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Stichting Laka: Documentatie- en onderzoekscentrum kernenergie

De Laka-bibliotheek

Dit is een pdf van één van de publicaties in de bibliotheek van Stichting Laka, het in Amsterdam gevestigde documentatie- en onderzoekscentrum kernenergie.

Laka heeft een bibliotheek met ongeveer 8000 boeken (waarvan een gedeelte dus ook als pdf), duizenden kranten- en tijdschriften-artikelen, honderden tijdschriftentitels, posters, video's en ander beeldmateriaal. Laka digitaliseert (oude) tijdschriften en boeken uit de internationale antikernenergie-beweging.

De [catalogus](#) van de Laka-bibliotheek staat op onze site. De collectie bevat een grote verzameling gedigitaliseerde [tijdschriften](#) uit de Nederlandse antikernenergie-beweging en een verzameling [video's](#).

Laka speelt met oa. haar informatie-voorziening een belangrijke rol in de Nederlandse anti-kernenergiebeweging.

The Laka-library

This is a PDF from one of the publications from the library of the Laka Foundation; the Amsterdam-based documentation and research centre on nuclear energy.

The Laka library consists of about 8,000 books (of which a part is available as PDF), thousands of newspaper clippings, hundreds of magazines, posters, video's and other material. Laka digitizes books and magazines from the international movement against nuclear power.

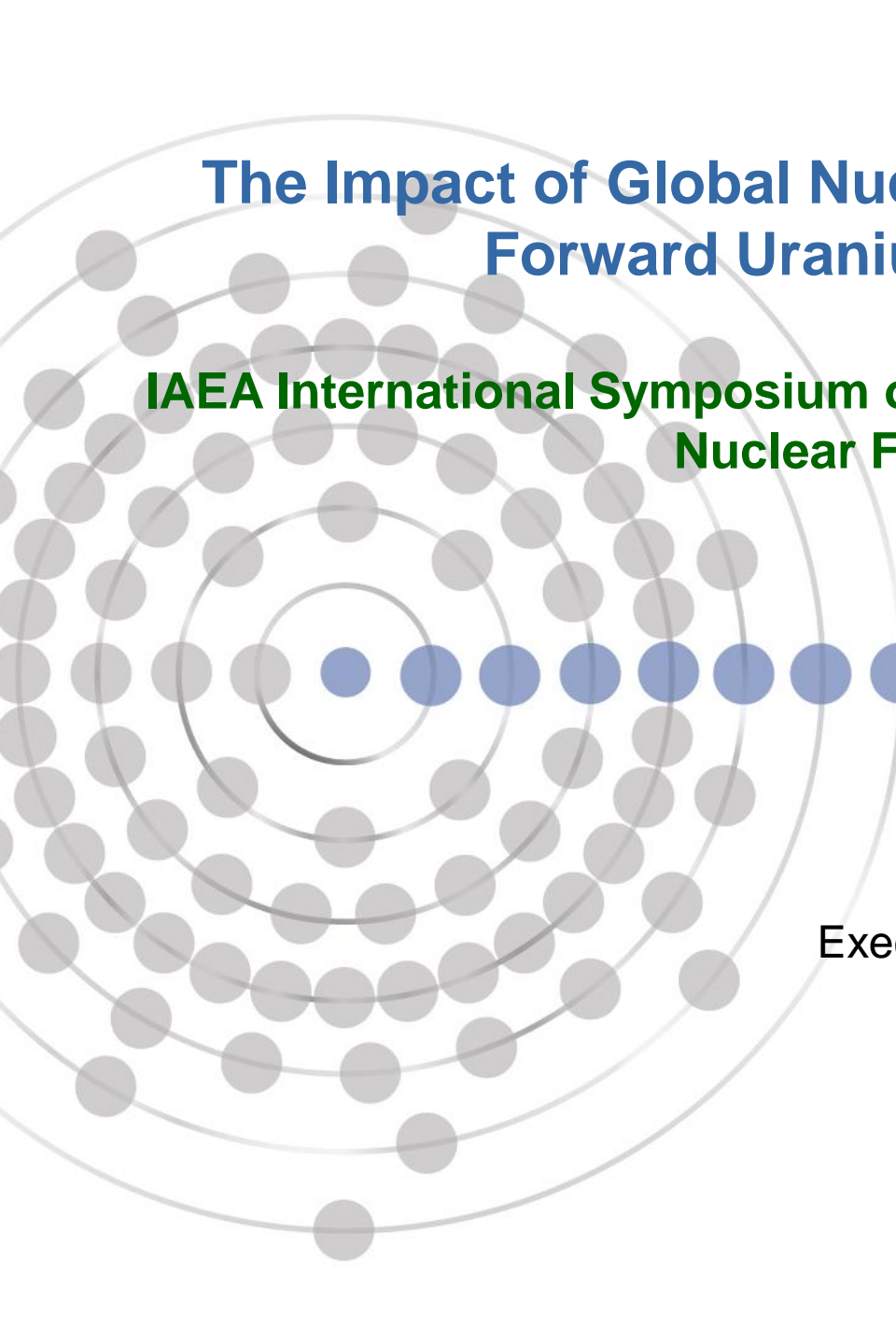
The [catalogue](#) of the Laka-library can be found at our website. The collection also contains a large number of digitized [magazines](#) from the Dutch anti-nuclear power movement and a [video-section](#).

Laka plays with, amongst others things, its information services, an important role in the Dutch anti-nuclear movement.

Appreciate our work? Feel free to make a small [donation](#). Thank you.



www.laka.org | info@laka.org | Ketelhuisplein 43, 1054 RD Amsterdam | 020-6168294



The Impact of Global Nuclear Fuel Inventories on Forward Uranium Production

IAEA International Symposium on Uranium Raw Material for the Nuclear Fuel Cycle

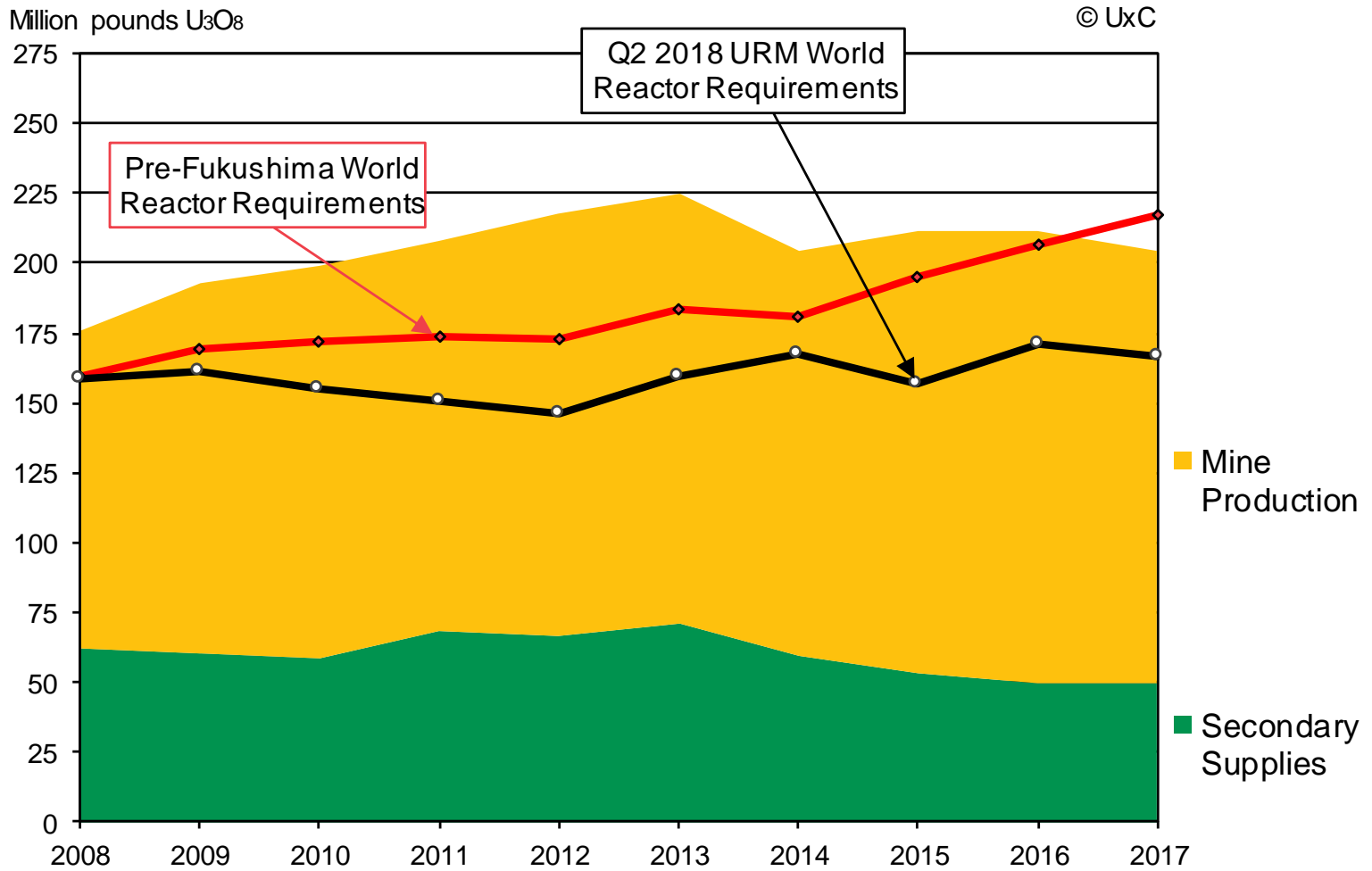


Nicolas Carter
Executive Vice President, Uranium

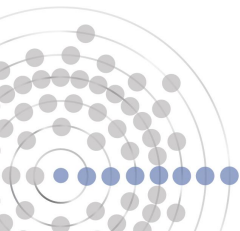
June 25, 2018
The Ux Consulting Company, LLC
www.uxc.com



Uranium Supply vs. Reactor Requirements 2008-2017



Source: *Uranium Market Outlook, Q2 2018*





Global Nuclear Fuel Inventory Holders

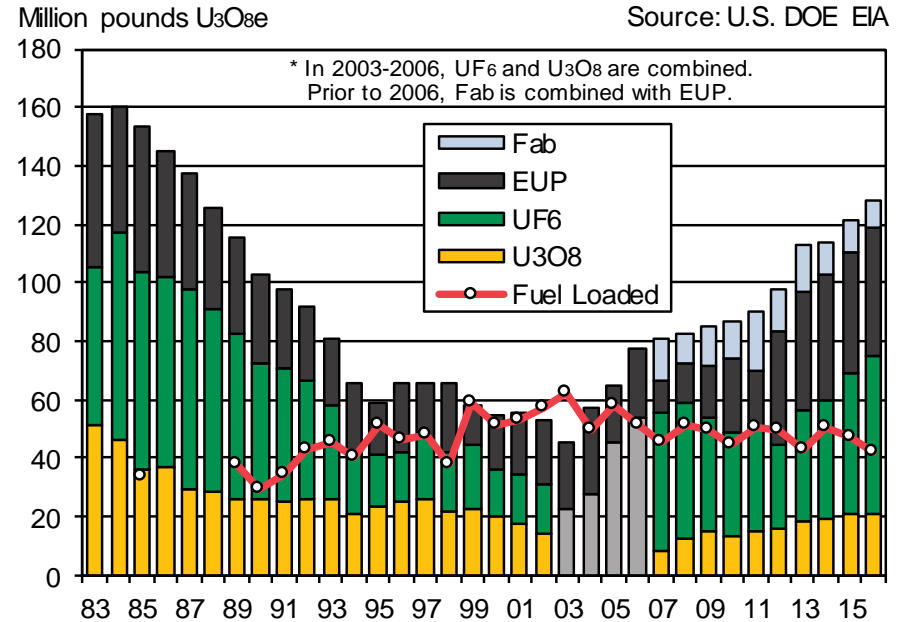
- ▶ **End-user nuclear power utilities and their relevant fuel procurement/management subsidiaries**
- ▶ **Suppliers throughout the fuel supply chain – uranium producers, converters, enrichers, fabricators, and even reprocessors and mixed-oxide (MOX) fuel fabricators**
- ▶ **Traders, investors, and financial institutions, as well as other non-end users**
- ▶ **Governments that have been historically involved in the production of nuclear fuel for both civilian and military applications**





U.S. Utility Inventory Holdings

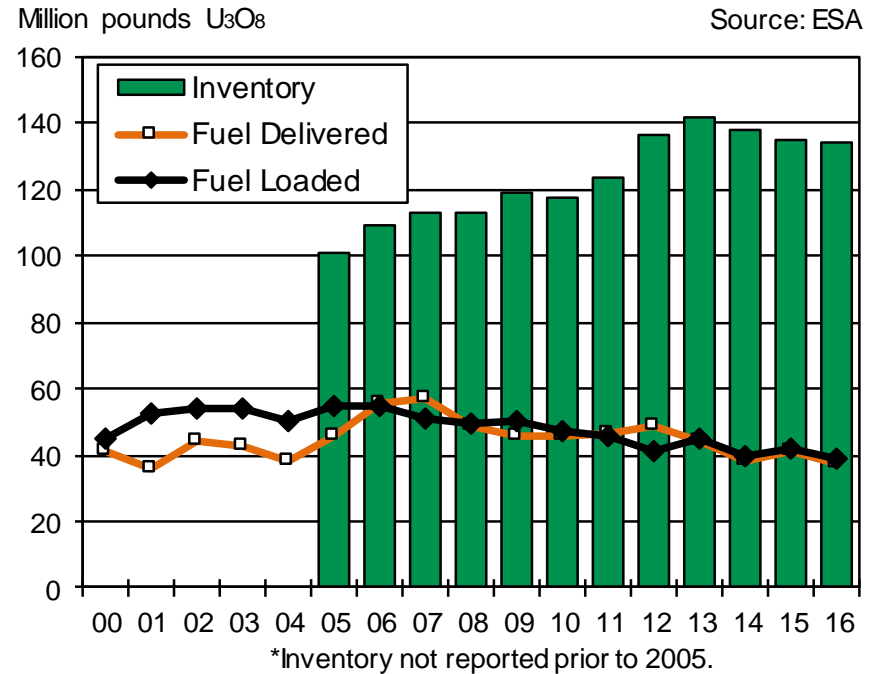
- ▶ Although far from its peak in the mid-1980s, U.S. utility inventories have increased dramatically since 2011 to 128.6 million pounds U_3O_8 (49,461 tU) at the end of 2016
- ▶ U.S. utility forward inventory coverage is 34 months
- ▶ Notable shift in form (i.e., less U_3O_8 , more UF_6 & EUP)
- ▶ U.S. utilities have been the most active in terms of “buy and hold” and “carry-trades”





EU Utility Inventory Holdings

- ▶ **European utilities have also added inventory since 2011; although holdings peaked in 2013 and have decreased since**
- ▶ **Total inventories now stand at ~134 million pounds U_3O_8 (51,538 tU)**
- ▶ **Forward inventory coverage equals almost 42 months**
- ▶ **Early reactor retirements have added to inventory levels, but some has been worked off over past couple of years**





Japanese Inventory Holdings

- ▶ Japanese utilities' total value of fuel assets at ~\$14.6 billion
- ▶ UxC estimates (at very conservative cost assumptions) current inventory holdings are ~126 million pounds U_3O_8e (48,462 tU) in various forms
- ▶ The largest inventory holders are TEPCO & Kansai, followed by Kyushu, Chubu, and Chugoku
- ▶ Given delays in reactor restarts and shutdowns, most utilities have sufficient inventories to last through at least 2030 (or even longer)
- ▶ Some of the inventories have already been quietly finding their way into the market

Japanese Utility Inventories in 2017		
Form	Quantity	Unit
U_3O_8 equivalent	125.6	million pounds
U_3O_8	18.8	million pounds
UF_6	16.8	million kgU
EUP/Fabricated	2,608	MTU
SWU	17.9	million

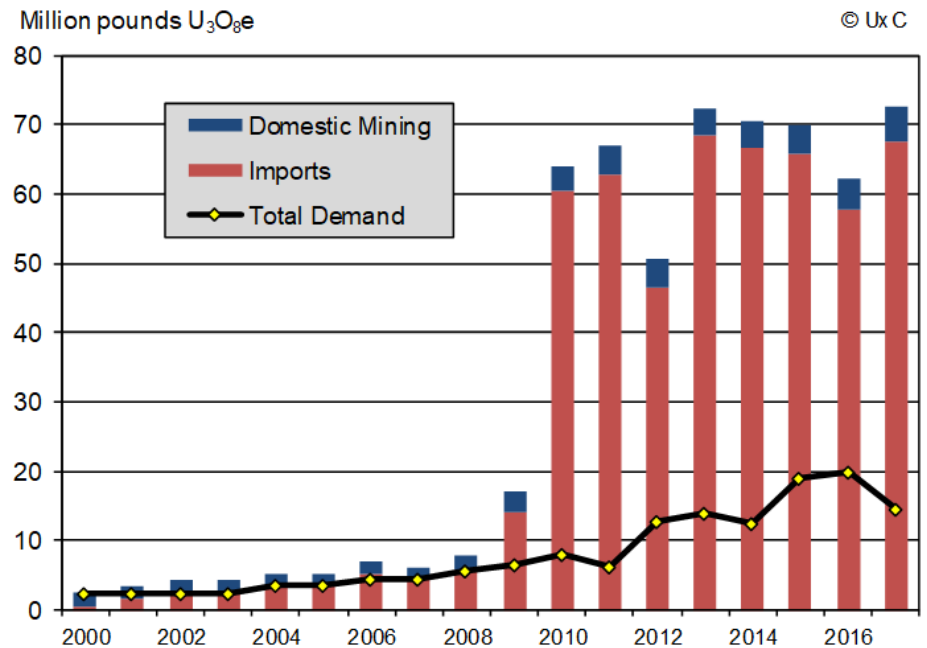




Chinese Inventory Holdings

- ▶ China's government policy promotes stockpiling of uranium
- ▶ 2010-today has been an intensive period of inventory growth, averaging ~45 million pounds U_3O_8e /year
 - Focus towards self-sufficiency; decreased presence in the spot market
- ▶ UxC estimates China's utility inventory to be ~447 million pounds U_3O_8e (~331 million pounds in U_3O_8 form)
- ▶ A large portion (~50%) should be considered a "national strategic stockpile" and not excess

China Uranium Supply/Demand Balance, 2000-2017



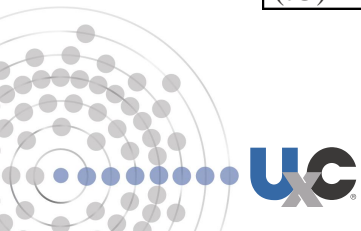


Utility Inventories - 2017

Inventory Holder	Uranium equivalent (million lbs U ₃ O ₈ e / tU)	U ₃ O ₈ (million lbs / tU)
U.S. Utilities	128.6 / 48,692	20.8 / 8,000
EU Utilities	133.9 / 51,500	20.1 / 7,730
Japanese Utilities	125.6 / 48,307	18.8 / 7,231
Chinese Utilities	447.2 / 172,000	331.2 / 127,385
Other Utilities	111.1 / 42,730	40.8 / 15,692
Global Utility Total	946.4 / 364,000	431.7 / 166,038

Assuming 9 months forward coverage for pipeline material, plus an average of 19 months for strategic stocks of U₃O₈ ...

Estimate for Global Desired Utility Uranium Inventories						
Form	Current Annual Requirements	Pipeline Inventory	Strategic Inventory	Desired Inventory	Current Totals	Estimated Excess
Uranium equivalent (million lbs U ₃ O ₈)	172	129	272	401	722	321
Uranium equivalent (tU)	66,154	49,615	104,615	154,231	277,692	123,642





Supplier & Financial Inventories

- ▶ In addition to working stock, uranium producers now hold larger inventories due to reduced sales and overproduction
- ▶ Traders facilitate the flow of supply, and in some cases with offtake agreements, end up holding inventories
 - UxC estimates traders hold ~33 million pounds U_3O_8 e (12,692 tU)
- ▶ Two large banks hold significant quantities of uranium, as does Uranium Participation Corp.
- ▶ Renewed interest in uranium sector by investor community

Supplier & Financial Inventories in 2017		
Form	Quantity	Unit
U_3O_8 equivalent	230.8	million pounds
	88,769	tU
U_3O_8	135.9	million pounds
UF_6	27.4	million kgU
EUP	1,902	MTU





Enricher Uranium “Production”

- ▶ Nexus between uranium and enrichment has become very important in current market conditions
- ▶ Rise of enrichers as uranium and conversion “producers” through underfeeding and tails re-enrichment as excess capacities have increased due to drop in SWU demand
- ▶ Increased underfeeding / tails re-enrichment by URENCO and Russia
 - **URENCO**: “SWU for U” uses 15-20% of installed capacity; contributes ~8-9 million pounds U_3O_8 /year
 - **Russia**: Large excess capacity; UxC estimates ~10-12 million pounds U_3O_8 /year to be “produced” by Russia’s enrichment complex
 - Angarsk enrichment plant devoted solely to tails re-enrichment
 - **Orano**: ~1.3 million pounds U_3O_8 /year underfeeding currently
- ▶ **Overall, enricher uranium “production” is estimated at 20-22 million pounds U_3O_8 equivalent (8,462 tU) per year**





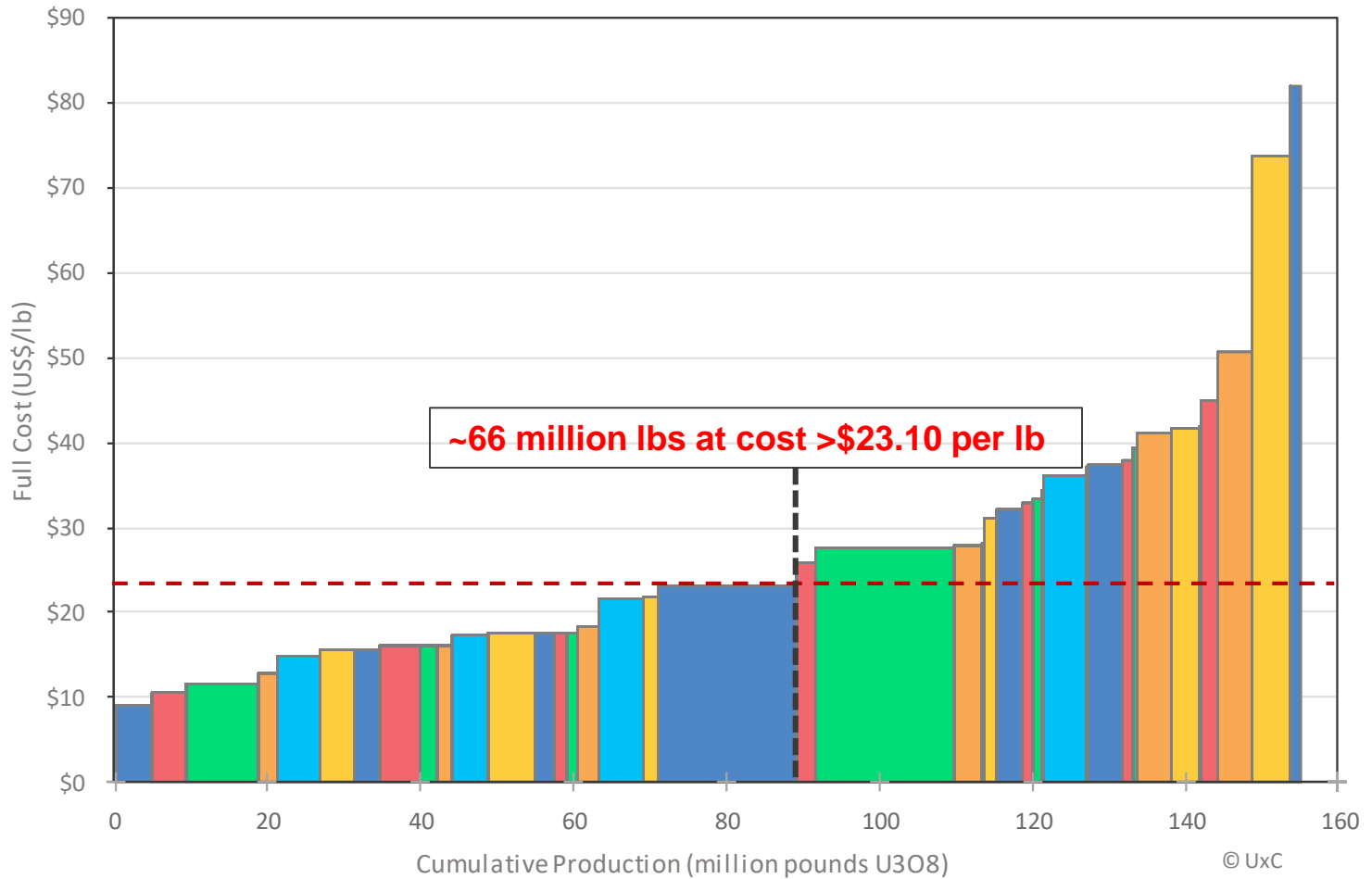
Government Inventories

- ▶ **Government Inventories total ~609 million pounds U_3O_8e (234,192 tU)**
- ▶ **U.S. Government holds ~241 million pounds U_3O_8e (92,769 tU)**
 - Majority is for DOE's proposed tails re-enrichment program, which could yield ~208 million pounds U_3O_8e (80,000 tU)
 - Remaining natural UF_6 for barter totals ~11 million pounds U_3O_8e (4,231 tU)
- ▶ **Russian Government holds ~368 million pounds U_3O_8e (141,538 tU)**
 - However, most of this material must undergo some time of processing to be utilized
 - Depleted uranium accounts for ~180 million pounds U_3O_8e (69,231 tU), but these have low tails assays
 - Slightly irradiated uranium (SIU) totals 115 million pounds U_3O_8e (44,231 tU), but requires additional processing





2017 Global Production Cost Curve



Source: *Uranium Production Cost Study*, September 2017





2017 & 2018 Production Response

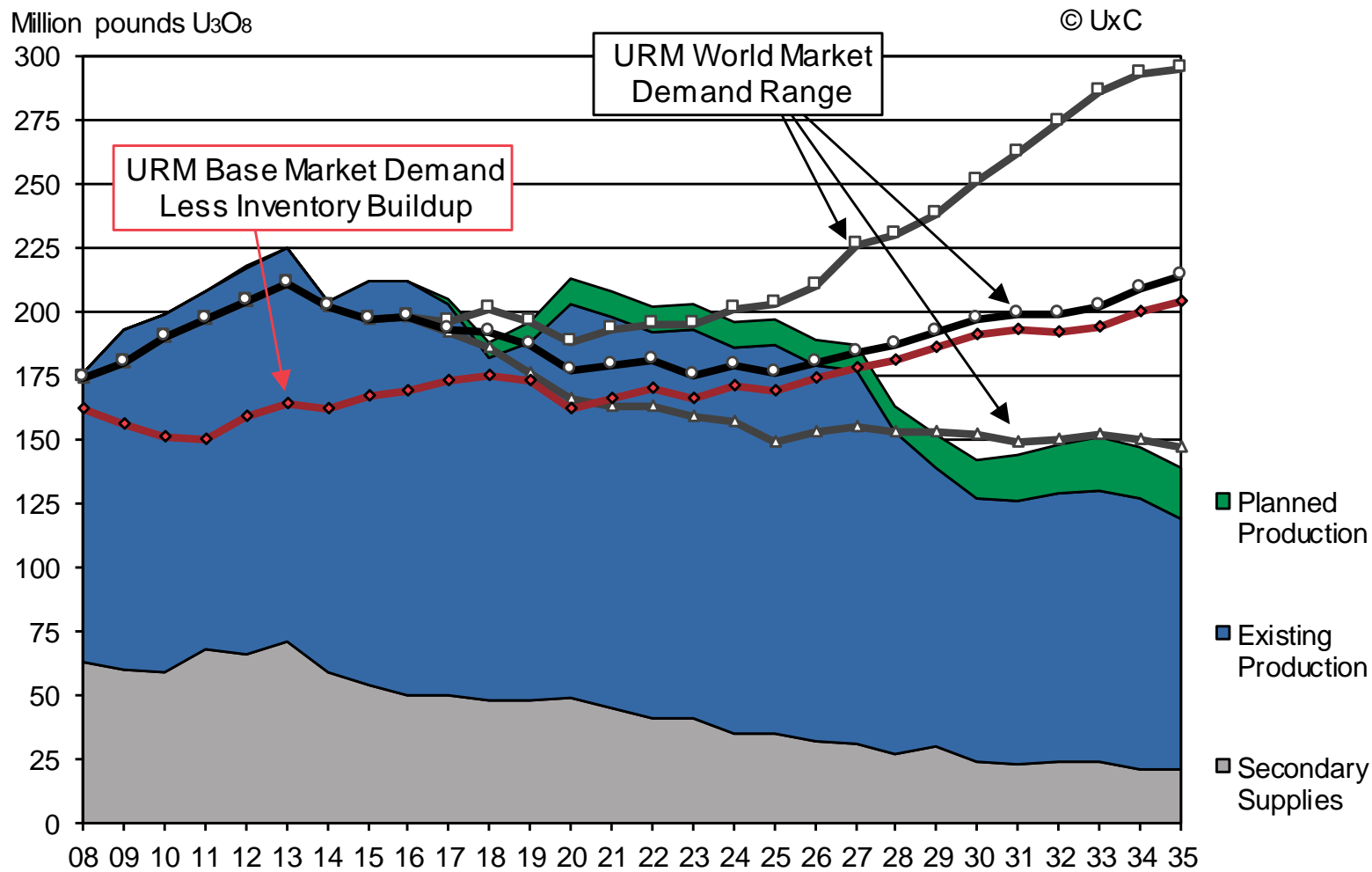
- ▶ **January 2017** – Kazatomprom announces 10% cut to planned 2017 Kazakh production
- ▶ **October 2017** – AREVA to cut 2018 production at SOMAIR in Niger by 1.1 million pounds (423 tU)
- ▶ **November 2017** – Cameco elects to suspend production at McArthur River/Key Lake for 10 months starting end of January 2018 – reduction of ~16 million pounds (6,154 tU)
- ▶ **December 2017** – Kazatomprom announces further reductions to planned Kazakh production by 20% under Subsoil Use Contracts of Company Enterprises for 2018 through 2020
- ▶ **May 2018** – Paladin Energy places Langer Heinrich project in Namibia on care & maintenance
- ▶ **June 2018** – Kazakh Energy Minister states Kazakhstan will further lower 2018 production target to 56.2 million pounds U_3O_8 (21,600 tU)
- ▶ **Global uranium production declined to 155 million pounds (59,615 tU) in 2017 from 162 million pounds (62,308 tU) in 2016**
 - For 2018, global production is expected to trend significantly lower to ~139 million pounds (53,462 tU)





Major World Supply Sources

2008-2035 – Mid Production Case



Source: *Uranium Market Outlook*, Q2 2018





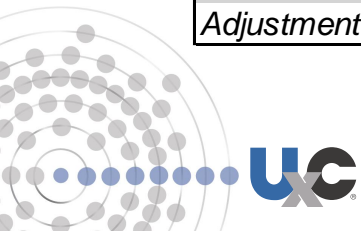
Impact on Forward Uranium Production

► Near and Medium-Term Outlook

- Secondary supplies will meet up to one-quarter of uranium demand over the next several years
- Significant inventory overhang in 2018-2027 will require existing production be no greater than 135-145 million pounds per annum
- Inventory overhang could stretch out without further production cuts or if more reactors are retired early

**Further Adjustments Needed to Production in Response to Excess Inventories
2018-2030**

	(Million lbs U ₃ O ₈)												
	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Real Demand for Production	144	140	128	134	141	134	145	141	148	153	160	162	174
Planned Mid Production Case	139	148	164	163	162	162	161	162	157	157	136	123	118
Planned Low Production Case	132	133	150	153	151	149	148	148	143	142	122	116	108
<i>Adjustment to Production Plans - Mid Case</i>	5	-8	-35	-29	-21	-28	-17	-21	-9	-3	24	39	56
<i>Adjustment to Production Plans - Low Case</i>	12	7	-22	-19	-11	-15	-3	-7	6	11	38	47	66



Thank You!



Questions?