU), natural uranium (NU), and depleted uranium (DU), that are currently held as excess and not dedicated to U.S. national security missions. Much of this uranium has potential value that could play a role in achieving vital DOE programmatic missions.

The Office of Nuclear Energy, the Office of Environmental Management, and the National Nuclear Security Administration (NNSA) are the organizations within DOE that coordinate the management of these excess uranium inventories. On December 16, 2008, DOE issued its Excess Uranium Inventory Management Plan (2008 Plan), setting forth possible uses for these inventories. This updated Excess Uranium Inventory Management Plan (2013 Plan) replaces the 2008 Plan and reflects updated and evolving information, programs, and mission needs, including additions to and deletions from the inventory and changes to DOE's uranium management strategy.

The 2013 Plan identifies uranium inventories that have entered the commercial uranium market since the issuance of the 2008 Plan, as well as transactions that are ongoing or being considered by DOE through Calendar Year (CY) 2018. The 2013 Plan's objectives include providing current information and enhanced transparency to the general public and interested stakeholders regarding the management of DOE's potentially marketable uranium. The planned and prospective sales or transfers of uranium into the commercial market identified in 2013 Plan reflect current and reasonably foreseeable DOE mission needs. The ongoing strategies, plans, and prospective actions in this Plan are not commitments to specific activities on the part of DOE beyond those that have already been contracted nor are they restrictions on actions that may be required in the future as a result of changing conditions, and all future actions will follow applicable legal requirements. DOE anticipates periodically updating the Plan, as necessary, to reflect new and evolving information, policies, and programs.

The Department complies with the requirement in Section 3112(d) of the United States Enrichment Corporation (USEC) Privatization Act, when applicable, to ensure that prior to covered sales or transfers of natural or enriched uranium, the Secretary of Energy determines that those transfers will not have an adverse material impact on the domestic uranium mining, conversion, or enrichment industry (Secretarial Determination).

Several Secretarial Determinations have been made in advance of sales or transfers of uranium undertaken by DOE since 2008 to further programmatic interests. Each determination found that the introduction of a specified quantity of DOE excess uranium into the commercial market would not have an adverse material impact on the covered domestic industries. A Secretarial Determination for the sale or transfer of natural or enriched uranium, issued May 15, 2012 (May 2012 Determination), covers transfers that are planned or under consideration by the

Department through 2021.[1] The May 2012 Determination specifically considered the potential impact on the domestic uranium market from the following potential transactions:

1. Up to 9,082 metric tons uranium (MTU) of DU transferred to Energy Northwest (ENW) in CYs 2012 and 2013, which would be followed immediately by enrichment to LEU (equivalent to 482 MTU). ENW would use a portion of the LEU to fuel its power reactor. The remaining LEU would be sold as LEU, or in its component parts as NU and separative work units, to the Tennessee Valley Authority as part of a commercial transaction to support future power generation and tritium production from 2013 through 2030, thereby serving national security purposes.

2. Up to 2,400 MTU per year of NU transferred to DOE contractors for cleanup services at gaseous diffusion plant sites (at Paducah, Kentucky, or Portsmouth, Ohio). These would take place in quarterly transfers of up to 600 MTU for the period 2012 through 2021.

3. Up to 400 MTU NU equivalent per year contained in LEU transferred to NNSA contractors for down-blending HEU to LEU for the period 2012 through 2020.

The May 2012 Determination addresses the market impact of transferring specific quantities and types of DOE's excess uranium inventories through 2021. Under Section 312(a) of the Consolidated Appropriations Act, 2012, determinations by the Secretary pursuant to Section 3112(d)(2)(B) of the USEC Privatization Act remain valid for only two calendar years from the date of issuance. Thus, the Department anticipates revisiting the potential market impact for transfers of uranium, covered under Section 3112(d)(2)(B) of the USEC Privatization Act, every two years if it seeks to continue the covered transfers.

[1] A more recent Secretarial Determination, dated March 15, 2013, covers a one-time transaction whereby DOE provided USEC with 47.6 MTU of LEU and received in return from USEC the value of the 299,000 SWU, the enrichment component of the LEU, which was applied to the government cost share in the 2012 Cooperative Agreement Between DOE, USEC, and ACD Concerning the American Centrifuge Cascade Demonstration Test Program, and approximately 409 MTU of the natural uranium equivalent to the feed component of the LEU.

EXCESS URANIUM INVENTORY MANAGEMENT PLAN

Table of Contents

ACRONYMS

AFS	Assured Fuel Supply
CY	calendar year
DOE	Department of Energy
DU	depleted uranium
DUF_4	depleted uranium tetrafluoride
DUF_6	depleted uranium hexafluoride
EM	Office of Environmental Management
ENW	Energy Northwest
FY	fiscal year
GDP	Gaseous Diffusion Plant
HEU	highly enriched uranium
LEU	low-enriched uranium
MOX	mixed oxide
MT	metric tons
MTU	metric tons uranium
NNSA	National Nuclear Security Administration
NU	natural uranium
SWU	separative work unit
TVA	Tennessee Valley Authority
UF_4	uranium tetrafluoride
UF_6	uranium hexafluoride
UO_2	uranium oxide
USEC	United States Enrichment Corporation

I. LEGISLATIVE LANGUAGE

This report responds to legislative language set forth in Consolidated Appropriations Act, 2012 (Public Law 112-74, div. B, tit. III), Section 312 (c), wherein it is stated:

> *"(c) Not later than June 30, 2012, the Secretary shall submit to the House and Senate Committees on Appropriations a revised excess uranium inventory management plan for fiscal years 2013 through 2018."*

II. INTRODUCTION

Uranium Inventory Management Principles and Objectives

This Excess Uranium Inventory Management Plan (2013 Plan) seeks to provide the public and interested stakeholders more specific information and enhanced transparency regarding Department of Energy (DOE) management of potentially marketable uranium inventories. The Office of Nuclear Energy, the Office of Environmental Management (EM), and the National Nuclear Security Administration (NNSA) are the organizations within DOE that coordinate the management of these inventories, which exist in the forms of highly enriched uranium (HEU), low-enriched uranium (LEU), natural uranium (NU) in the form of uranium hexafluoride (UF_6), and depleted uranium hexafluoride (DUF_6). The Department has prepared the 2013 Plan to replace the *Department of Energy Excess Uranium Inventory Management Plan* (DOE 2008; hereinafter referred to as the 2008 Plan) and to reflect updated and evolving information, programs, and mission needs since the 2008 Plan was issued. The 2013 Plan identifies uranium inventories that have entered the uranium market since the 2008 Plan and those anticipated to potentially enter the market through the end of Calendar Year (CY) 2018. Among the changes described in the 2013 Plan are additions to and deletions from the inventory and changes to DOE's uranium management strategy.

On December 16, 2008, the Department released the 2008 Plan, providing information about transactions planned or under consideration by the Department for the disposition of its excess uranium consistent. The Department is committed to managing excess inventories in a manner that:

1. Is consistent with all applicable legal requirements,
2. Maintains sufficient uranium inventories to meet the current and reasonably foreseeable needs of DOE missions,
3. Undertakes transactions involving non-U.S. Government entities in a transparent and competitive manner, and
4. Is consistent with and supportive of the maintenance of a strong domestic uranium industry.

The 2008 Plan included reference to a Departmental guideline that, as a general matter, the introduction into the domestic market of uranium from Departmental inventories in amounts that do not exceed 10 percent of the total annual fuel requirements of all nuclear power plants should not have an adverse material impact on the domestic uranium mining, conversion, or enrichment industry.[2] The 2008 Plan noted that the Department might introduce into the domestic market, in any given year, less than that amount, or, in some years for certain special purposes such as the provision of initial core loads for new reactors, more than that amount. Based on experience gained since issuance of the 2008 Plan[3], including in particular the market impact analysis that supported the May 15, 2012 Secretarial Determination (the May 2012 Determination), the Department has determined that it can meet its statutory and policy objectives in regard to DOE uranium sales or transfers without an established guideline. In addition, as discussed below, decisions to introduce uranium into the market pursuant to section 3112(d) must be reviewed every two years. Accordingly, the 10 percent guideline will no longer be used.

The Department remains committed to the maintenance of a strong domestic uranium industry and will conduct uranium transactions, where applicable, in accordance with Section 3112(d) of the United States Enrichment Corporation (USEC) Privatization Act (Public Law 104-134), which states that sales or transfers of natural or LEU from DOE's stockpile must meet the following criteria:

1. The President determines the material is not necessary for national security needs;

2. The Secretary determines that the sale of the material will not have an adverse material impact on the domestic uranium mining, conversion, or enrichment industry, taking into account the sales of uranium under the Russian HEU Agreement, and the Suspension Agreement; and

3. The price paid to the Secretary will not be less than the fair market value of the material.

Section 3112(d) of the USEC Privatization Act only covers transfers of natural or enriched uranium, but the Department also considers and analyzes the potential market impacts of transactions involving DUF_6 and structures those transactions to mitigate any significant impact on the domestic uranium mining, conversion, or enrichment industry.

Further, Section 312(a) of the Consolidated Appropriations Act, 2012 provides that all determinations pursuant to Section 3112(d)(2)(B) are only valid for two calendar years. Thus, the Department will revisit its analyses of market impacts and issue new Determinations every

[2] Even with this guideline, any transfer subject to section 3112(d) of the USEC Privatization Act still underwent a market impact analysis to ensure there was no adverse material impact.

[3] Subsequent to issuance of the 2008 Plan, in 2009 the Department issued its "Finding of No Significant Impact: Disposition of DOE Excess Depleted Uranium, Natural Uranium, and Low Enriched Uranium." 74 Fed. Reg. 31420 (July 1, 2009); DOE/EA-1607. In the mitigation action plan (MAP) of that finding, DOE determined that any potentially significant impacts on the domestic uranium industry from the sale or transfer of depleted uranium could addressed by conducting a market impact analysis similar to those conducted in accordance with section 3112(d) and, if necessary, adjusting sales or transfers to avoid or mitigate any potentially significant impacts.

two years for transfers covered under Section 3112(d) if it seeks to continue the covered transactions. As in the past, the Department's analysis of potential market impacts under Section 3112(d) will account for all Departmental uranium sales or transfers into the market in the relevant period – including any that may fall outside of Section 3112(d) – to determine potential market impacts. Taken together, these legal requirements and actions by the Department protect the interests of the domestic uranium industry in an effective and reasonable manner while providing the Department with the necessary flexibility to meet its programmatic needs and responsibilities. Lastly, any updates to the 2013 Plan, May 2012 Determination, or any subsequent Secretarial Determinations required by Section 312(a) of Consolidated Appropriations Act, 2012, would provide the public and the domestic uranium industry with information and transparency regarding the Department's planned uranium sales or transfers.

Changing Departmental priorities may require changes to plans or schedules for sale or transfer of uranium that cannot be anticipated at this time. This includes the possibility that uranium that is now directed to national security needs might be declared to be excess and, conversely, that uranium now considered to be excess might be redirected to national security needs. Although the focus of this Plan includes those transactions being considered by the Department through CY 2018, the final disposition of DOE's excess uranium inventories could take at least 20 years when all inventories are considered.

The May 2012 Determination (Appendix A) effectively sets forth uranium transfers being considered during the time span of this Plan. Any additional transfers will be evaluated separately using the same requirements described in this Plan.[4] The May 2012 Determination specifically considered the following potential transfers:

1. Up to 9,082 metric tons uranium (MTU) of DUF_6 to Energy Northwest (ENW) in CYs 2012 and 2013, which would be immediately followed by enrichment to LEU equivalent to 482 MTU, with ENW utilizing a portion of the LEU for fueling the nuclear power reactor it operates. The remaining LEU would be sold as LEU or, in its component parts, as NU and separative work units (SWUs) to the Tennessee Valley Authority (TVA) as part of a commercial transaction to support future power generation and tritium production from 2013 through 2030, thereby serving national security purposes.

2. Up to 2,400 MTU per year of NU to DOE contractors as compensation for cleanup services at the Gaseous Diffusion Plant (GDP) sites at Paducah, Kentucky, or Portsmouth, Ohio, in quarterly transfers of up to 600 MTU for the period 2012 through 2021.

3. Up to 400 MTU NU equivalent per year contained in LEU transferred to NNSA contractors for down-blending HEU to LEU for the period 2012 through 2020.

[4] A more recent Secretarial Determination, dated March 15, 2013, covering a one-time transaction resulting in the transfer of 299,000 SWU, the enrichment component of 47.6 MTU of LEU, is described below.

DOE Uranium Inventories as of December 31, 2012

The scope of this Plan covers DOE uranium currently held as excess in various forms and qualities, including HEU, LEU, NU, and high-assay DUF_6 (defined for purposes of this Plan as DUF_6 with an assay greater than 0.34% ^{235}U but less than 0.711% ^{235}U[5]) that have the potential to enter the commercial uranium market. (For purposes of this report, the term "uranium inventory" means that uranium currently held by DOE as excess and not dedicated to national security missions.) Table 1 summarizes the Department's uranium inventory as of December 31, 2012.

Table 1. Overview of Uranium Inventories Included in the 2013 Plan, as of December 31, 2012

Inventory	Enrichment Level	MTU	NU Equivalent Million lbs. U_3O_8	NU Equivalent MTU
Unallocated Uranium Derived from U.S. HEU Inventory	HEU/LEU	18.0	8.8	3,394†
Allocated Uranium Derived from U.S. HEU Inventory	HEU/LEU	11.4	5.4	2,077†
LEU	LEU	47.6	1.1	409
U.S.-Origin NU as UF_6	NU	5,234	13.6	5,234
Russian-Origin NU as UF_6	NU	7,705	20.0	7,705
Off-spec LEU as UF_6	LEU	1,106	4.9	1,876
Off-spec Non-UF_6	NU/LEU	221	1.6	600
DUF_6*	DU	114,000	65-90	25,000-35,000

† The NU equivalent shown for HEU is the equivalent NU within the LEU derived from this HEU, most of which will be retained by DOE in the timeframe under consideration herein. This table includes LEU down-blended from HEU and HEU that is to be down-blended or that is in the process of being down-blended.
* DUF_6 quantity is based on uranium inventories with assays greater than 0.34% ^{235}U but less than 0.711% ^{235}U. The amount of NU equivalent is subject to many variables, and a large range has been shown to reflect this uncertainty. DOE has additional DUF_6 inventory that is equal to or less than 0.34%^{235}U that is not reported in this Table.

Changes from 2008 Plan

Table 2 represents annual snapshots of the Department's uranium inventory, as published in the 2008 Plan (through Fiscal Year [FY] 2008), and at the end of CYs 2009, 2010, and 2011. The

[5] Additional DUF_6 inventory below 0.34%^{235}U that may be considered for entry into the commercial uranium market.

changes within each inventory class reflect updated information and evolving programmatic mission needs.

Table 2. Overview of Annual Uranium Inventory Levels (FY 2008, end CYs 2009-2011)

Inventory	Enrichment Level	2008 Plan MTU (FY 2008)	CY 2009 MTU	CY 2010 MTU	CY 2011 MTU
Unallocated Uranium Derived from U.S. HEU	HEU/LEU	67.6	44.0	34.3	20.4
Allocated Uranium Derived from U.S. HEU	HEU/LEU	47.7	22.0	18.0	13.4
LEU added in CY 2012*	LEU	0	0	0	0
U.S.-Origin NU as UF_6**	NU	5,156	5,137	5,137	5,195
Russian-Origin NU as UF_6	NU	12,440	12,238	11,317	9,715
Off-spec LEU as UF_6	LEU	NA	1,104	1,106	1,106
Off-spec Non-UF_6	DU/NU/LEU	4,461.0	3,133	2,099	221
DUF_6***	DU	75,300	123,000	123,000	123,000

*The LEU was added to DOE's inventory in CY 2012 as shown in Table 1.

** The volume of U.S.-origin NU as UF_6 has increased slightly since the 2008 Plan by taking into account additional uranium contained in certain cylinders received in exchange from USEC for DOE NU cylinders previously not listed in the 2008 Plan due to being rejected cylinders.

*** DUF_6 at 0.35% ^{235}U in 2008 Plan; subsequent volume of DUF_6 is at 0.34% ^{235}U. All DUF_6 is less than 0.711% ^{235}U. There is additional available DUF_6 inventory that is equal to or less than 0.34%^{235}U that is not reported in this Table.

Transactions that have taken place since the 2008 Plan include:

- Quarterly transfers of Russian-origin NU in exchange for accelerated cleanup services at the Portsmouth GDP site at Piketon, Ohio, covered by a November 10, 2009 Secretarial Determination, totaled 1,123 MTU through the end of CY 2010.

- Continued quarterly transfers of Russian-origin NU, covered by a March 2, 2011 Secretarial Determination to fund continued accelerated cleanup activities at Portsmouth, totaled 1,600 MTU during CY 2011. An additional 1,601 MTU of Russian-origin NU was transferred during CY 2012 for cleanup activities.

- NNSA continued the down-blending of allocated HEU to meet the Department's nonproliferation objectives. Specifically, NNSA down-blended all of the 17 MTU of HEU under the American Assured Fuel Supply (AFS) project; 6 MTU of the 12 MTU HEU under its mixed uranium and plutonium oxide (MOX) backup LEU project; and all of the off-specification (off-spec) HEU under the TVA Off-specification Fuel and H-Canyon EU Disposition programs. Since 2008 NNSA also increased the allocation of HEU to meet research reactor LEU requirements by nearly 17 MTU (this LEU, at 19.75% ^{235}U, is not considered part of the commercial market). The quantity of HEU that NNSA plans to down-blend also decreased due to a reduction in the amount of HEU coming from the Naval Reactors program for down-blending, and a decrease in the amount of off-spec HEU planned for processing through the H-Canyon at Savannah River.

- DOE entered into an agreement with ENW in May 2012 to transfer DUF_6 to ENW as part of a series of interrelated agreements also referred to as the Depleted Uranium (DU) Enrichment Project. The agreement provides that DOE will transfer 9,082 MTU of DUF_6 to ENW by April 30, 2013.

- DOE added 47.6 metric tons (MT) of LEU to its inventory in early 2012. This LEU resulted from DOE's March 13, 2012 procurement of approximately 299,000 SWU from USEC. DOE provided USEC with 409 MT of Russian-origin NU as feedstock for the enrichment, took title to, and eventual disposal responsibility for, a quantity of USEC's DU tails as payment for the SWU, and received the 47.6 MT of LEU in return. In March 2013, DOE transferred 299,000 SWU (the enrichment component of this LEU) to USEC and American Centrifuge Demonstration, LLC (ACD, a USEC subsidiary) as part of the government cost share in the 2012 Cooperative Agreement Between DOE, USEC, and ACD Concerning the American Centrifuge Cascade Demonstration Test Program. After a March 15, 2013 Secretarial Determination that the transfer of the SWU component of the LEU would not have an adverse material impact on the domestic uranium mining, conversion, or enrichment industry, DOE provided USEC with the LEU and received in return from USEC the value of the SWU component of the LEU, which was applied to the cooperative agreement, and approximately 409 MTU of the natural uranium equivalent to the feed component of the LEU.

The following events have also led to adjustments to the quantities of material in the Department's inventories that would require further processing, or that have been determined to be waste after evaluation:

- In the 2008 Plan, DOE reported approximately 4,461 MTU of off-spec material at the Portsmouth GDP site. EM determined that selling certain off-spec non-UF_6 uranium was not feasible and disposed of a significant amount of this material at the Nevada National Security Site during FY 2010. DOE also sold 1,183 MTU of depleted uranium tetrafluoride (DUF_4) for fluorine extraction. This material is still at DOE pending transfer to the commercial customer. The DUF_4 will not result in any uranium entering into the nuclear fuel cycle market. The DU product will be disposed of by the processor after commercial fluorine extraction. The remaining inventory is approximately 221 MTU, about 31 MTU of which has some potential commercial interest.

- In the 2008 Plan, DOE included cylinders of DUF_6 with an assay between 0.35% ^{235}U and 0.711% ^{235}U. Further review of the inventory revealed a significant amount of material slightly below the 0.35% ^{235}U assay, which could have potential economic value if commercially enriched. The Department has added this quantity to its reported DUF_6 inventory. The Department also has additional DUF_6 inventory below 0.34% ^{235}U, which may be considered for entry into the market. This decision would be based on several factors including, but not limited to, the impact on the uranium market and the economic viability of the DUF_6.

- DOE has approximately 1,106 MTU of off-spec LEU as UF_6 in storage, referenced in unspecified amounts in the 2008 Plan. DOE has since quantified the amount of this material, not previously considered to have marketable value, and included in the 2013 Plan for completeness and its potential for commercial use. Specifically, 929 MTU of the off-spec LEU is out of specification for ^{236}U, 3.5 MTU of the off-spec LEU was recovered from cleanup activities at the Portsmouth GDP, and the balance of the off-spec LEU includes various contaminants.

III. DETAILED DESCRIPTION OF URANIUM INVENTORIES

Uranium Originating from U.S. HEU

The allocated and unallocated inventories in this Plan include the inventories of LEU that have been derived from U.S. HEU inventories. In the 2008 Plan, 47.7 MTU of surplus U.S.-origin HEU was identified as allocated to specific disposition projects, and another 67.6 MTU of HEU was considered unallocated. As of December 31, 2012, DOE held 11.4 MTU of surplus HEU remaining in active disposition programs, and approximately 18.0 MTU of unallocated surplus HEU. The difference reflects both down-blending from the end of FY 2008 through December 31, 2012; allocation of 5 MTU of HEU to a follow-on to the MOX Backup LEU Inventory Program; and the reallocation of significant quantities of surplus HEU to activities that will not impact uranium markets (i.e., research reactor and naval reactor fuel supplies).

Table 3 summarizes the inventories as of the end of the FY 2008 Plan and through December 31, 2012. These inventories are explained more fully in Section IV.

U.S.-Origin NU as UF_6

As of December 31, 2012, DOE had an inventory of 5,234 MTU of U.S.-origin NU remaining from its former uranium enrichment activities. The volume of U.S.-origin NU as UF_6 has increased slightly since the 2008 Plan (5,137 MTU) due to an exchange of damaged NU cylinders with USEC during the return of the Portsmouth site. The DOE NU provided was previously evaluated as damaged cylinders and not listed as usable NU.

Russian-Origin NU as UF_6

In 1999, DOE and the Russian Federation entered into the "Agreement between the U.S. DOE and the Ministry of the Russian Federation for Atomic Energy Concerning the Transfer of Source Material to the Russian Federation," which obligated DOE to purchase approximately 11,000 MTU of NU as UF_6 from Russia. DOE purchased this uranium for $325 million, as directed by Public Law 105-277. This Russian-origin NU meets commercial nuclear fuel specifications. This material was added to DOE's existing inventory of approximately 1,079 MTU of Russian-origin NU acquired to facilitate the HEU Purchase Agreement with the Russian Federation and 361 MTU already in inventory. Through March 2011, 1,473 MTU of this material was transferred to USEC in exchange for services on accelerated cleanup work at the Portsmouth GDP. An additional, 1,250 MTU of NU was transferred to EM's cleanup contractor in exchange for services at the Portsmouth GDP site through December 31, 2011, with subsequent transfers (1,601 MTU) continuing through December 31, 2012. In March 2012, DOE procured 299,000 SWU from USEC and received 47.6 MT of U.S.-origin LEU by providing 409 MT of Russian-origin NU as feed.

Table 4 contains a summary of inventories of U.S.-and Russian-origin NU as UF_6.

Table 3. Allocated and Unallocated Uranium from HEU
(2008 Plan [end of FY 2008] and December 31, 2012 [end CY 2012])

Inventory	Enrichment Level	2008 Plan MTU	End CY 2011 MTU	End CY 2012 MTU	End CY 2012 Equivalent Million lbs. U_3O_8	End CY 2012 NU Equivalent MTU
Unallocated	HEU/LEU	67.6	20.4	18.0	8.8	3,394
Allocated to Specific Disposition Projects	HEU/LEU	47.7	13.4	11.4	5.4	2,077
Total		**115.3**	**33.8**	**29.4**	**14.2**	**5,471**

Note: The NU equivalent shown for HEU is the equivalent NU within the LEU derived from this HEU, most of which will be retained by DOE during the timeframe considered in this Plan. This table includes LEU down-blended from HEU and HEU that is to be down-blended or that is in the process of being down-blended.

Table 4. DOE Inventories of U.S. and Russian Origin Natural Uranium as UF_6
(2008 Plan [end of FY 2008] and December 31, 2012 [end CY 2012])

Inventory	Enrichment Level	2008 Plan MTU	End CY 2011 MTU	End CY 2012 MTU	End CY 2012 Equivalent Million lbs. U_3O_8	End CY 2012 NU Equivalent MTU
U.S. Origin	NU	5,156	5,195	5,234	13.6	5,234
Russian Origin	NU	12,440	9,715	7,705	20	7,705
Total NU		**17,596**	**14,910**	**12,939**	**33.6**	**12,939**

Off-spec Non-UF_6 Material and Off-spec UF_6

In the 2008 Plan, DOE reported approximately 4,461 MTU of off-spec material of various enrichments stored at the Portsmouth GDP site. A significant portion of this inventory (3,058 MTU) was dispositioned, 1,183 MTU was uranium tetrafluoride (UF_4) that was sold in October 2010 for recovery of fluorine, with a uranium oxide (UO_2) by-product to be disposed of as waste. Of the remaining 221 MTU of off-spec material, 31 MTU are currently being considered for commercial exchange or transfer on the international market (see Table 5, which summarizes off-spec uranium inventories).

DOE has identified approximately 1,106 MTU of off-spec LEU as UF_6 (1,876 MTU NU equivalent) in its inventory that were referenced in unspecified amounts in the 2008 Plan. This LEU is slightly enriched up to approximately 2% ^{235}U and may have value as feed and SWUs for further enrichment. Included in this amount is approximately 3.5 MTU NU equivalent of LEU that EM has recovered during ongoing cleanup activities at the Portsmouth GDP. The off-spec LEU also includes 929 MTU that contains ^{236}U above the specifications for commercial nuclear fuel. The remainder of the material having various level of contamination was not previously considered to have marketable value but are now included in the 2013 Plan to recognize potential commercial marketability and to provide for transparency.

Depleted Uranium as UF_6

Approximately 123,000 MTU of the Department's inventory of approximately 510,000 MT of DUF_6 at the end of CY 2011 is believed to have potential economic value for enrichment to NU levels or higher. This material is commonly referred to as high-assay tails. DOE has expanded the quantity of tails that could have potential economic value to include a large number of cylinders that contain inventories slightly below the 0.35% ^{235}U assay that are also potentially attractive for enrichment depending on tradeoffs between the market price of uranium and the cost of enrichment services. The 123,000 MTU at the end of CY 2011 includes uranium tails greater than 0.34% ^{235}U assay. As noted previously, the Department also has additional DUF_6 inventory below 0.34%^{235}U, which may be considered for entry into the market. This decision would be based on several factors including, but not limited to, the impact on the uranium market and the economic viability of the DUF_6. On May 15, 2012, DOE announced plans to transfer 9,082 MT of the higher-assay DUF_6 to ENW as part of a multi-party agreement that would produce U.S.-origin LEU that could be used for the production of tritium for national security purposes. In addition, the continued operation of the Paducah GDP to produce the LEU provided an extra year for the Department to plan for the eventual decommissioning and cleanup of the plant site. These transfers will reduce DUF_6 inventories to around 114,000 MTU after the transaction is completed.

Other non-technical and financial considerations (e.g., cylinder condition, potential contaminants in the DUF_6 from historical recycling that may make it unattractive for enrichment, and transportation issues) must be included as part of any initiative for enriching DUF_6. Approximately half of the high-assay DUF_6 is located at the Paducah site.

Table 6 contains a summary of DOE's DUF_6 inventories that are considered to have potential economic value.

Table 5. Off-specification Uranium
(2008 Plan [end of FY 2008] and December 31, 2012 [end CY 2012])

Inventory	Enrichment Level	2008 Plan MTU	End CY 2011 MTU	End CY 2012 MTU	End CY 2012 Equivalent Million lbs. U_3O_8	End CY 2012 NU Equivalent MTU
Off-spec Non-UF_6	DU/NU/LEU	4,461	221	221	1.6	600
Off-spec UF_6	LEU	Not specified	1,106	1,106	4.9	1,876

Table 6. DUF_6 Considered to Have Potential Economic Value
(2008 Plan [end of FY 2008] and December 31, 2012 [end CY 2012])

Inventory	Enrichment Level	2008 Plan MTU	End CY 2011 MTU	End CY 2012 MTU	End CY 2012 Equivalent Million lbs. U_3O_8	End CY 2012 NU Equivalent MTU
DUF_6†	DU	75,300*	123,000**	114,000**	65-90	25,000-35,000

† DOE did not describe the variables and assumptions used to arrive at the final NU equivalent for DUF_6 in the 2008 Plan. The amount of NU equivalent is subject to many variables, and a large range has been shown to reflect this uncertainty.

* Considers DUF_6 above .35% potentially recoverable.

**Considers DUF_6 above .34% potentially recoverable.

Low-enriched Uranium

In March, 2012, the Department entered into an agreement with USEC whereby it procured approximately 299,000 SWU from USEC and provided USEC with approximately 409 MTU of Russian-origin NU from the DOE inventory as feedstock. USEC exchanged the Russian-origin NU with U.S.-origin NU in its inventory, and the Department received the resultant 47.6 MTU of U.S.-origin LEU. After a March 15, 2013 Secretarial Determination that the transfer of the SWU component of the LEU would not have an adverse material impact on the domestic uranium mining, conversion, or enrichment industry, DOE transferred the SWU component of this LEU to USEC and American Centrifuge Demonstration, LLC (ACD, a USEC subsidiary) as part of the government cost share in the 2012 Cooperative Agreement Between DOE, USEC, and ACD Concerning the American Centrifuge Cascade Demonstration Test Program. DOE provided USEC with the LEU and received in return from USEC the value of the SWU component of the LEU, which was applied to the cooperative agreement, and approximately 409 MTU of the natural uranium equivalent to the feed component of the LEU.

IV. URANIUM MANAGEMENT AND DISPOSITION PLANS

Uranium Originating from U.S. HEU

Management Strategy: The NNSA strategy is to down-blend and dispose of its excess HEU inventories in a manner that meets DOE's nonproliferation objectives. The implementation of the strategy and the timing of planned sales take into account several key factors, including:

- The primary purpose of the down-blending activity,
- Availability of HEU to be down-blended, as well as nuclear weapons dismantlement schedules,
- Availability of HEU down-blending capacity, and
- Commercial nuclear fuel market conditions.

As of December 31, 2012, NNSA has an inventory of 11.4 MTU of surplus HEU allocated to existing disposition programs. NNSA expects to complete down-blending of this material by the end of 2015. Down-blending of the 18.0 MTU of unallocated HEU is expected to begin with one or more new disposition projects in 2015 and will occur gradually over about a decade, with the rate controlled by the rates of weapon dismantlement and other NNSA programs. While 18.0 MTU of HEU is the best current estimate for this material, the exact quantities may change as NNSA requirements for down-blended material change based on development of new projects (i.e., research reactors or other changes in plans) and as other material sources are identified. NNSA anticipates transferring up to 400 MTU of NU-equivalent LEU down-blended from HEU per year during CYs 2012 to 2018 to cover the cost of down-blending HEU to LEU. As part of these down-blending operations, DOE's commercial down-blending contractors will purchase approximately 500 MTU of NU from the U.S. market during this period for use as diluents.

Discussion: The 11.4 MTU of HEU planned for down-blending during CY 2013, CY 2014, and into CY 2015 will supply the remaining 6.4 MTU of the 12.1 MTU MOX Backup LEU Inventory and the 5.0 MTU of the MOX Backup LEU Inventory extension. The 11.4 MTU of HEU will produce approximately 224 MTU of LEU (containing the equivalent of 2,077 MTU of NU). Approximately 120 MTU of this LEU (containing the equivalent of 1,116 MTU of NU) will enter the market directly to pay for down-blending services. These transfers of LEU into the market are covered by the May 2012 Determination. The remaining LEU will be retained by DOE as part of the AFS and the MOX backup LEU inventory. A firm date for the potential entry of the DOE-owned AFS and MOX backup LEU material into the market has not been determined, and both are intended as backup or emergency supplies.

U.S. - Origin NU as UF_6

Management Strategy: The Department is continuing to evaluate its program needs regarding the potential uses of U.S.-origin NU. This U.S.-origin uranium is considered unobligated and unencumbered by peaceful use restrictions and therefore available to the Department for use in national security missions. The same uranium has value to other DOE missions as well.

Discussion: Under the 2008 Plan, DOE discussed the possible exchange of its U.S.-origin uranium with other-origin uranium supplied by TVA under the DOE-TVA Tritium Production Interagency Agreement. More recently, this material was considered for use to support additional accelerated cleanup activities at the Paducah and/or Portsmouth GDP sites after the Department's Russian-origin NU inventory is exhausted. This potential was analyzed as part of the analysis supporting the May 15, 2012 Secretarial Determination (Appendix A). The Secretarial Determination determined such an exchange would not adversely impact the domestic uranium mining, conversion, or enrichment industry. Although enrichment of depleted uranium tails under the DU Enrichment Project provides a near-term solution to support the tritium production requirements, it is not a sustainable solution. Accordingly, the Department will continue to analyze national security needs for the U.S.-origin uranium and evaluate its appropriate use and disposition in the future.

Russian - Origin NU as UF_6

Management Strategy: The May 2012 Determination anticipates the transfer of up to 2,400 MTU of NU per year, with no more than 600 MTU per quarter, in exchange for additional accelerated cleanup activities at the Paducah and/or Portsmouth GDP sites through 2021.

Discussion: After the issuance of the 2008 Plan, DOE transferred Russian-origin NU in exchange for accelerated cleanup activities at the Portsmouth GDP, including:

- 202 MTU as UF_6 in CY 2009,

- 921 MTU as UF_6 in CY 2010, and
- 1,600 MTU as UF_6 in CY 2011.

An additional 1601 MTU as UF_6 was transferred during CY 2012. Further decreasing the Russian-origin NU inventory, DOE procured SWU from USEC in March 2012, and received 47.6 metric tons of U.S.-origin LEU by providing 409 MT of Russian-origin NU as feed. At the end of CY 2012, 7,705 MTU remained in this inventory. The Department anticipates transfers of up to 2,400 MTU per year of NU (consistent with the May 2012 Determination) will come from this inventory. At the 2,400 MTU per year rate, the inventory of Russian-origin NU could be exhausted in about 4 years.

Off-spec Non-UF_6

Management Strategy: Of the 221 MTU of off-spec non-UF_6 material in DOE's inventory, approximately 31 MTU has potential commercial interest. DOE is currently evaluating options involving the potential transfer or exchange of this material, after extensive processing not currently available in the United States, in a manner that would exclude introduction of any uranium product into the domestic uranium fuel market.

Discussion: EM has the responsibility of completing site cleanup at the GDP sites and is continuing to identify disposition paths for uranium materials at these sites. It is anticipated that more such uranium might be identified and evaluated for disposal options.

Off-spec LEU as UF_6

Management Strategy: DOE has approximately 1,106 MTU of off-spec LEU with varying degrees of contaminants and enrichment levels. Specific pathways for commercial disposition will likely require processing (or other actions) to return the material to commercial specification or utility. DOE is evaluating technical options available to perform the processing and the potential to return the material to specification.

Discussion: EM has processed approximately 157 MTU of off-spec LEU as UF_6 to reduce ^{99}Tc. The 157 MTU requires processing or blending to reduce ^{236}U concentration in order to meet commercial fuel specifications. Other options for this material are still being considered. The remaining 949 MTU with various levels of contamination is expected to be more difficult to process and return to specification.

Depleted Uranium as UF_6

Management Strategy: DOE has no specific plans to transfer sell, or enter into contracts for further DUF_6 enrichment beyond the approximately 9,082 MTU transferred to ENW under the DU Enrichment Project announced on May 15, 2012. However, DOE continues to assess options for the sale, transfer, or enrichment of a portion of its high-assay DUF_6 inventory to NU or LEU should circumstances arise to make these options attractive. On February 6, 2013, DOE issued an Expression of Interest (EOI) to determine whether there is potential interest for the purchase, transfer or exchange of specified lots of DUF_6. After evaluating the responses to the EOI, DOE is beginning a Request for Offers process in July 2013, to help further assess its options. For the purposes of this Plan, DOE's remaining potentially marketable inventory of DUF_6 is 114,000 MTU.

Discussion: EM contractors have completed construction of and have begun operating the two DUF_6 conversion plants: Paducah, Kentucky, and Piketon, Ohio. Processing of the higher assay DUF_6 will occur at the end of the DUF_6 project cycle thereby allowing sufficient time to consider the potential sale or transfer of higher assay DUF_6 should it prove to be commercially viable.

V. SUMMARY OF URANIUM MANAGEMENT PLAN

The planned and potential sales and/or transfers of uranium into the commercial market identified in this Plan reflect current and reasonably foreseeable DOE mission needs and intentions. The Department will comply with all applicable laws, including Section 3112(d) of the USEC Privatization Act and Section 312(a) of the Consolidated Appropriations Act, 2012, in its management and disposition of its uranium inventories.

The transactions that have taken place between the issuance of the 2008 Plan and 2013 Plan and the representative projected annual quantity of NU equivalent that could enter the commercial market through CY 2018 based upon DOE planned or potential sales or transfers, as described or referenced in this Plan, are presented in Table 7. Table 8 shows the historic transactions and representative projected annual enrichment, or SWUs, contained in the associated LEU that could enter the market. Actual quantities made available during those years will depend on program approval and implementation, and thus may vary from year to year.

The Department continues to evaluate potential options for the disposition of its high-assay DUF_6 but has no specific plans to sell, transfer, or enrich this material during the period covered by this Plan. The Department will regularly revisit its analyses of market impacts and issue new Determinations every two years for transfers of uranium covered under Section 3112(d)(2)(B) of the USEC Privatization Act, if it seeks to continue the covered transfers.

Ongoing Departmental strategies, plans, and prospective actions in this Plan are not commitments or obligations to specific activities on the part of DOE beyond those that have already been contracted. DOE anticipates periodically updating the Plan, as necessary, to reflect new and evolving information, policies, and programs.

Table 7. Historic and Representative Future Transactions (CYs 2009-2018)

Natural Uranium Equivalent (metric tons)										
	2009	**2010**	**2011**	**2012**	**2013***	**2014***	**2015***	**2016***	**2017***	**2018***
HEU Down-blending for the American AFS, LEU Available to the Commercial Market	53	26	31	86	0	0	0	0	0	0
HEU Down-blending for the MOX Backup LEU Inventory, LEU Available to the Commercial Market	0	0	112	90	369	44	0	0	0	0
HEU Down-blending for the MOX Backup LEU Inventory Extension, LEU Available to the Commercial Market	0	0	0	0	0	341	132	0	0	0
HEU Down-blend to LEU for TVA Off-spec Transfers	81	117	151	0	0	0	0	0	0	0
Projected Down-blending of Currently Unallocated HEU, LEU available to the Commercial Market	0	0	0	0	0	0	262	378	378	373
U.S.-Origin NU**	0	0	0	0	0	0	0	1,589	2,327	1,318
Russian-Origin NU***	202	921	1,600	1,601	2,336	2,320	2,311	738	0	0
DUF_6	0	0	0	****	****	*****	*****	*****	*****	*****
Off-spec UF_6 and non-UF_6					*****	*****	*****	*****	*****	*****
Total	**336**	**1,064**	**1,894**	**1,777**	**2,705**	**2,705**	**2,705**	**2,705**	**2,705**	**1,691**

* Calendar years 2013-2018 are projections and do not represent commitments beyond those already contracted.

** This material may be considered for use to meet national security missions.

*** The 1,601 MTU in 2012 does not include 409 MTU of Russian-origin NU provided to USEC as feed material for DOE's purchase of SWU, which resulted in adding 47.6 MT of LEU to its inventory in 2012. No uranium was introduced into the market by DOE's transfer of NU as feed material; the NU provided to USEC equals the equivalent amount of NU contained in the LEU returned to DOE's inventory.

**** DOE transferred 9,082 MTU of DUF_6 to ENW as part of the DU Enrichment Project. In Tables 1 and 6, DOE provided a large range for the NU equivalent of its inventory of DUF_6, however, to avoid confusion, the NU equivalent is not estimated for the ENW transfer, given the many variables and uncertainties in converting DUF_6 to its NU equivalent and the stated plans for this material in accordance with the DU Enrichment Project.

*****DOE continues to evaluate options for DUF_6 and Off-spec material disposition within the context of this Plan. (See discussion "Off-spec Non-UF_6" under Section IV, Uranium Management and Disposition Plans.)

Table 8. Historic and Representative Future Enrichment Transactions Associated with Uranium Management Plan (CYs 2009-2018)

SWU (thousands)										
	2009	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Allocated HEU Down-blend (to commercial market)	287	205	325	292	494	427	154	0	0	0
Projected Down-blend of Currently Unallocated HEU (to commercial market)	0	0	0	0	0	0	290	419	419	413
LEU*				**(299)**	**299**					
Total	**287**	**205**	**325**	**(7)**	**793**	**427**	**444**	**419**	**419**	**413**

* The Department procured 47.6 MTU of LEU containing approximately 299,000 SWU from the market to its inventory in 2012. In 2013, DOE transferred the SWU component of this LEU to the market (USEC and American Centrifuge Demonstration, LLC.).

VI. REFERENCES

DOE, 2008, *Department of Energy Excess Uranium Inventory Management Plan*, Department of Energy, December 16, 2008.

Public Law 104-134 (42 U.S.C. 2297h), "USEC Privatization Act," April 26, 1996.

Public Law 105-277, "Omnibus Consolidated and Emergency Supplemental Appropriations Act, 1999," October 21, 1998.

Public Law 112-74, "Consolidated Appropriations Act, 2012," December 23, 2011.

VII. GLOSSARY OF TERMS

American Assured Fuel Supply Program (AFS) – The AFS Program is a nonproliferation initiative available to support countries that pursue peaceful civilian nuclear programs by providing a back-up source of fuel in the event of a supply disruption that threatens normal operations. In addition, the AFS will be available to address supply disruptions affecting domestic nuclear power plants.

Blending or down-blend – The term used in this report to describe the process whereby HEU is mixed with depleted, natural, or low-enriched uranium to create low-enriched uranium product with an assay less than 20% ^{235}U.

Conversion – The process of converting uranium oxide (U_3O_8) from uranium mines and processing facilities to uranium hexafluoride (UF_6), a feedstock for the uranium enrichment process.

Depleted uranium (DU) – Uranium having an assay less than natural uranium or 0.711% ^{235}U.

Deposit removal material – Uranium recovered during the process of gaseous-diffusion-plant cleanup activities.

Diluent – Natural, depleted, or low-enriched uranium used to blend with HEU to produce lower-assay enriched uranium.

Enriched uranium – Uranium having an assay greater than 0.711% ^{235}U. Commercial nuclear fuel uses uranium with enrichment assays that can be between 3.0% and 5.0% ^{235}U.

Fissile material – Any material fissionable by thermal (slow) neutrons. The three primary fissile materials are ^{233}U, ^{235}U, and plutonium-239 (^{239}Pu).

Gaseous diffusion – A uranium enrichment process whereby UF_6 as a gas is compressed through a series of membranes to increase the concentration of ^{235}U isotopes.

High-assay tails – Depleted uranium tails that have a higher assay than commercial enrichment plants are currently producing (between .25% and .3% ^{235}U assay), such as .35% or higher.

Highly enriched uranium (HEU) – HEU is uranium having an assay of 20% or greater of the ^{235}U isotope.

Kilogram of uranium (kgU) as UF_6 – Approximately equal to 2.6 pounds of U_3O_8.

Low-enriched uranium (LEU) – Uranium having an assay greater than 0.711% ^{235}U but less than 20%. Most nuclear reactor fuel contains uranium content with an assay that is less than 5% ^{235}U.

Metric ton of uranium (MTU) – 1,000 kilograms of uranium.

Natural uranium (NU) – Uranium having an assay of 0.711% ^{235}U. This is the ^{235}U content that begins the nuclear fuel cycle.

Natural uranium component – The uranium feed material provided to a uranium enricher to produce enriched uranium and uranium tails.

Off-spec (off-specification) uranium – Uranium that does not meet the specification for commercial material, as defined by the standards of the American Society for Testing and Materials.

Off-spec Agreement – DOE and TVA signed an Interagency Agreement for the Off-specification Fuel Project in April 2001.

Paducah Gaseous Diffusion Plant – Uranium enrichment plant owned by DOE and leased by USEC located in Paducah, Kentucky.

Portsmouth Gaseous Diffusion Plant – DOE owned uranium enrichment plant located in Piketon, Ohio. The plant ceased operation in 2001 and the site is undergoing cleanup.

Separative work unit (SWU) – A unit of measurement enrichment used in the process of changing levels of ^{235}U in uranium.

Tails – The DU waste stream produced as part of the processor enriching uranium.

Uranium – A radioactive, metallic element with the atomic number 92, which is one of the heaviest naturally-occurring elements. Uranium has at least 14 known isotopes, of which ^{238}U is the most abundant in nature. ^{235}U is commonly used as a fuel for nuclear fission.

Uranium hexafluoride (UF_6) – At room temperature, UF_6 is a solid form that can be heated into a gas to enrich the ^{235}U isotope to a higher concentration in a gaseous diffusion or gas-centrifuge enrichment plant.

USEC Privatization Act – Public Law 104-134 (42 U.S.C. 2297h), enacted April 26, 1996.

APPENDIX A

Secretarial Determination for the Sale or Transfer of Uranium, May 15, 2012

The Secretary of Energy
Washington, D.C. 20585

SECRETARIAL DETERMINATION
FOR THE SALE OR TRANSFER OF URANIUM

Having considered the current status of the domestic uranium mining, conversion, and enrichment industries, and the Department's analysis regarding the potential impacts of the transfers of:

1) up to 9,156 metric tons uranium (MTU) of depleted uranium to Energy Northwest in calendar years 2012 and 2013, which would be immediately followed by enrichment to low enriched uranium (LEU) equivalent to 482 MTU, with Energy Northwest utilizing a portion of the LEU for fueling the power reactor it operates and the remaining LEU sold as LEU or in its component parts as natural uranium and separative work units (SWU) to TVA as part of a commercial transaction supporting future power generation and tritium production from 2013 through 2030, thereby serving national security purposes;

2) up to 2,400 MTU per year of natural uranium to DOE contractors for cleanup services at the Paducah or Portsmouth GDPs, in quarterly transfers of up to 600 MTU for the period 2012 through 2021; and

3) up to 400 MTU natural-uranium equivalent per year contained in low-enriched uranium (LEU) transferred to NNSA contractors for down-blending highly-enriched uranium to LEU for the period 2012 through 2020,

I have determined that these Departmental sales or transfers will not have an adverse material impact on the domestic uranium mining, conversion, or enrichment industries. I have taken into account the sales of uranium under the Russian Highly-Enriched Uranium Agreement and the Suspension Agreement. This determination fulfills the requirement in section 3112(d)(2)(B) with respect to transfers of natural and enriched uranium.

Steven Chu

Steven Chu

MAY 15 2012

Date

Exhibit 9

Department of Energy
Washington, DC 20585

June 9, 2015

The Honorable Lisa Murkowski
Chairman
Committee on Energy and Natural Resources
United States Senate
Washington, DC 20510

Dear Madam Chairman:

On February 12, 2015, Secretary Ernest Moniz testified regarding the Department of Energy's budget request for Fiscal Year 2016.

Enclosed are answers to the questions that were submitted by Ranking Member Maria Cantwell, Senators John Barrasso, Steve Daines, Jeff Flake, Al Franken, Martin Heinrich, Mazie Hirono, Angus King, Mike Lee, Joe Manchin, Rob Portman, and you to complete the hearing record.

If we can be of further assistance, please have your staff contact our Congressional Hearing Coordinator, Fahiye Yusuf, at (202) 586-2764.

Sincerely,

Brad Crowell
Assistant Secretary
Congressional and Intergovernmental Affairs

Enclosures

cc: The Honorable Maria Cantwell, Ranking Member

QUESTIONS FROM SENATOR PORTMAN

Q1. Based on the Administration's budget submission, it is clear that you continue to support development and deployment of U.S. uranium enrichment technology, and specifically the American Centrifuge technology. Can you provide your views on the importance of maintaining this current domestic centrifuge capability and your perspective on the attributes necessary to justify further development and deployment of an American uranium enrichment technology?

A1. The Department is responsible for a number of national security missions that require a reliable supply of enriched uranium in varying assays and forms. This includes low-enriched uranium for commercial light water reactors involved in tritium production, and highly enriched uranium for naval propulsion. The Department needs an enrichment capacity using U.S.-origin technology because enrichment facilities using foreign technology, even if they are located in the U.S., produce uranium that carries peaceful use assurances that render the material unavailable to be used for such defense purposes. The Department has taken interim measures to maintain the current centrifuge capability at the American Centrifuge Plant in Piketon, Ohio in warm standby while the detailed analysis requested by the Congress is performed.

Q2. Can you explain how this technology can help meet national security needs, support U.S. energy security, and maintain help maintain U.S. leadership in nonproliferation.

A2. An enrichment capability based on U.S. technology would meet national security missions that require unobligated low-enriched uranium for commercial light water reactors involved in tritium production, and eventually highly enriched uranium for naval propulsion. Development of an enrichment capability based on U.S. technology and its associated knowledge base and supply chain would allow the U.S. to better detect, deter, and assess potential proliferation of new uranium enrichment programs around the world and to maintain global leadership in the effort to minimize the spread of enrichment technology.

Q3. Can you confirm it is your understanding that the United States will need additional enriched uranium in the future and that American domestic enrichment technology is required for future U.S. national security purposes?

A3. Yes, the U.S. will need an enrichment capability based on U.S. technology to provide enriched uranium for several national security purposes including unobligated low-enriched uranium for commercial light water reactors involved in tritium production, and eventually highly enriched uranium for naval propulsion.

Q4. What is the status of DOE's report on tritum requirements? Is it still on track to be completed in April and Will you provide my office a copy of the report once completed?

A4. The Department is required to produce a report that includes an accounting of the current and future availability of low-enriched uranium, highly-enriched uranium, and tritium to meet defense needs as well as a cost-benefit analysis of uranium enrichment technology options available to supply enriched uranium for defense purposes, including a preliminary cost and schedule estimate to build a national security train. The Department intends to complete the reports in the requested time frame and will provide a copy to your office.

Q5. Besides preserving the American Centrifuge Project, what other opportunities for improving the front-end of the fuel cycle are being pursued and funded in the FY2016 budget request?

A5. In FY 2016, the Office of Nuclear Energy (NE) will continue to support long-term, "game-changing" R&D activities as part of the Fuel Cycle R&D Program. Specifically, NE supports technology development to enable recovery of uranium from seawater. The main objective is to explore alternative uranium resources as extracted from seawater, which essentially holds unlimited supply of uranium. Success of the project will ultimately set a potential price cap of the uranium resource and minimize its price volatility. In addition to uranium from seawater in the Fuel Cycle R&D program, the Department has included front-end nuclear fuel cycle technologies in the definition of advanced nuclear facilities in the recent solicitation for $12.6 billion in loan guarantees available for advanced nuclear energy projects. Of the $12.6 billion, $2 billion is available exclusively for front-end projects. This could include uranium conversion or enrichment, as well as nuclear fuel fabrication.

Q6. What is your estimate of the future costs to complete the clean-up of the cold-war legacy at all DOE sites, and what is your error band on the cost and schedule to complete the job?

A6. The Department has been pleased to provide your staff members with this information. We will continue to keep you informed of any new developments on this issue.

Q7. What factors contribute to cost and schedule uncertainty, and what can Congress do to decrease this uncertainty?

A7. The Department has been pleased to discuss this issue with your staff members. We will continue to keep you informed of any new developments on this issue.

Q8. During his 2008 Presidential campaign, candidate Barack Obama committed to working: "with Congress to provide adequate funding to commence decontamination and decommissioning activities of those facilities [at DOE's Portsmouth Gaseous Diffusion Plant] which are no longer needed, and to maximize the employment of site workers to achieve this end"

In 2009, Secretary Chu made a high-profile announcement that DOE would accelerate work at the site and complete the clean-up by 2024. Last summer, DOE unexpectedly announced that a funding gap of $110 million dollars would force lay-offs of up to 700 workers before Christmas. Subsequently, Congress augmented project funding to stabilize and continue the clean-up through the end of this fiscal year.

The President's FY 2016 budget request for the Portsmouth cleanup is nearly $49 million below the FY 2015 appropriation; will you confirm the Administration's commitment to complete the clean-up of the Portsmouth GDP site by 2024?

A8. The goal of 2024 is not achievable. The Department's schedule range for completing cleanup of the site is 2044-2052 reflecting 50 percent and 80 percent confidence levels, respectively.

Q9. Will this budget request without augmentation facilitate completing the clean-up of the Portsmouth GDP site by 2024?

A9. The goal of completing cleanup of the site by 2024 is not achievable. The Department's schedule range for completing cleanup of the site is 2044-2052 reflecting 50 percent and 80 percent confidence levels, respectively.

Q10. Given the enormity of the remaining Environmental Management task and the cost being passed on to future generations, I am struck by the fact that the President's budget request for the environmental management program is $42 million below that enacted by the Congress for FY 2015. This is particularly troubling, given that DOE - as an agency - is requesting $2,500 million more that it received in FY2015.

And, EM's budget request is $151 million less than last year at the former government gaseous diffusions plants being deactivated and decommissioned in Oak Ridge, TN, Paducah, KY, and Portsmouth, OH. Despite many years of effort and much that has been remediated, a huge amount of work remains undone at each of those sites.

At the Oak Ridge East Tennessee Technology Park they are just beginning the demolition of the enormous K-27 and K-31 buildings, they have yet to begin D&D of half century old facilities at Y-12, much work remains to be done to finally resolve U233 disposition at ORNL's building 3019, and construction of the sludge processing facility will begin when technology maturation and design is completed. Yet the clean-up budget request is 15.2% less than FY 15.

At Paducah, KY, the government recently re-assumed responsibility for all the facilities formerly leased, operated and maintained by the former-USEC Corporation and EM is beginning preparations for site remediation. But despite the expanded government role and responsibility, the clean-up budget request is 14% less than FY15.

And at Portsmouth, in addition to continuing the on-going D&D work, design and construction of an on-site landfill must be funded. It appears obvious that under the proposed budget, work scope must be reduced if the 17.6% decrease is enacted.

Deactivation of the former government uranium enrichment plants began in Oak Ridge in 1987, in Portsmouth a decade ago, and just recently in Paducah. An opportunity to complete the D&D of one site at a time has been missed. Instead, the government finds itself responsible for all the overhead of the three combined sites and unable to divest itself of these fixed costs in the near term.

In September of 2013, I requested the plan for waste disposal and building demolition at the Portsmouth GDP that we had been told was completed in 2012. We were subsequently told that the plan would be finalized in September, 2014. We have not yet seen the plan.

Environmental clean-up and restoration work is critically important to Southern Ohio, and merits your attention to ensure financial stability, fulfill the federal obligation to the community, and sustain productivity at the Portsmouth GDP site.

Will you commit to providing me with a comprehensive management plan for completing D&D at the Portsmouth site by 2024?

A10. The goal of completing cleanup of the site by 2024 is not achievable. The Department's schedule range for completing cleanup of the site is 2044-2052 reflecting 50 percent and 80 percent confidence levels, respectively.

Q11. Will you commit to providing this Committee with an integrated plan for completing D&D at all three DOE GDP sites?

A11. Although the three sites are similar, they are also unique in many ways. Funding is not shared among the sites and cleanup is performed under separate regulatory requirements. For these reasons, an integrated technical plan for D&D completion at the three sites does not make operational or financial sense. Integrated financial information for the three gaseous diffusion plants is provided in DOE's Tri-Annual D&D Fund Report and through the annual budget request process. The Department will continue to integrate lessons learned among the sites, particularly as work at the Oak Ridge site is completed, followed by the Portsmouth site, and the Paducah site, respectively.

Q12. As you know the costs of cleaning-up the site of the former Portsmouth Gaseous Diffusion Plant in Ohio's Pike County have been significant and the bartering of uranium from the DOE stockpile has been critical to keep that project alive. DOE's uranium barter program enables us to ensure that there's adequate funding for demolition and waste disposal, which will save the taxpayers money over time. We also, I think, need to be clear that this directly offsets an equal amount of tax payer funds that would otherwise be used. I want to clarify in the record that the barter agreement, which I support, is critical to our clean-up efforts in Pike, Ohio at the Portsmouth Gaseous Diffusion Plant.

Do you intend to continue the uranium barter program to subsidize the Portsmouth GDP clean-up funding, understanding that the stockpiles are limited?

A12. Yes.

Q13. How much uranium is left in the stockpile?

A13. The Department has been pleased to provide your staff members with this information.

We will continue to keep you informed of any new developments on this issue.

Q14. The Ohio delegation has previously requested that DOE open an office in Piketon charged with managing the site clean-up effort. Management is currently done from the Portsmouth – Paducah Project Office (PPPO) in Lexington, Kentucky Office, which is located mid-way between the Kentucky and Ohio facilities. Much has changed since the PPPO was opened in January 2004. The majority of the DOE site was returned from USEC management to DOE control, the DUF6 plant was built and began operations, and DOE has taken over management of the Gas Centrifuge Project & Facilities. Achieving the management goal of accelerating the site cleanup at Portsmouth, eliminating potential environmental threats, reducing life-cycle costs, and facilitating re-industrialization requires close oversight of the contractors and frequent and routine interactions with the community.

Will DOE strengthen its presence in the community and at the Portsmouth site by opening a Piketon Office?

A14. The Department does not plan to open a Piketon Office. DOE has a well-staffed office located on the Portsmouth site.

Q15. The DOE-recognized Community Reuse Organization, SODI (Southern Ohio Diversification Initiative) has an existing agreement with DOE to reuse or recycle assets from the Portsmouth site. As a result, DOE has received millions of dollars from the proceeds and has awarded $600,000 in grants for economic development projects. In 2009 DOE included Community Investment Provisions in the PORTS D&D Request for Proposals (RFP) and the resulting contract.

Will Community Investment Provisions equivalent to those in the 2009 PORTS D&D RFP, be included in future RFPs and contracts for Infrastructure & Site Services, DUF6 Operations, and extensions for the D&D contract at Portsmouth? Please explain your response.

A15. The Department has been pleased to provide your staff members with this information.

We will continue to keep you informed of any new developments on this issue.

Q16. Will the selection criteria for future contracts credit the use of local contractors and venders, and preference for local businesses? Please explain your response.

A16. Current and future procurements use selection criteria consistent with the Federal Acquisition Regulations. It is important that the selection criteria limiting competition to local contractors and vendors or preference for local businesses not violate the Competition in Contracting Act of 1984 that requires full and open competition for prime contract awards.

Q17. Will DOE include award fee incentives for contractor execution of Re-industrialization and Asset Recovery programs in future Requests for Proposals, contract awards and contract extensions at PORTS? Please explain your response.

A17. It is DOE's intent to continue to work with its community reuse organizations, including SODI, in the future as cleanup work makes more assets available. DOE's expectations regarding recycling/reuse of DOE assets under its contracts are put in procurement requests with language that evolves over time. Any future procurement request will include language developed by DOE, consistent with DOE policy and the federal and

Department of Energy Acquisition Regulation for all procurements at the time and as appropriate for the services being provided under the contract. DOE procurements are routinely sent out in draft for comment and we will welcome any community input at that time.

Q18. Will a portion of the proceeds from reuse and recycle of Portsmouth assets be reinvested in SODI to continue the Re-industrialization and Asset Recovery Program? Please explain your response.

A18. Yes, it is DOE's intent to continue to work with its community reuse organizations, including SODI, as cleanup work makes more assets available. Per the existing DOE/SODI Asset Transition Agreement, DOE provides excess property to SODI that is eligible for transfer and economically viable to recycle or reuse. A portion of the proceeds from the sale of the property is retained by SODI for community reinvestment. To date, DOE has transferred property to SODI with a value of approximately $4.5 million, with SODI retaining approximately $2.2 million.

Q19. Southern Ohio and Pike County in particular, represents a low-income population that leads the State of Ohio in unemployment, and that carries the federal Appalachian Regional Commission designation of "distressed county." In 2008, DOE's Office of Environmental Management organized the Portsmouth Site Specific Advisory Board (SSAB). The SSAB has made a number of recommendations regarding employment continuity, regional purchasing, community support, and education outreach. With only 14% of Pike County residents pursuing higher degrees, mostly due to financial concerns, education investments related to, or as part of the on-going work at the Portsmouth site could, for example, provide a stimulus for future economic development.

How have the recommendations made by the Portsmouth SSAB been incorporated into DOE's planning and work scope?

A19. Recommendations from the Portsmouth SSAB have been routinely helpful in DOE's decision making at the site. Perhaps the most significant example is reflected in the SSAB and DOE lengthy and detailed discussions on the waste management Remedial

Investigation and Feasibility Study (RI/FS) that is expected to result in a Record of Decision later this year. SSAB comments provided input that was used to augment the final language that was developed by the site.

In addition, in January 2009, the Portsmouth SSAB passed Recommendation 09-01, which requested community investment provisions in the Portsmouth D&D contract. The Board specifically outlined employment continuity, a regional purchasing program, community support and educational outreach. Since 2011, DOE prime contractors have procured more than $250 million in local goods and services and distributed more than $3 million to local economic development projects and charitable organizations. Site contractors have also awarded more than 50 scholarships to local high school students and more than 100 internships to assist local college students.

DOE also has an educational outreach program, including the Science Alliance – a three-day, interactive science fair in Piketon, Ohio that brings about 1,200 students and educators on-site for STEM-related demonstrations. In 2013, DOE also established a regional Science Bowl at Portsmouth, which is part of the nationwide academic competition, with the winning team traveling to Washington DC. The SSAB participated in both the Science Alliance and Science Bowl. In addition, DOE partners with Ohio University on a program that has local high school students summarize the site's Annual Site Environmental Report (ASER). Site representatives routinely visit local high schools for various presentations related to site history, current activities and potential careers.

Exhibit 10