ENABLING REGULATION

The Operators View

WENRA Workshop on Decommissioning

6th November 2019

Berlin
Scope

- Sellafield today
- Origins of legacy
- Making sure we are safe
- Overview of ponds and silos
- Retrieval activities
- Waste Management
- Consequences
- Progressing the mission
- Summary
Sellafield today

- Sellafield is a site that has reprocessed nuclear fuel for almost 70 years.
- As a result it is complex from a nuclear and chemical hazard standpoint, and provides many unique challenges.
- Reprocessing concludes in 2020
- The site covers 2 square miles, nearly 6 square kilometres
- There are over 200 nuclear facilities and over 2,500 buildings in total
- 11,000 staff and over 3,000 contractors
- The site has very significant inventory
- Sellafield continues to receive spent fuel to support nuclear generation
- It has been and remains a major national priority
Sellafield through the decades

- **1940s**
  - Munitions, Nuclear Deterrent
  - Nuclear build begins
  - Initially a military programme
  - Later civil programme begins

- **1950s**
  - Reactor Construction & Operation
  - Waste stored safely – pending treatment
  - Storage capacity extended incrementally
  - Coarse segregation of waste arising from process
  - Magnox reprocessing starts

- **1960s**
  - Commercial Reprocessing
  - Main expansion of site
  - Major waste treatment focus
  - Environmental impact substantially reduced
  - Magnox reprocessing starts

- **1970s**
  - Waste Management
  - Commercialisation of reprocessing — Thorp comes online
  - Waste arising from processes treated in ‘real time’
  - Product waste forms compatible with disposal concepts

- **1980s**
  - Multiple Missions
  - Nuclear Decommissioning Authority formed
  - Stop/start progress in Decommissioning
  - Calder Hall ceased generating power after 47 years in operation

- **1990s**
  - Decision taken to end Thorp reprocessing
  - Vitrification of all overseas Highly Active Waste complete
  - Decommissioning gathering pace with significant progress in remediation and retrievals

- **2000s**
  - First sludge and fuel exports from early Magnox pond

- **2010s**
  - Risk & Hazard Reduction

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Sellafield Ltd
Origins of the legacy

• 1950’s to 1970’s
  • Initial defence priorities were the primary focus
  • Subsequent rapid development of Magnox generation
  • Energy security requirements in 1970’s
  • Immediate storage of wastes pending final treatment
  • Future requirements changed e.g. fast reactor programme

• 1980’s onwards
  • Materials processed in near real time to final form

• Today
  • Early legacies continue to be actively managed day to day
  • Legacy solutions require complex programmes to maintain safety and provide future modern safe storage. These are underway
  • Consolidation being accommodated in the national interest
How Do We Make Sure We Are Safe?

- Many Sellafield facilities cannot be simply shutdown in the manner of a power reactor
- What are the Hazards and Risks (Sources)
  - Criticality (self sustaining nuclear reaction)
  - Loss of cooling
  - Loss of containment
  - Loss of control of process chemistry
- Minimise impact on the workforce and the public below the prescribed limits considering
  - Nuclear safety (Operations and external events)
    - Safety Case
      - Defence in Depth
      - Protect and Prevent
      - Conservative Approach
    - Preparedness and Resilience
      - Beyond Design Basis (Resilience)
      - Malicious intent (Security plan)
- Effective management and leadership
  - Suitably qualified and experienced staff operating and maintaining facilities
  - Instructions and procedures for safe operation
- Benchmarking to ensure performance to high standards
  - WANO (World Association of Nuclear Operators)
  - High Hazard Industries
- Assurance and Governance
  - Nuclear Independent Oversight
  - Sellafield Board engagement
Risk Management Framework

- Managing the significance of nuclear safety risk
- Some facilities can create off site impact
- Framework guides prioritisation and enabling regulation
Cumulative risk profile for Sellafield
Legacy Issues

- Legacy Ponds
- Legacy Silos
- HA Liquor
- Special Nuclear Material Management
Magnox Swarf Storage Silo

Risk reduction focus
- Building strengthened
- Retrieval machine in place
- Passive venting installed
- Liquor activity reduction underway
- Interim storage under construction

2019
Start retrievals to Encapsulated Product Stores

2021
Start retrievals to Box Encapsulation Plant

2022
SEP3 completion of inactive commissioning

2026
Original start of sustained retrievals pre-alternative approach

2046
Completion of bulk retrievals Moved into Region A

Alternative ILW approach with ‘raw’ waste storage agreed Oct 2015

SEP2 waste retrievals machine now energised

Avexis ROV deployed in silo liquor Aug 2017

Gamma gates installed in Silos Maintenance Facility
Pile Fuel Cladding Silo

Risk reduction focus
- Building strengthened
- Argon inerting in place
- Retrievals access established
- Retrieval equipment in build
- Interim storage under construction

2019
Start of early retrievals

2022
Original forecasted start of retrievals in PP14

2027
Completion of bulk retrievals
Moved into Region A

June 2016: UK Govt approval of ‘lead and learn’ early retrievals approach

Nov 2017: All 6 deflector plates removed from inside silo

Dec 2017: All 6 access holes cut and doors sealed over holes
First Generation Magnox Storage Pond

Risk reduction focus
• Building strengthened
• Interim storage for fuel and sludge implemented

2019
Export zeolite skips in Self-Shielded Boxes

2022
Complete bulk sludge and fuel exports
Moved into Region A

2033
Complete solid waste retrievals
Start dewatering

2038
Complete dewatering

2048
Existing schedule to complete decommissioning

Use of Remotely Operated Vehicles to retrieve waste

Bulk sludge exports started March 2016

Fuel exports started April 2016. 51te removed in first 12 months

Export of u-bit bins started Nov ’17. By Feb ’18 82te of fuel removed, including u-bit bins
Pile Fuel Storage Pond

**Risk reduction focus**
- Moved into Region A with removal of metal fuel in 2016
- Lead and learn development of retrievals solutions

**Timeline**
- **2019**: Start of Dewatering
- **2022**: Bulk sludge removed
- **2024**: All ILW removed
- **2029**: Pond Dewatered
- **2040**: Original Dewatering schedule

- All bulk fuel removed (2.75te of canned fuel and 3.4te of metal fuel) **70% reduction in radioactive content**
- First dewatering trials carried out Feb 2017
- 140 drums of sludge exported to Waste Encapsulation Plant by Feb 2018
- 83 skips removed (103 remaining). More than 260te of ILW solids removed by Feb 2018
Highly Active Liquor management

Risk reduction focus

• Continued safe storage
• Effective operation of new evaporator
• Anticipated completion of liquor from reprocessing in 2022
• Preparation for post reprocessing requirements
• Supporting site clean up until ~2035
Special Nuclear Materials (SNM) management

Risk reduction focus

• Continued safe and secure storage
• Timely active management of SNM packages
• Provision of retreatment facilities
• Implementing successful consolidation
First Generation Reprocessing Plant Stack
Pile Chimney
Enabling regulation

Supporting the risk and hazard reduction focus at Sellafield
Regulatory Engagement

• How the Office for Nuclear Regulation regulates
  o Nuclear site licensing
  o Permissioning
  o Influence
  o Inspection
  o Enforcement
  o Co-ordination
• “Left hand/right hand” – project delivery/safety, compliance, intelligence and enforcement
• Site Inspections
• Engagement Week and immediate feedback
• Level 3 Regulator Interface Meeting
  o Hold Point Control Plan – guides permissioning activities
• G6 collaborative working
Progressing the mission at Sellafield

- Significant progress has been made with hazard and risk reduction
- Effective investment in security enhancements has strengthened the site
- Resilience programme fully implemented incorporating post-Fukushima learning
- Cyber security analysis confirms no significant radiological release potential from Sellafield plant
- 24/7 cyber security operations centre established
- Completion of reprocessing on track to facilitate simplification for the future
- Long term spent fuel storage being implemented pending future direct disposal
- Waste retrievals approach now underway
- Major skyline change indicates progress with remediation
- Relocation of Special Nuclear Materials inventory into modern storage underway
- Plants and projects to support the mission are in design, build, delivery and early stages of operation
- Supply chain skills are an integral part of delivery
- Enhancements of capability and capacity to undertake future projects in hand
- Skills training and apprenticeships integrated to provide future workforce skills
- Enabling regulation supports our success
- Effective stakeholder engagement is a continuing activity
Summary

- Sellafield is a complex site. Many facilities cannot simply be shutdown
- Hazard profile is well characterised but still significant
- Priorities focused on high hazard and risk reduction
- Programmes aligned to delivering risk reduction in the near term
- Independent oversight and assurance is important
- Risk Management Framework supports effective safety management and investment decisions
- Enabling Regulation encourages progress in the key areas
- Skilled and competent workforce, leadership and supply chain are focussed on delivery
- Emergency preparedness and resilience are crucial and is available 24/7 and regularly tested
- Effective stakeholder engagement is essential
- Significant additional investment in new facilities is required to deliver the mission
- Relentless focus needs to be maintained for decades