Commercial Decommissioning…
a Vendor’s Global Perspective

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Key Statistics

- In the next 20 years more than 200 nuclear power plants are expected to be closed, primed for or begin decommissioning worldwide – more than half currently in operation.

- Main drivers for plant shutdown:
  1. Units that have lived out their lifetime, fulfilled their purpose, or are no longer economically justifiable to run (74%)
  2. Units that close following an accident or serious incident (8%)
  3. Units which are closed prematurely by political decision or due to regulatory reasons (18%)
Europe

▶ On track to decommission 150 reactors in the next 20 years
  ◆ Contains 69% of projected nuclear power related closures by 2030 (as of 2012 estimates)
  ◆ Market values of these decommissioning efforts stands at $81.5 billion (2012 estimates)

▶ France
  ◆ $21.5 billion in market value over the next 20 years
  ◆ EdF to pursue its D&D program (Chooz, Superphénix, Bugey ...)
  ◆ Main driver: Completion of expected reactor lifetime in the long term

▶ Russia
  ◆ $13.5 billion in market value over the next 20 years
  ◆ Main driver: completion of reactor lifetime

▶ UK
  ◆ $18.7 billion in market value over the next 20 years
  ◆ 3 units shut down since 2011
  ◆ Main driver: completion of reactor lifetime

▶ Germany
  ◆ 8 Units closed down prematurely that could be dismantled in the medium term (due to German immediate phase out)
  ◆ Final costs may exceed $32.5 billion considering long term fuel storage costs
  ◆ Currently dismantling 4 units
  ◆ Eventual shutdown of remaining 9 plants (12.7 GW)
  ◆ Main driver: political decisions
Market value of Asia Pacific region in the next 20 years estimated to be $20.3 billion

Second highest market projection globally following Europe

Japan

- Fukushima will continue to generate strong needs for D&D work on-site (remediation, fuel retrieval and D&D, soil decontamination)
- Accident expected to generate additional need for D&D support of other Japanese reactors
- Difficulty for foreign players to support D&D market in Japan
- Main drivers: Fukushima accident and political decisions

End of Operating Licenses Globally

- Expected / Already announced shutdown of LWR per year (in # of reactors)
- 5 units at 4 sites announced shutdown in 2013
- Key question on post-Fukushima shutdown and D&D strategies, 28 units affected
- 8 units shutdown in 2011, 9 extra to shutdown by 2022
- 18 Units from the Magnox and AGR fleet
United States

- Current forecasts for known U.S. D&D estimated at $8 billion +/-
- 2012 lowest forecasted region globally
- 38 reactors will be shutdown by 2035 due only to end of license
- However, energy market conditions have driven several premature plant closings, including 5 in 2013 (SONGS 2&3, VY, Kewaunee, CR3)
- Current projection to expect potential additional early shutdowns due to economic performance pressures

United States

- A number of nuclear plants running low or negative economic projections are in danger of premature shutdown if market conditions do not change
- Political implications and site specific situations have also influenced decisions to shut down plants
- Analysts reaffirm recent closures are not indicative of a wider trend (citing specific circumstances), but assert that decisions to shut down plants are more hastily done in this economic environment
Future US Market
Reactor Shutdown to 2035

40 Year Licenses expected to be extended by 20 years – all still are running

An estimated 5 to 10 plants are at risk of early closure due to adverse economic conditions over next 5 years

Plants most at risk are small, single unit sites in deregulated electrical markets (most economically stressed), but technical issues are responsible for half of all of those recently shutdown.

SAFSTOR vs. DECON

- SAFSTOR vs. near term D&D influenced by:
  - Status of and confidence in decommissioning fund (NDT) and cost estimate
  - Local and state politics
  - Public pressure
- Most early shutdown plants tend to have underfunded decommissioning funds and opt for SAFSTOR
- SAFSTOR allows for fund growth through interest compounding; but...
- Must assume that cost increase less than fund growth
  - May not be true across the board
  - Much uncertainty / risk in waste disposal costs, regulatory requirements, etc. when projected out several decades
SAFSTOR vs. DECON

- Once initiated SAFSTOR decision is not easily changed to DECON
  - Plant infrastructure equipment and components not readily available
  - RCS chemical decon can be very challenging
  - Key / knowledgeable plant personnel are gone

- Consideration for phased approach to DECON
  - Full System Decon
  - Removal of NSSS and DECON of the Containment Building
  - Removes >95% of the radiological source term under today’s known regulations and cost
  - Improves risk profile in those areas most vulnerable to excessive cost growth
  - Can defer D&D of the remainder of the plant

- Bottom line... it is incumbent on our industry (utilities and vendors) to responsibly, cost effectively and safely decommission our shutdown fleet.

Closing Comments

- Globally and domestically, the number of shutdown units will grow dramatically over the next 20 years
- Early shutdown projections have tended to underestimate the actual rate of closures
- Phased approaches to D&D should be considered
  and finally...
- Our industry must safely and cost effectively deal with our retiring fleet to sustain the ability to build new plants