

# Industry Note

Equity Research

June 15, 2021

Metals &amp; Minerals

## Uranium Weekly: Leaking Fuel Rods Not Unusual

The Ux Consulting (UxC) weekly spot price indicator, published earlier this week, rose to US\$32.25/lb (up \$0.20/lb), or +0.6% versus the previous week. Year-to-date, the spot price is up 7.3%.

According to a report from CNN on Monday, the U.S. government has spent the past week assessing a report of a leak at a Chinese nuclear power plant after a French company, that part owns and helps operate the plant, warned of an "imminent radiological threat". U.S. officials have deemed the situation does not currently pose a severe safety threat to workers at the plant or the Chinese public. We understand that the radiological threat is most likely a fairly common nuclear plant event caused by one or more fuel bundles leaking fission products into the core cooling water.

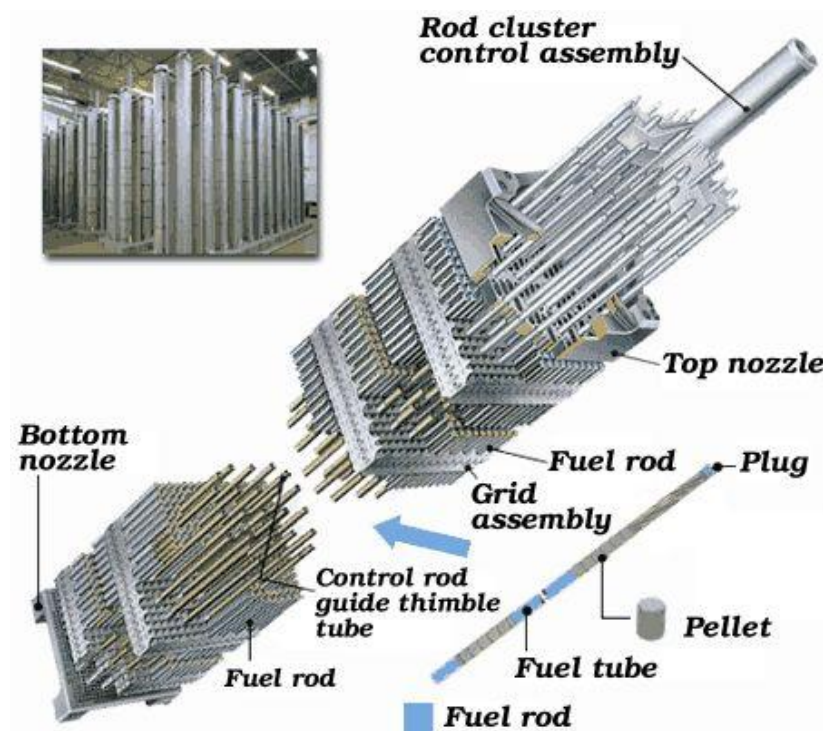
The operation where the event occurred is the Taishan Nuclear Power Plant in Guangdong province. The plant features two operational EPR (European Pressurized Reactors) reactors. The first unit, Taishan 1, entered commercial service in December 2018. The second unit, Taishan 2, entered commercial service in September 2019.

CNN reported on Tuesday that the French utility company, EDF, indicated in a statement that it has been informed of an increased concentration of "noble gases in the primary circuit" of reactor number 1 of the Taishan nuclear power plant. EDF said "the presence of certain noble gases in the primary circuit is a known phenomenon, studied and provided for in the reactor operating procedures". On Monday, a spokesperson for EDF said the increased levels of radiation were caused by a "degradation of the housing of the fuel rods." The spokesperson affirmed that the levels of radioactivity observed at the plant were below the threshold stipulated by the Chinese authorities, adding the affected housings are the first of three containment barriers between the rods and the atmosphere.

The Taishan plant would use ceramic fuel pellets that are stacked in metal fuel rods that in turn are grouped into fuel bundles (Exhibit 1). When the ceramic pellets are undergoing fission they swell and crack and release xenon, a noble gas. The gas is retained within the fuel rod during the time it spends in the reactor and later in storage. It is not atypical for fuel rods to crack and leak noble gases, although in the U.S., a lot of effort has been spent to mitigate this issue - which we understand is largely a maintenance issue as opposed to a safety issue. Cracking of the fuel rods can occur due to a number of events including mishandling, debris in the coolant circuit, or insufficient baffling between the fuel rods.

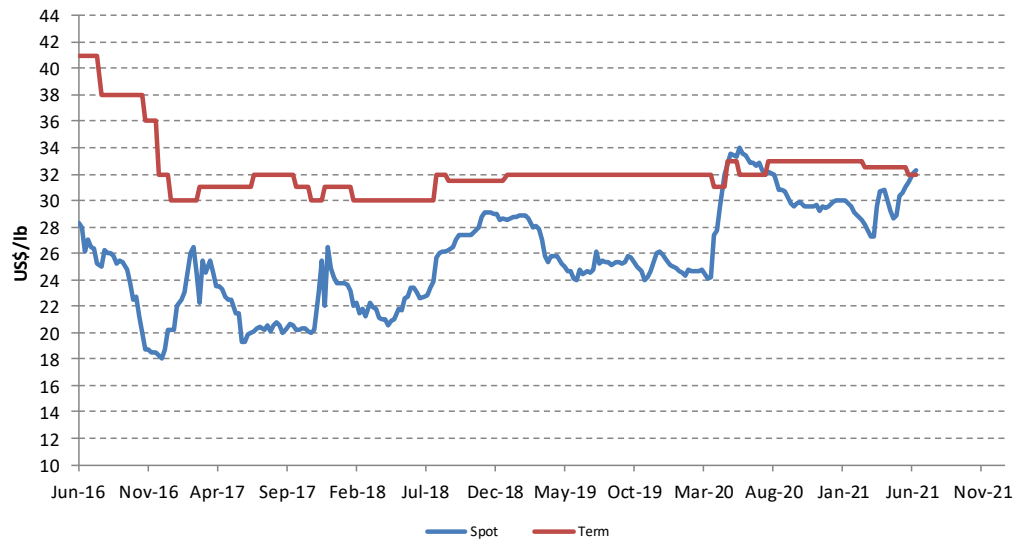
**Greg Barnes****Craig Hutchison, P. Eng****Derick Ma, CFA, CPA, CA**

**Exhibit 1. Schematic View of a Fuel Bundle Assembly**



Source: Mitsubishi Nuclear Fuel; World Nuclear Association

**Exhibit 2. Spot and Term Uranium Prices (US\$/lb)**



Source: UxC; TD Securities estimates

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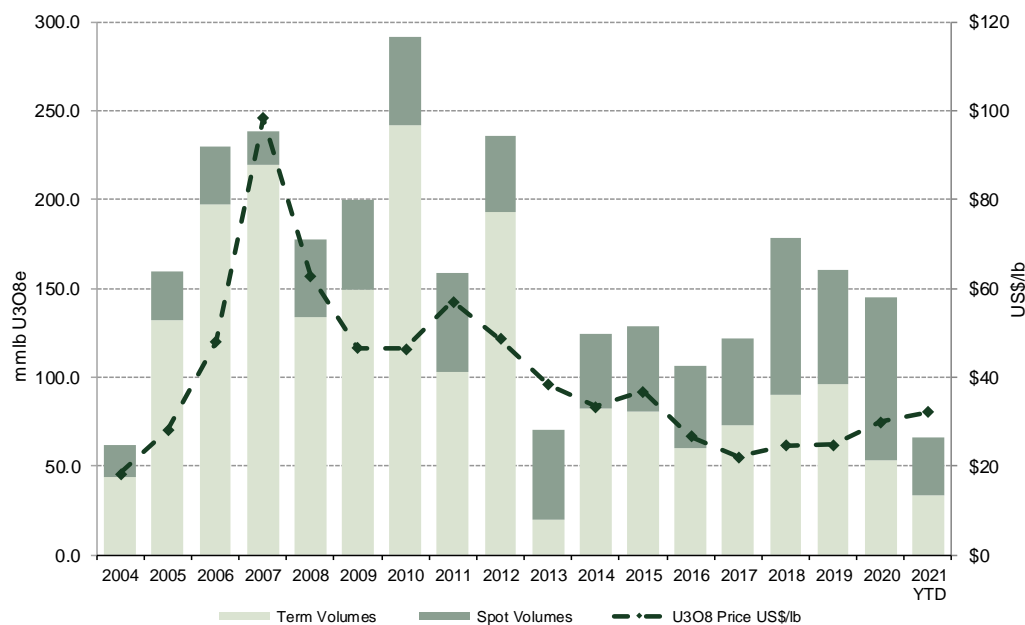
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## Exhibit 3. Uranium company equity offerings and uranium purchases

Company	Date Equity Offering and/or Uranium Purchase Announced	Equity Offering (US\$ millions)	Uranium Purchased or Planned to Purchase (million pounds)	Estimated Average Price of Uranium Purchases (Planned or Actual) (US\$/lb)
Yellow Cake	25-Feb-21	140.0	3.90	28.78
Denison Mines	15-Mar-21	86.3	2.50	29.61
Uranium Energy	17-Mar-21	30.5	1.40	29.00
Boss Energy	29-Mar-21	46.0	1.25	30.15
Uranium Energy	6-Apr-21	12.0	0.71	31.70
Uranium Participation Corp. <sup>1</sup>	3-May-21	66.4	1.78	30.50
Yellow Cake	11-May-21	n/a	0.34	29.15
Western Uranium & Vanadium	2-Jun-21	n/a	0.13	31.50
<b>Total/Average</b>		<b>381.2</b>	<b>12.00</b>	<b>29.59</b>

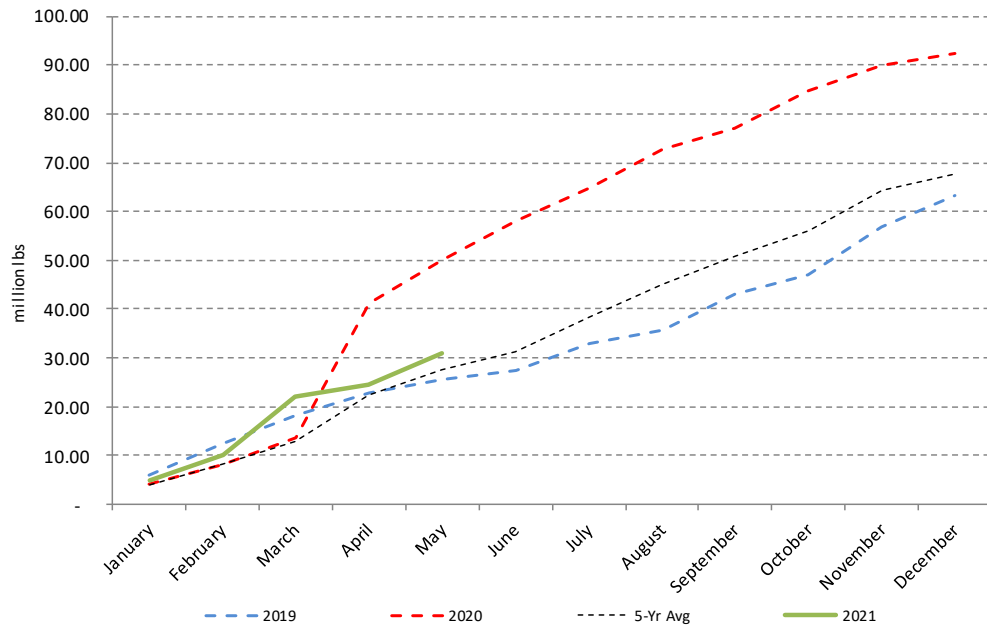
Source: Company reports; TD Securities estimates

## Exhibit 4. Spot and Term Volumes



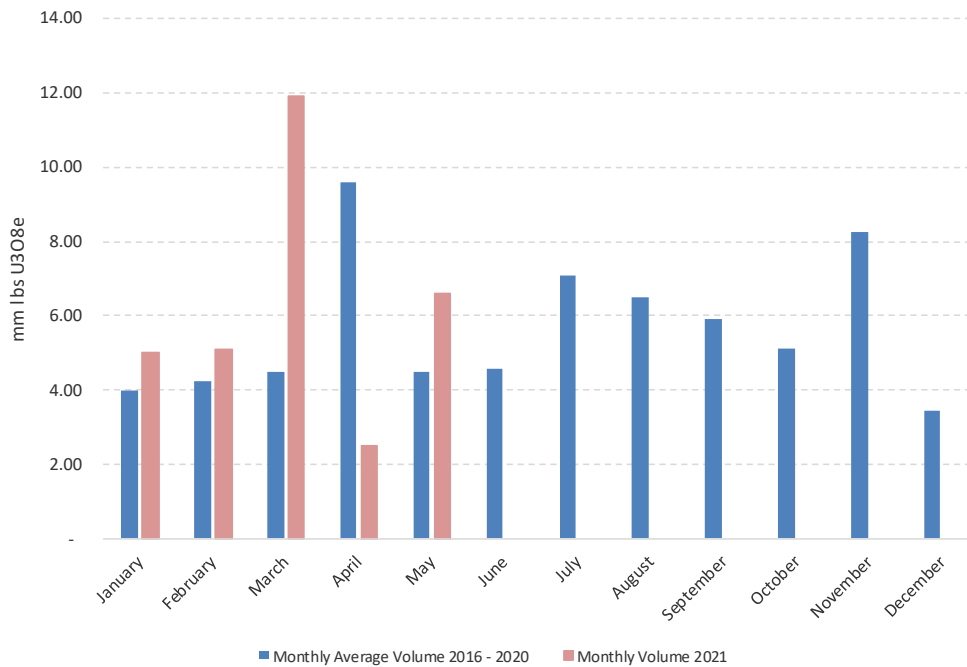
Source: UxC; TD Securities estimates

**Exhibit 5. Historical vs. 2021 Cumulative Monthly Spot Volumes**



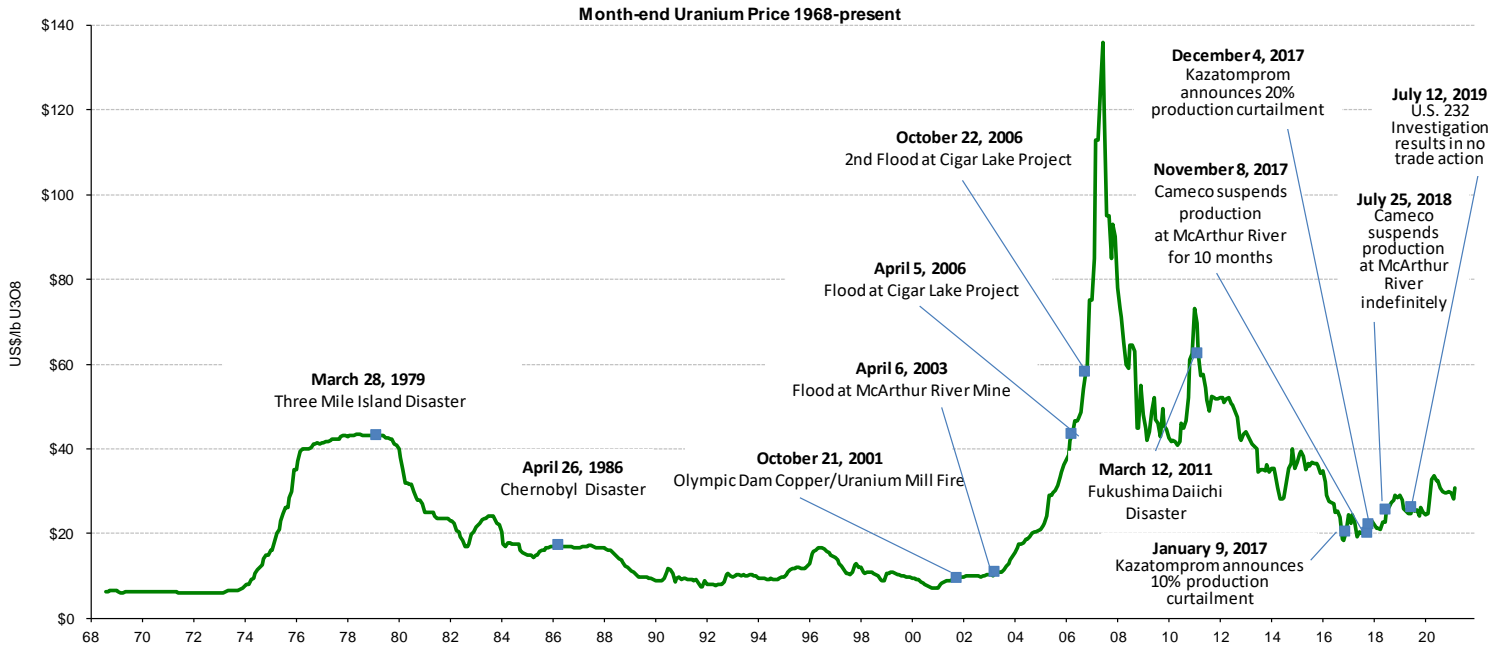
Source: UxC; TD Securities estimates

**Exhibit 6. Monthly Average Spot Volumes**



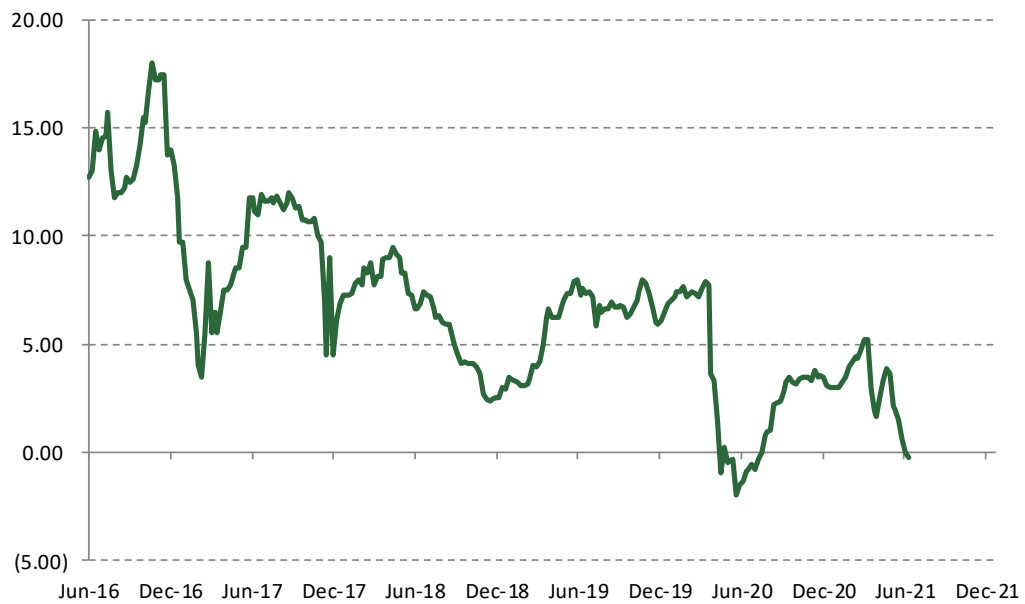
Source: UxC; TD Securities estimates

## Exhibit 7. Historical Spot Price and Market Impacting Events (US\$/lb)



Source: UxC, Companies, TD Securities Inc.

## Exhibit 8. Uranium Term Price Premium to Spot (US\$/lb)



Source: UxC; TD Securities estimates

**Exhibit 9. Uranium Prices – Spot, 3yr Fwd and 5yr Fwd**



Source: UxC

**Exhibit 10. Fund Implied Price (FIP) and Spot Price**



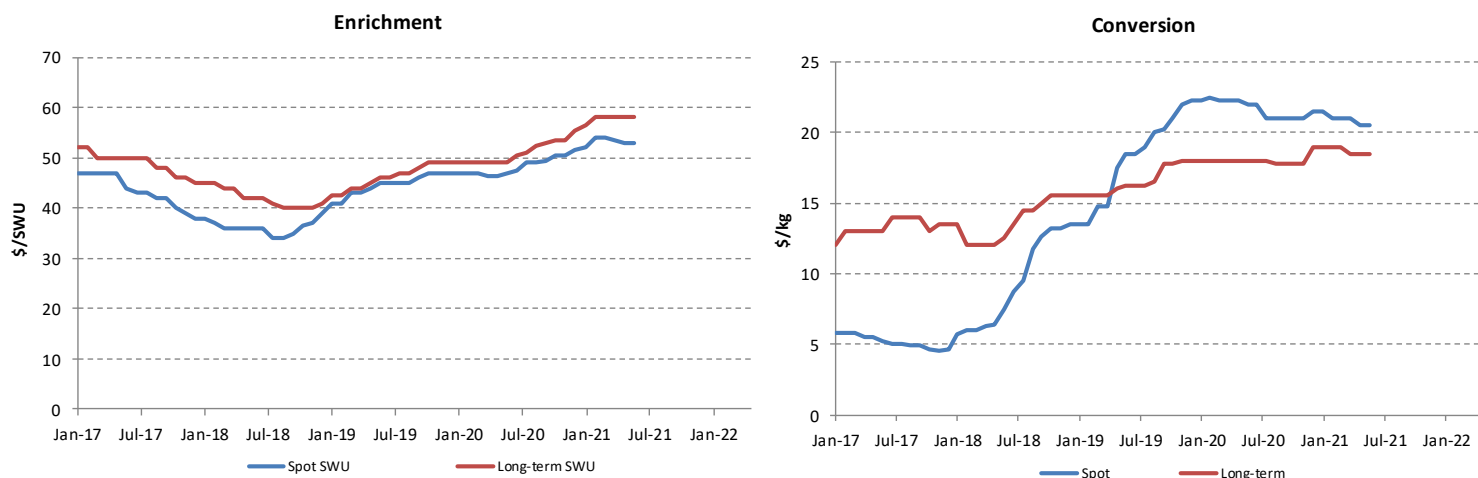
Source: UxC; TD Securities estimates

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## Exhibit 11. Monthly SWU and Conversion Pricing



Source: UxC; TD Securities estimates

## Exhibit 12. TD Securities Uranium Supply/Demand Model

	2017	2018	2019	2020	2021E	2022E	2023E	2024E	2025E
<b>Mine Supply - Western World (Mlb U3O8)</b>									
Total Mine Supply - Western World	100	83	85	81	73	80	85	88	86
Net Eastern Mine Supply (lbs U3O8)	54	54	55	44	52	53	60	66	72
<b>Total World Mine Supply (Mlb U3O8)</b>	<b>154</b>	<b>138</b>	<b>140</b>	<b>125</b>	<b>126</b>	<b>132</b>	<b>145</b>	<b>154</b>	<b>158</b>
YoY % change	-7.6%	-10.2%	1.7%	-10.9%	0.7%	5.3%	9.1%	6.8%	2.6%
<b>Secondary Supply</b>									
Global underfeeding and tails re-enrichment*	19	18	18	16	16	15	15	14	14
Mixed Oxide Fuel (MOX)*	5	5	6	6	6	6	6	7	8
US government sales (DOE Proposed)*	3	2	2	1	0	0	0	0	0
Additional Russian secondary supply*	0	0	0	0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0
<b>Total Secondary Supply (Mlb)</b>	<b>27</b>	<b>24</b>	<b>26</b>	<b>24</b>	<b>22</b>	<b>21</b>	<b>21</b>	<b>21</b>	<b>21</b>
Secondary supply as % of global reactor demand	16%	14%	15%	13%	12%	12%	12%	11%	11%
<b>Mobilization of Commercial Inventory</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>	<b>7</b>
<b>Total Supply</b>	<b>187</b>	<b>169</b>	<b>173</b>	<b>156</b>	<b>155</b>	<b>161</b>	<b>173</b>	<b>183</b>	<b>187</b>
<b>Total World Demand</b>									
Total World Nuclear Generating Capacity (MWe) *	358,819	368,571	372,978	374,420	384,508	385,211	389,242	394,906	398,885
Uranium requirements per MWe	472	472	472	472	472	472	472	472	472
Uranium demand (mmlb)	169	174	176	177	181	182	184	186	188
First Core Requirement (2 year lead)	-	-	-	-	-	-	-	-	-
<b>Total World Demand (Mlb U3O8)</b>	<b>169</b>	<b>174</b>	<b>176</b>	<b>177</b>	<b>181</b>	<b>182</b>	<b>184</b>	<b>186</b>	<b>188</b>
YoY % change	1.7%	2.7%	1.2%	0.4%	2.7%	0.2%	1.0%	1.5%	1.0%
<b>Supply / Demand Balance (Mlb)</b>	<b>18</b>	<b>-5</b>	<b>-3</b>	<b>-21</b>	<b>-27</b>	<b>-21</b>	<b>-11</b>	<b>-4</b>	<b>-2</b>
<b>Spot Uranium Price (US\$/lb U3O8)</b>	<b>\$22.12</b>	<b>\$24.82</b>	<b>\$25.94</b>	<b>\$29.52</b>	<b>\$32.99</b>	<b>\$36.00</b>	<b>\$38.00</b>	<b>\$40.00</b>	<b>\$45.00</b>

\* Source: World Nuclear Association - Nuclear Fuel Report 2019-2040 Reference Case

Note - TD LT price assumption starts in 2025; a flat US\$45/lb price is assumed for 2025 and beyond.

Source: UxC, Bloomberg, World Nuclear Association, TD Securities Inc.

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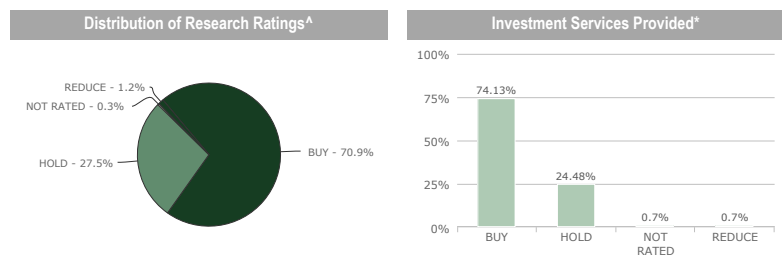
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Current as of: June 15, 2021

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