Outline

- Who is UxC?
- General Overview of Spent Fuel Management
  - Global Overview
  - Storage overview
  - Disposal overview
- US
- China
- Finland
- Spain
- Sweden
- Switzerland
- Final thoughts
UxC, LLC

- Provides nuclear fuel market information services to suppliers, utilities, investors, and government agencies internationally
  - Founded in March 1994
  - 15 professionals in company, plus consultant base
  - Home office is in Atlanta, GA

- Three major lines of business
  - Publishing industry market reports
  - Data services
  - Market analysis
UK's Radioactive Waste Inventory Summarized in New Report

The UK’s Radioactive Waste Inventory is a comprehensive database of radioactive waste and high-level waste in the United Kingdom. As of April 1, 2019, the inventory includes over 180,000 entries, totaling approximately 170,000 cubic meters of waste. The inventory is updated annually to ensure accurate and current information.

The inventory is divided into two main categories: radioactive waste and high-level waste. Radioactive waste includes materials that emit ionizing radiation, such as spent fuel and decommissioning waste, while high-level waste is primarily composed of solidified high-level waste from nuclear power plants.

A significant portion of the inventory is located at the Sellafield site, which is the largest single site for radioactive waste storage in the UK. Other major contributors include the Windscale and Windscale Power Station sites.

The inventory serves as a critical tool for waste management planning, ensuring that the UK can meet its environmental and regulatory obligations.

SpentFUEL

StoreFUEL and Decommissioning Report

INMM Spent Fuel Management Seminar January 2020
Currently 450 nuclear power reactors are operating in 30 countries (IAEA data). UxC projects that 12 new reactors will begin operations in 2020 but possibly as many as 16 permanent shutdowns.

174 reactors have been permanently shutdown worldwide, with about half of those are in Western Europe.

Spent fuel treatment, storage, and disposal are crucial components of the nuclear fuel cycle. The IAEA has encouraged its Member States to develop and implement a “cradle to grave” approach to radioactive waste with disposal as the end point.
Spent Fuel: A Waste or Resource?

- Open fuel cycle, also called the “once through strategy” considers spent fuel a waste product. After a storage period, the spent fuel is packaged for disposal in a DGR. Most countries operate under this policy.

- Closed fuel cycle spent fuel is reprocessed to recover uranium and plutonium to be reused with the high-level radioactive waste stored until a DGR is available.

- UxC estimates that about 133,000 MT of spent fuel from commercial NPPs have been reprocessed through 2018, and that by 2035 the total will be close to 170,000 MT.

Source: UxC 2018 Nuclear Industry Value Chain
Spent Fuel Management

- **On-site storage** – safely stored in pools and dry casks for many years.

- **Interim storage facilities** – safely stored for decades (Switzerland’s Zwilag facility shown here).

- **Reprocessing** – used today in France, India, Russia, the UK (ceasing this year), and is planned in China and Japan. A number of other countries have reprocessed in the past.

- **Advanced recycling** – under development in some countries.

- **Deep geologic repositories** – required even if reprocessing is in use.

Zwilag Source: Zwilag.ch/en
Spent Fuel Storage

- Collectively, nuclear power plants discharge about 11,300 MT of spent fuel each year (average 2015-2035).
- Through the end of 2019, about 433,000 MT of spent fuel have been discharged.
- At least 50 countries have spent fuel in storage awaiting reprocessing or disposal.
- About 80% of the global inventory is located in the US and Western Europe.
- UxC estimates that by 2035 the amount of spent fuel discharged will be nearly 618,000 MT and the amount in storage will be nearly 450,000 MT.
Consolidated Storage

- In a few countries centralized storage facilities, both wet and dry, are operation or planned:
  - Finland
  - France
  - Germany (no further shipments planned)
  - Hungary
  - Spain (construction suspended)
  - Sweden
  - Switzerland
  - Ukraine
  - US

Zwilag – Centralized Interim Storage Facility

Source: Nagra
Spent Fuel Disposal

- Deep geological disposal is widely accepted as the end point for spent nuclear fuel and HLW.
- Designed to provide passive safety for many thousands of years.
- No such facility for spent fuel is currently operating.
- Repository programs are in process in multiple nations. Finland is the only country to have a construction license; repository operations are expected to begin in 2024-2026.
## Countries with Repository Programs

<table>
<thead>
<tr>
<th>Country</th>
<th>Location</th>
<th>Status</th>
<th>Start of operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>Eurajoki</td>
<td>Under construction</td>
<td>2024-2026</td>
</tr>
<tr>
<td>Sweden</td>
<td>Forsmark</td>
<td>License pending</td>
<td>2020s</td>
</tr>
<tr>
<td>Switzerland</td>
<td>3 potential sites</td>
<td>Siting regions identified</td>
<td>~2040</td>
</tr>
<tr>
<td>France</td>
<td>Region of Bure</td>
<td>Siting region identified</td>
<td>2025</td>
</tr>
<tr>
<td>Canada</td>
<td>2 potential sites</td>
<td>Preferred site identified by 2023</td>
<td>2040-2045</td>
</tr>
</tbody>
</table>
United States

- Open fuel cycle.
- US spent fuel inventory is located at 113 sites in 39 states at 98 operating commercial power reactors, 21 shutdown reactors, the GE Morris ISFSI, research reactors, and DOE sites.
- Total SNF inventory at the end of 2018 was ~84,800 MT; about 82,500 MT was commercial spent fuel. This is contained in 285,956 SF assemblies.

<table>
<thead>
<tr>
<th>Material Category</th>
<th>SNF (MTHM)</th>
<th>SNF (Asbl)</th>
<th>HLW (Canisters)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial SNF and HLW</td>
<td>82,463</td>
<td>285,956</td>
<td>278</td>
</tr>
<tr>
<td>Non-commercial SNF and HLW</td>
<td>2,318</td>
<td></td>
<td>4,173</td>
</tr>
<tr>
<td>Total</td>
<td>84,781</td>
<td>285,956</td>
<td>4,451</td>
</tr>
</tbody>
</table>

Source: DOE Spent Nuclear Fuel and High-Level Waste Inventory Report
Nothing has changed

- January 31, 2010 marks 22 years since the US government defaulted on its obligation to remove spent fuel from reactor sites.
  - NWF has over $40 billion
  - DOE estimated future liability as of Sept 30, 2019 to be $28.5 billion (assumes a repository in operation in 2048).
  - At least one state (Minnesota) has imposed per-cask fees for storage; others have proposed additional fees for continued spent fuel storage.

- Legislation introduced to modify spent fuel policy, but nothing has become law. One bill, the Nuclear Waste Policy Amendments Act of 2019 addresses the need for both interim storage and long-term disposal. Would give DOE clear authority to use interim storage facilities, would advance the Yucca Mountain program, and would reform the financing mechanism of the Nuclear Waste Fund to ensure DOE has adequate funding to build and operate a repository.
Consensus is building that consolidated storage must be implemented in parallel with work on a permanent disposal facility.

Two proposals are moving forward as the NRC reviews of Holtec and Interim Storage Partners applications continues. NRC reviews for both facilities could be complete early next year.

Legislation has been introduced that would give DOE clear authority to use consolidated storage facilities.

Industry is planning to use consolidated storage facility with no support from DOE.
Dry Storage in the US

- Every US nuclear reactor site except for TMI-1, Shearon Harris, and Wolf Creek has an ISFSI.
  - Wolf Creek signed a contract with TN for dry storage starting in 2021; will use TN’s NUHOMS EOS 37.
  - NAC International will provide MAGNASTOR dry storage systems for TMI-1 with first campaign scheduled for 2022.
  - Shearon Harris has 4 spent fuel pools and will not need dry storage for the foreseeable future. Duke has shipped SNF from other sites to the Harris pool.

Source: US NRC
Trojan and TMI-2 ISFSI licenses were renewed in 2019.

Currently the NRC is reviewing:

- Rancho Seco (submitted March 31, 2018)
- Humboldt Bay.

Renewals for Diablo Canyon (shown) and Idaho Spent Fuel facility are coming up.
Storage CoC renewal applications

- Storage CoC renewals:
  - NUHOMS – Renewed CoC took effect on December 11, 2017.
  - NAC-MPC renewal was submitted December 18, 2019.
  - Other systems will be up for renewal:
    - The NRC is expecting to receive renewal applications for the HI-STORM 100, the TN-32, TN-68, and NAC-UMS, and the FuelSolutions.
## Growth of Commercial Dry Storage in the US

<table>
<thead>
<tr>
<th>End of Year</th>
<th>Assemblies</th>
<th>Casks</th>
<th># Placed in Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>41,856</td>
<td>1,111</td>
<td>152</td>
</tr>
<tr>
<td>2009</td>
<td>47,455</td>
<td>1,240</td>
<td>129</td>
</tr>
<tr>
<td>2010</td>
<td>54,046</td>
<td>1,387</td>
<td>147</td>
</tr>
<tr>
<td>2011</td>
<td>60,304</td>
<td>1,542</td>
<td>155</td>
</tr>
<tr>
<td>2012</td>
<td>67,831</td>
<td>1,710</td>
<td>168</td>
</tr>
<tr>
<td>2013</td>
<td>76,097</td>
<td>1,892</td>
<td>182</td>
</tr>
<tr>
<td>2014</td>
<td>85,166</td>
<td>2,087</td>
<td>195</td>
</tr>
<tr>
<td>2015</td>
<td>93,426</td>
<td>2,277</td>
<td>190</td>
</tr>
<tr>
<td>2016</td>
<td>102,416</td>
<td>2,471</td>
<td>194</td>
</tr>
<tr>
<td>2017</td>
<td>113,797</td>
<td>2,720</td>
<td>249</td>
</tr>
<tr>
<td>2018</td>
<td>126,521</td>
<td>2,981</td>
<td>261</td>
</tr>
<tr>
<td>2019</td>
<td>135,949</td>
<td>3,203</td>
<td>222</td>
</tr>
</tbody>
</table>
Reactor Closures in 2013-2019

2013
- Crystal River – was SAFSTOR but changed to DECON in 2019 and contracted with Accelerated Decommissioning Partners (a JV of Orano USA and NorthStar)
- Kewaunee – SAFSTOR
- SONGS 2 & 3 – DECON using a Decommissioning General Contractor (JV of AECOM and EnergySolutions known as SONGS Decommissioning Solutions)

2014
- Vermont Yankee – Sold to NorthStar and in DECON

2016
- Fort Calhoun – Was SAFSTOR but now DECON (contract with EnergySolutions to decommission the site)

2018
- Oyster Creek – Sold to Holtec and in DECON

2019
- Pilgrim – Sold to Holtec and DECON
- Three Mile Island 1 – SAFSTOR
Reactor Closures in 2020-2025

- **2020**
  - Indian Point 2 – Will be sold to Holtec for accelerated DECON
  - Duane Arnold – Decommissioning strategy not announced but will be a “multi-year decommissioning process”

- **2021**
  - Beaver Valley 1 and 2 – Not announced
  - Indian Point 3 – Will be sold to Holtec for accelerated DECON

- **2022**
  - Palisades – Will be sold to Holtec for accelerated DECON

- **2024**
  - Diablo Canyon 1 – DECON

- **2025**
  - Diablo Canyon 2 – DECON
Decommissioning Models

- New decommissioning models to accelerate decommissioning, which is generally preferred by communities:
  - VY sale to NorthStar completed January 11, 2019.
  - Oyster Creek sale to Holtec July 1, 2019.
  - Pilgrim sale to Holtec completed on August 26, 2019.
  - Holtec has agreements to purchase Palisades and the Big Rock Point ISFSI.
  - EnergySolutions signed a contract to purchases all licenses and assets of TMI-2.

Entergy, Exelon Sign Agreements with Holtec for Accelerated Decommissioning of Three Reactors

- Entergy will sell Oyster Creek to Holtec, which will manage and complete its decommissioning in 8 years.
- Entergy will sell Pilgrim and Palisades to Holtec, who will manage and complete decommissioning in 8 years.
- Two weeks after Holtec International and SNC-Lavalin announced the formation of a joint venture subsidiary, Comprehensive Decommissioning International, LLC (CDI), to perform the safe, rapid, and economic decommissioning of nuclear power plants, the two companies announced they have signed agreements with two of the largest energy providers in the United States – Exelon Corporation and Energy Corporation, whereby Holtec will purchase, upon prior mutual agreement, the existing Oyster Creek Generating Station in New Jersey, the Palisades Nuclear Power Plant in Michigan, and the Pilgrim Nuclear Power Station in Massachusetts for the purpose of accelerating the decommissioning of these plants.
- Holtec’s vice president, Corporate Business Development at Holtec, emphasized in an essay that the accelerated decommissioning is possible because Holtec’s dry storage systems are capable of offloading the spent fuel from the pool more rapidly than any system available in the industry.
- Holtec will operate with CDI to perform the decommissioning and decommissioning of the reactors. CDI is headquartered in Camden, New Jersey, which is also home to Holtec’s new technology center (SpentFUEL No. 1219, July 20, 2019).
- Holtec will also purchase the decommissioned Big Rock Point Nuclear Power Plant in Michigan, where all that remains of that former reactor is the independent spent fuel storage installation (ISFSI).
- Entergy to sell Oyster Creek to Holtec

Exelon Generation and Holtec announced July 31 that the two companies have signed an agreement in which Holtec will purchase the existing Oyster Creek Generating Station and decommissions the plant within eight years, “over 30 years ahead of the industry-allowed 60-year timeline.” Exelon noted in its announcement. Under the terms of the agreement, Holtec will assume ownership of the site, the property, and the spent fuel. As the site’s owner, Holtec will manage all site decommissioning and restoration activities. To that end, Holtec will work closely with CDI to perform the decommissioning and decommissioning of the plant on an accelerated timeline “with the highest standard of safety, quality, and environmental stewardship.”

The funds from the Oyster Creek decommissioning trust (NDT) fund will transferred to Holtec upon closing to be used to cover the cost of decommissioning. Holtec emphasized that no additional funds from utility customers will be required.

Exelon is required to cease operations at Oyster Creek no later than December 2019, or in agreement with the State of New Jersey, but Exelon announced in February of this year that the plant will be permanently shut down at the end of its current operating cycle this fall.

As part of the sale agreement, CDI will offer employment to Oyster Creek decommissioning employees, effective upon the transaction closing. Holtec’s President and CEO, Dr. K.S. Singh, said “We hope to offer job opportunities to the many Oyster Creek-based Exelon employees who wish to pursue exciting career opportunities with our company.”

Bryan Hanson, Exelon Generation’s chief nuclear officer said, “This landmark agreement is good news for Oyster Creek employees, the Laceys community and the state of New Jersey. Holtec’s commitment to the nuclear industry and its presence in New Jersey will allow many of our employees previously facing relocation to continue living and working in the Garden State. Further, with these decades of experience in nuclear fuel technologies and a partnership with global decommissioning leader SNC-Lavalin, Holtec is ideally positioned to complete the decommissioning of Oyster Creek safely and swiftly.”

The transaction is expected to close in the third quarter of 2019, pending the requisite approvals, including from the US Nuclear Regulatory Commission (NRC). The purchase price was not disclosed.

As the new plant owner, Holtec will submit a new Oyster Creek decommissioning plan – a post-shutdown decommissioning activities report or PSDAR – to the NRC for its review and approval. That process allows for opportunities for public review and comment during the NRC review period.

Exelon submitted a PSDAR for Oyster Creek to the NRC on May 21, 2019. That report conveyed Exelon’s plans to decommission the plant using the SADV/DOS method, which meant that D&D activities would have been scheduled to enable the license to be terminated within 60 years of perm-
Shutdown Sites

- Transferring the spent fuel from the pool to dry storage is an important decommissioning milestone.

- Cask vendors have designed casks that can store spent fuel that has only been stored in the pool for two years in order to accelerate decommissioning of the plant.

- Out of a total of >3,200 casks in service in the US, almost 600 of these are at permanently shutdown sites.

- Southern California Edison is loading the rest of SONGS spent fuel into HI-STORM UMAX systems; over half of the 73 planned have been completed. Scheduled for completion this year.

- Fort Calhoun is loading its pool inventory into NUHOMS 32PT systems. Scheduled for completion this year.
Holtec International

- Best known for its HI-STORM cask technology.
- Over 1,300 casks in service in the US.
- Newer variations of the HI-STORM 100 include the HI-STORM FW and the HI-STORM UMAX.
- In 2019, 125 Holtec casks were deployed at 19 sites in the US, a decrease over 2018 when 172 casks were placed into service but still an increase compared to 2017 when 92 were deployed.
NAC International

- Specializes in nuclear materials transport, spent fuel storage and transport technologies, nuclear fuel cycle consulting, and fuel cycle information services.
- The MAGNASTOR system is in use at four sites, soon to be five when Palo Verde loads its first system early this year.
- About 470 casks in service, with 217 of those at permanently shutdown sites.

Photo credit: NAC
TN Americas is Orano’s dry storage and spent fuel transport company

- Currently markets the modular NUHOMS dry cask system.
- New NUHOMS EOS system shown below – first EOS placed into service in December 2019 at Davis-Besse.
- Has over 52,000 assemblies stored in over 1,300 systems in the US.
- In 2019, 82 TN systems were deployed at 11 sites in the US.
Westinghouse

- Acquired the intellectual property for the FuelSolutions and VSC-24 cask systems from EnergySolutions on September 13, 2019.
- Will submit an amendment to the FuelSolutions system that will add a new storage system, the SENTRY, that will have two new canister designs – a “minimum cooling time” canister and a “high capacity canister.”
- Currently has 67 systems in service at 5 sites in the US.
Current Status of US Dry Storage

Number of Assemblies in dry storage at the end of 2019

Source: January 2019 StoreFUEL

Dual-Purpose concrete casks in use

Total casks in use
Market Share – BWR Fuel

Dual-purpose concrete systems deployed

- BWR: 61%
- Orano TN: 38%
- NAC: 0%
- Other: 1%

BWR assemblies in dual-purpose concrete systems

- BWR: 64%
- Orano TN: 34%
- NAC: 1%
- Other: 1%

Source: January 2020 StoreFUEL
Market Share – PWR Fuel

Dual-purpose concrete systems deployed

PWR assemblies in dual-purpose concrete systems

Source: January 2020 *StoreFUEL*
Market Share at Shutdown Sites

- NAC: 36%
- Orano TN: 35%
- Holtec: 28%
- Westinghouse: 1%

Source: January 2020 StoreFUEL
### Spent Fuel Storage in Europe

<table>
<thead>
<tr>
<th>Country</th>
<th>Inventory (tons)</th>
<th>Inventory (asbl)</th>
<th>Wet Storage (tons)</th>
<th>Wet Storage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>501**</td>
<td>4,173</td>
<td>237</td>
<td>47%</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>876</td>
<td>4,383</td>
<td>788</td>
<td>90%</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>1,828</td>
<td>11,619</td>
<td>654</td>
<td>36%</td>
</tr>
<tr>
<td>Finland</td>
<td>2,095</td>
<td>13,887</td>
<td>2,095</td>
<td>100%</td>
</tr>
<tr>
<td>France</td>
<td>13,990</td>
<td>n.a.</td>
<td>13,990</td>
<td>100%</td>
</tr>
<tr>
<td>Germany</td>
<td>8,485</td>
<td>n.a.</td>
<td>3,609</td>
<td>43%</td>
</tr>
<tr>
<td>Hungary</td>
<td>1,261</td>
<td>10,507</td>
<td>216</td>
<td>17%</td>
</tr>
<tr>
<td>Lithuania</td>
<td>2,210</td>
<td>19,731</td>
<td>1,417</td>
<td>64%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>80***</td>
<td>266</td>
<td>80</td>
<td>100%</td>
</tr>
<tr>
<td>Romania</td>
<td>2,867</td>
<td>151,686</td>
<td>1,297</td>
<td>45%</td>
</tr>
<tr>
<td>Slovenia</td>
<td>350</td>
<td>884</td>
<td>350</td>
<td>100%</td>
</tr>
<tr>
<td>Spain</td>
<td>4,975</td>
<td>15,082</td>
<td>4,400</td>
<td>91%</td>
</tr>
<tr>
<td>Sweden</td>
<td>6,758</td>
<td>34,204</td>
<td>6,758</td>
<td>100%</td>
</tr>
<tr>
<td>Switzerland</td>
<td>1,377</td>
<td>6,474</td>
<td>831</td>
<td>60%</td>
</tr>
<tr>
<td>Ukraine</td>
<td>4,651****</td>
<td>27,325</td>
<td>4,081</td>
<td>94%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>7,700</td>
<td>n.a.</td>
<td>7,700</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>~ 60,500</td>
<td>~266,000</td>
<td>~ 49,000</td>
<td>81%</td>
</tr>
</tbody>
</table>

**2011 data, **2010 data, ****2008 data

www.worldnuclearwastereport.org
Fourteen EU Member States collectively operate 126 power reactors

- 50 of these will be closed by 2025
- But 10 states are planning new NPPs

Source: Massimo Garriba, Director General of the European Commission at the June 2019 IAEA Spent Fuel Conference
EU Member States have generated 58,300 MT of spent fuel (as of 2016).

15 Member States plan to build a DGR for intermediate-level waste, HLW, and spent fuel.

Source: Massimo Garriba, Director General of the European Commission at the June 2019 IAEA Spent Fuel Conference
As of February 1, 2019 China had 45 NPPs in operation and 11 under construction (not counting Taiwan).

Cumulative amount of SNF from these reactors projected to be about 7,000 MTHM by 2020.

Most SNF is stored in pools at the reactor site.

China plans to reprocess but will need to implement dry storage to bridge the gap.

China has been developing a dry storage supply chain.

Potential repository site in the Gansu province in NW China.

### Spent Fuel Production and Accumulation Under Two Scenarios (tU)

<table>
<thead>
<tr>
<th>Site</th>
<th>Year</th>
<th>2020</th>
<th>2030</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rapid development</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spent fuel production</td>
<td></td>
<td>1,000</td>
<td>3,200</td>
<td>7,700</td>
</tr>
<tr>
<td>Spent fuel accumulation</td>
<td></td>
<td>7,000</td>
<td>28,900</td>
<td>141,000</td>
</tr>
<tr>
<td><strong>Slow development</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spent fuel production</td>
<td></td>
<td>1,000</td>
<td>1,600</td>
<td>2,500</td>
</tr>
<tr>
<td>Spent fuel accumulation</td>
<td></td>
<td>7,000</td>
<td>20,800</td>
<td>62,700</td>
</tr>
</tbody>
</table>

Source: CNPEC presentation at the June 2019 IAEA Spent Fuel Conference
Three power companies, two of which have operating NPPS:
• TVO with Olkiluoto 1 and 2
• Fortum Power and Heat with Loviisa 1 and 2
• Fennovoima Oy applied for licenses for Hanhikivi 1
• Estimated 2,777 spent fuel assemblies in storage licensed for 3,304 asbl (Posiva IAEA Technical Meeting presentation November 2019)

Posiva, owned by Fortum and TVO, is responsible for spent fuel disposal.

World’s first deep geological repository for SNF is under construction; Operations scheduled to begin 2024-2026.
Spain

- Open fuel cycle.
- 7 operating nuclear power reactors at five sites – Almaraz 1 and 2, Ascó 1 and 2, Cofrentes, Trillo, and Vandelló II; 3 have been permanently closed – Santa María de Garoña, Vandellós I and José Cabrera.
- Spent fuel stored in pools or dry casks with various technologies, both bare casks and canister systems.
- After interim storage, all spent fuel will be transported to a centralized storage facility (ATC) that is in the licensing process but has been delayed because of political controversy. After ~100 years the SNF would be transported to a DGR for final disposal.
- ISFSIs in use at the following plants:
  - José Cabrera, plant closed, all fuel in ISFSI
  - Almaraz ISFSI in operation
  - Ascó ISFSI in operation
  - Trillo ISFSI in operation
  - Cofrentes ISFSI under construction; pool saturation in 2021
  - Garoña ISFSI in licensing process.
SKB, the Swedish Nuclear Fuel and Waste Management Company is owned by the nuclear power companies. Operates a repository for short-lived radioactive waste (SFR) and the Central Interim Storage Facility, Clab.

About 7,000 MT of SNF are in interim storage; permit allows 8,000 MT and SKB has applied for an expansion to 11,000 MT.

Clab is planned to be in operation until the last fuel is in the repository, projected to be the middle of the 2060s.

In 2011, SKB submitted applications to build a spent fuel repository at Forsmark and an encapsulation plant at Oskarshamn next to Clab.

About 12,000 MT of spent fuel in about 6,000 disposal canisters will be emplaced there at a depth of 500 meters.

SKB hopes to begin construction early this decade and begin operations about 10 years later.
Switzerland

- Five reactors: Gösgen, Leibstadt, Beznau 1 and 2, and Mühleberg provide about 40% of total power production.
- About 12,000 spent fuel assemblies are expected to be discharged from all NPPs.
- More than 1,000 spent fuel assemblies are in interim dry storage sites at ZWILAG and ZWIBEZ.
- 771 MTHM have been sent for reprocessing in France and the UK; 634 canisters of HLW will be returned.
- Both spent fuel and HLW will be disposed of in a DGR.
- NAGRA plans to submit a license application for a repository by 2022; operations planned to begin in 2060 with emplacement until 2075.
Spent fuel will be safely stored in pools and dry casks for many decades, as building a DGR is a complex, multi-generational, politically-charged endeavor, but one that is absolutely necessary.

The countries that have made and are making the most progress towards a DGR are those with a non-governmental company managing the process: Posiva in Finland; SKB in Sweden; NWMO in Canada, etc.

The dry cask storage market and the decommissioning market will continue to grow, cask vendors will continue to modify their designs to meet client needs.

If you subscribed to UxC’s backend publications, you would already know all of what I have presented.
Thank you

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