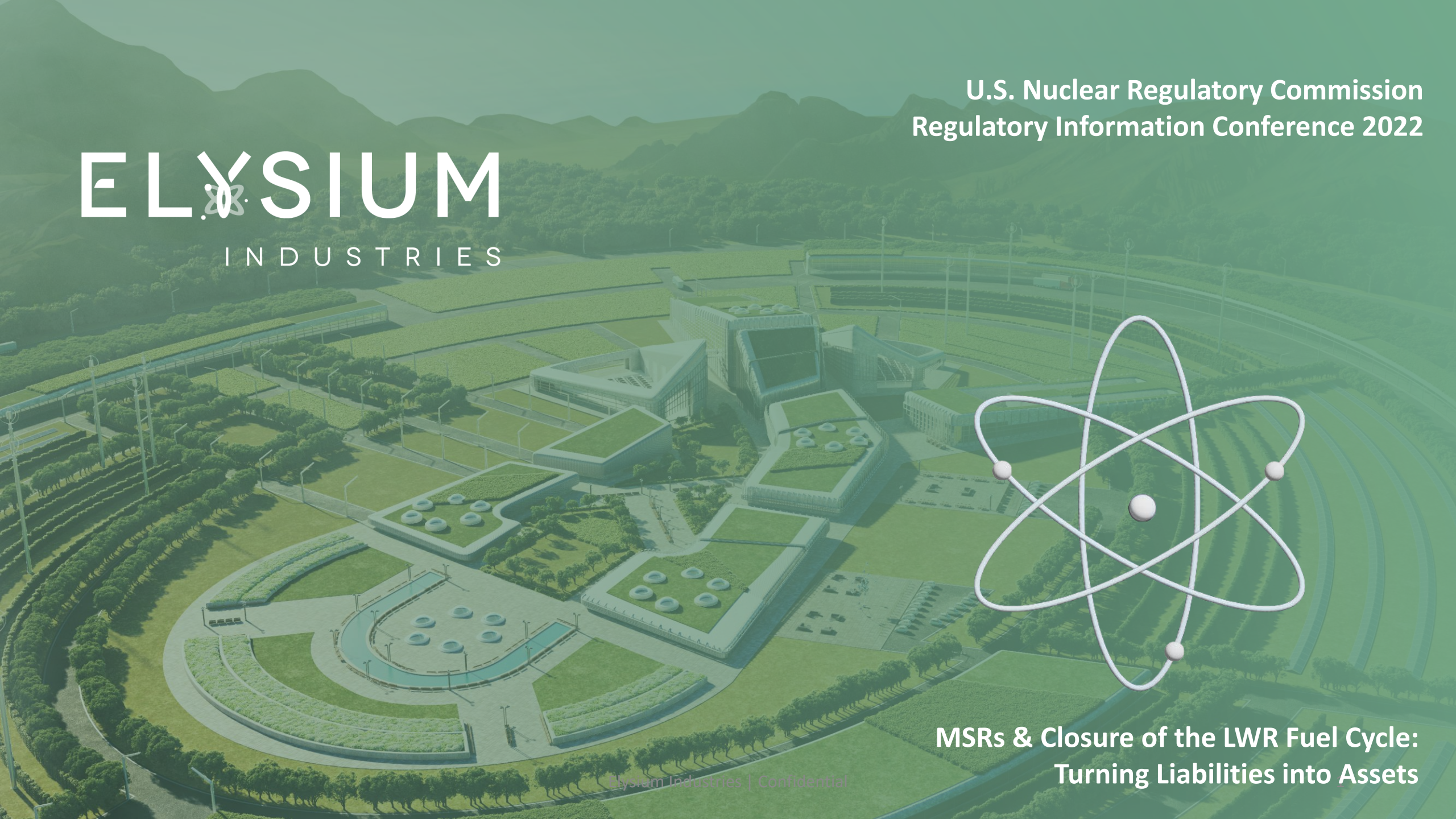
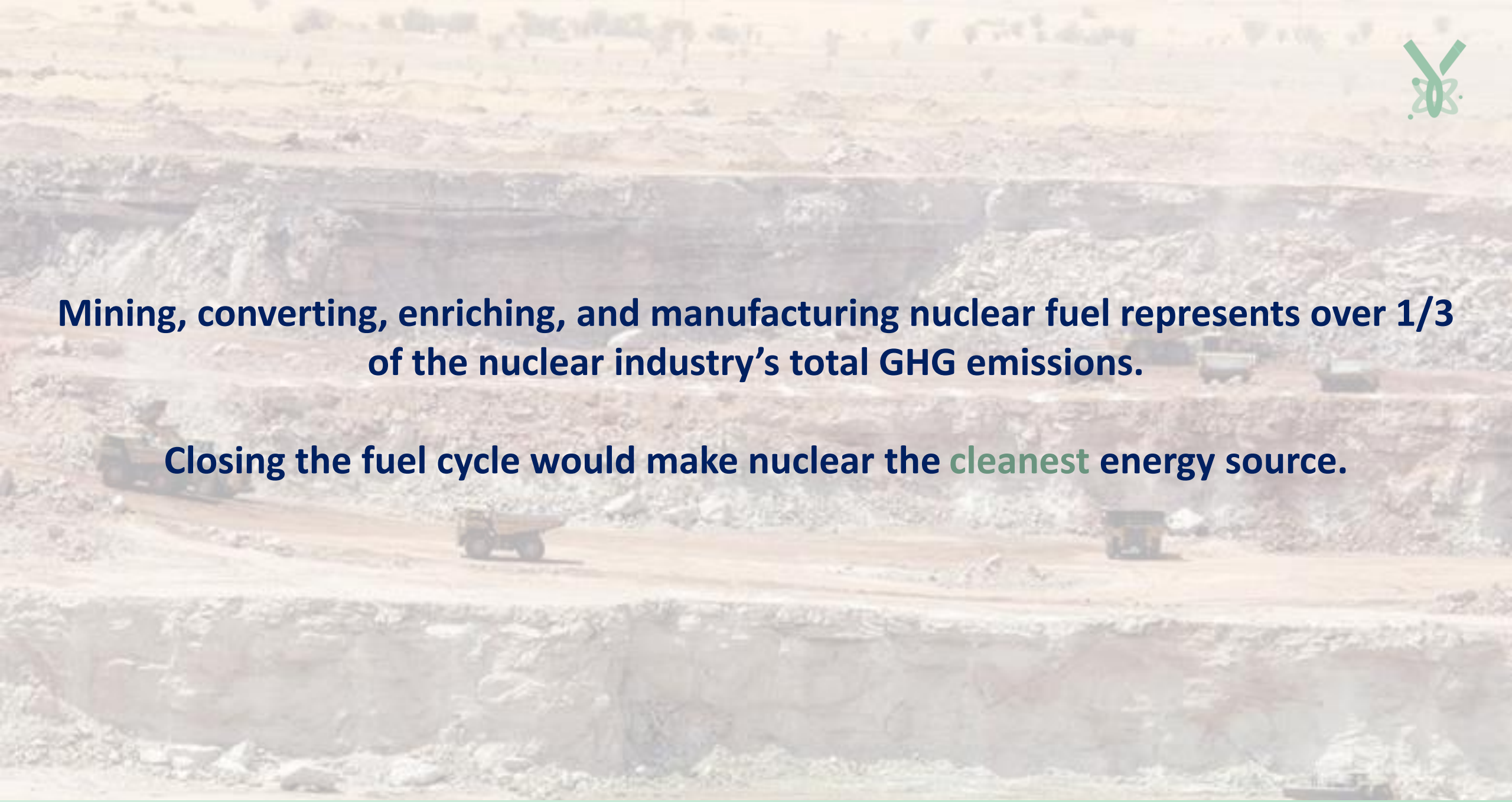
ELYSIUM INDUSTRIES

U.S. Nuclear Regulatory Commission
Regulatory Information Conference 2022



MSRs & Closure of the LWR Fuel Cycle: Turning Liabilities into Assets



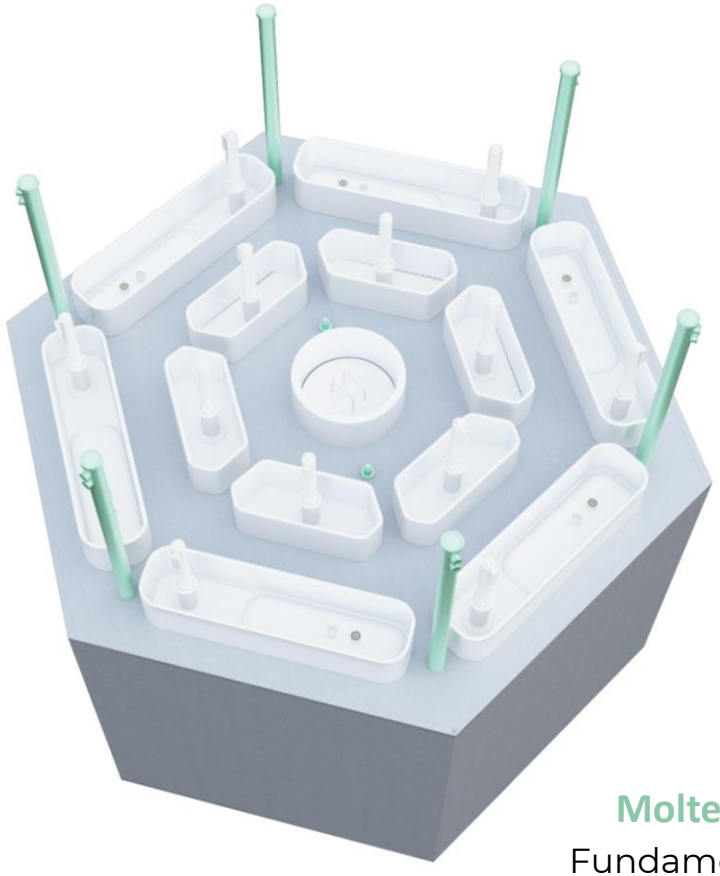
Mining, converting, enriching, and manufacturing nuclear fuel represents over 1/3 of the nuclear industry's total GHG emissions.

Closing the fuel cycle would make nuclear the cleanest energy source.

Safe, Clean, and Affordable Nuclear

Elysium's Fast Chloride – Molten Salt Reactor (FC-MSR)

1. Spent Nuclear Fuel **Recycling**
2. **Proliferation Resistance**: denature & consume **plutonium**
3. Economic **Competitiveness**: $20-40/MWh
4. **Passive Safety**: **No** Meltdowns & **No** Chemical Dispersal
5. Scalability / **Modularity**: 10 – 3,000 MWth
6. **Flexible** Operational Environment
7. Operates for **40 years** without refueling



Molten Salt Reactor Technology

Fundamentally **different** reactor type

+

Successfully built & operated in the 60's

Addressable Markets

Revenue Streams: **Waste Management** + **Energy**

Input Revenue

U.S. Nuclear Waste Management & Disposition Needs

(Source: US NRC, 2021)

Used Nuclear Fuel from Existing Reactors

> 80,000 Metric Tons (MT)

Weapons Material to be discarded

~ 60 MT

Depleted Uranium from Fuel Production

> 700,000 MT

Output Revenue

Residential/Commercial Electricity and Others

(e.g. Desalination's Reverse Osmosis)

Hydrogen Production

(e.g. Synthetic Fuels, Ammonia)

Process Heat 650°C — 950°C

Residential/District Heating

Industrial/Mining & Refining

Other End Uses:

Medical Isotopes

Irradiation Testing/Services

Carbon Capture Technology

Three main fuel types

- Start Up Fuel
  - SNF + WGPu Denatures to <90% Pu239
  - SNF “enriched” to 10-15% Pu ~33% Pu239
- Feed-in Fuel - Just converted from Oxide to Chloride

Fuel Cycle (assuming 1200MWe)

- Start Up Fuel
- Feed In fuel 3kg/day SNF converted to Cl for 40-60 years
- 1.04 Breeding ratio to override fission product Poisons

Waste Streams

- Nobel Gasses – On-line
- Nobel Metals – On-line
- At 40-60 yr
  - Purify 100 yr fission products
  - Cs & Sr left in recycled fuel
  - Fuel doubling time ~50yrs

Idaho National Laboratory

INL/EXT-19-53767

Summary Report: Synthesis of Molten Chloride Salt Fast Reactor Fuel Salt from Spent Nuclear Fuel

Guy L. Fredrickson, Steven D. Herrmann

May 1, 2019

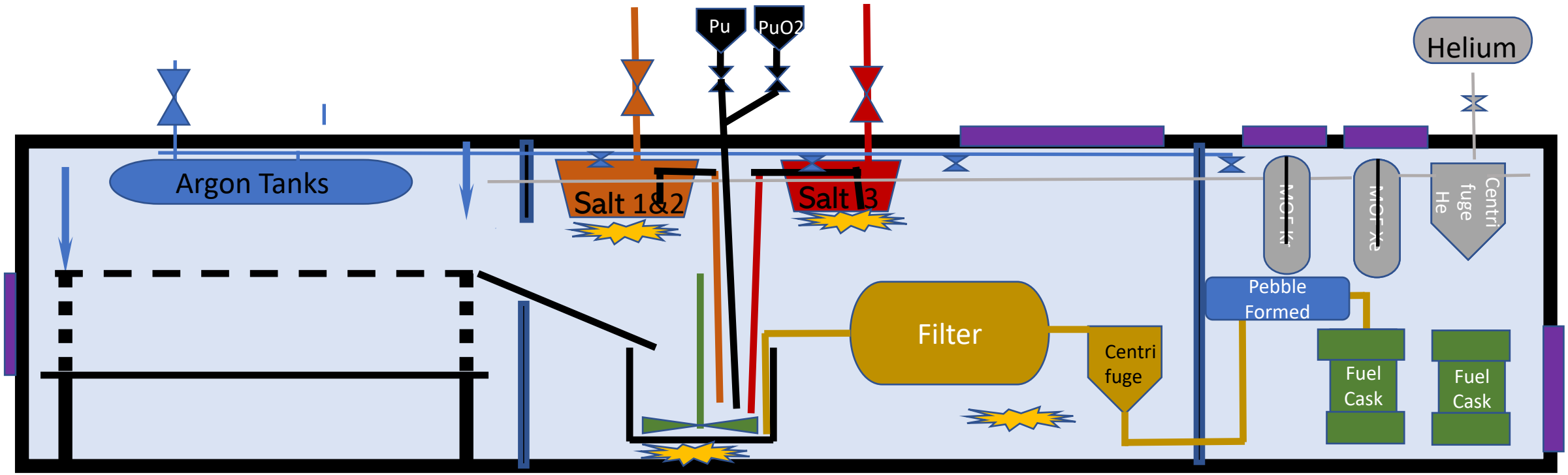
ABSTRACT

This summary report is based on information provided in final technical report: G. L. Fredrickson, S. D. Herrmann; “Final Technical Report: Synthesis of Molten Chloride Salt Fast Reactor Fuel Salt from Spent Nuclear Fuel”; Idaho National Laboratory, INL/EXT-18-52019; November 12, 2019; Official Use Only/Export Controlled

The experiment successfully demonstrated the chemical chlorination of irradiated MOX fuel into a NaCl-KCl eutectic salt at 700°C.

The strategy used was to add chlorinating reagents to the NaCl-KCl salt. These chlorinating reagents provided an environment that chlorinated the MOX fuel to produce UCl_3 and $PuCl_3$ in the salt. The lanthanide, alkali, and alkaline earth fission product oxides in the MOX fuel were likewise chlorinated into the salt. The exact nature of the chlorinating reagents and the reactions involved are not disclosed in this summary report. Omission of information regarding the chlorinating reagents and the reactions involved allowed this summary report to remain non-export controlled.

Single fuel cell conversion container



Recycle + Retrofit Model?

Rationale

- Licensed nuclear power plant site / shorter regulatory process
- Leverage existing plant infrastructure (offices, training facilities, other civil works)
- Fuel is on-site
- Preserve human resources, local incentives

Thank You!

Please do not hesitate to reach out if there are any other questions!

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