Office for Nuclear Regulation

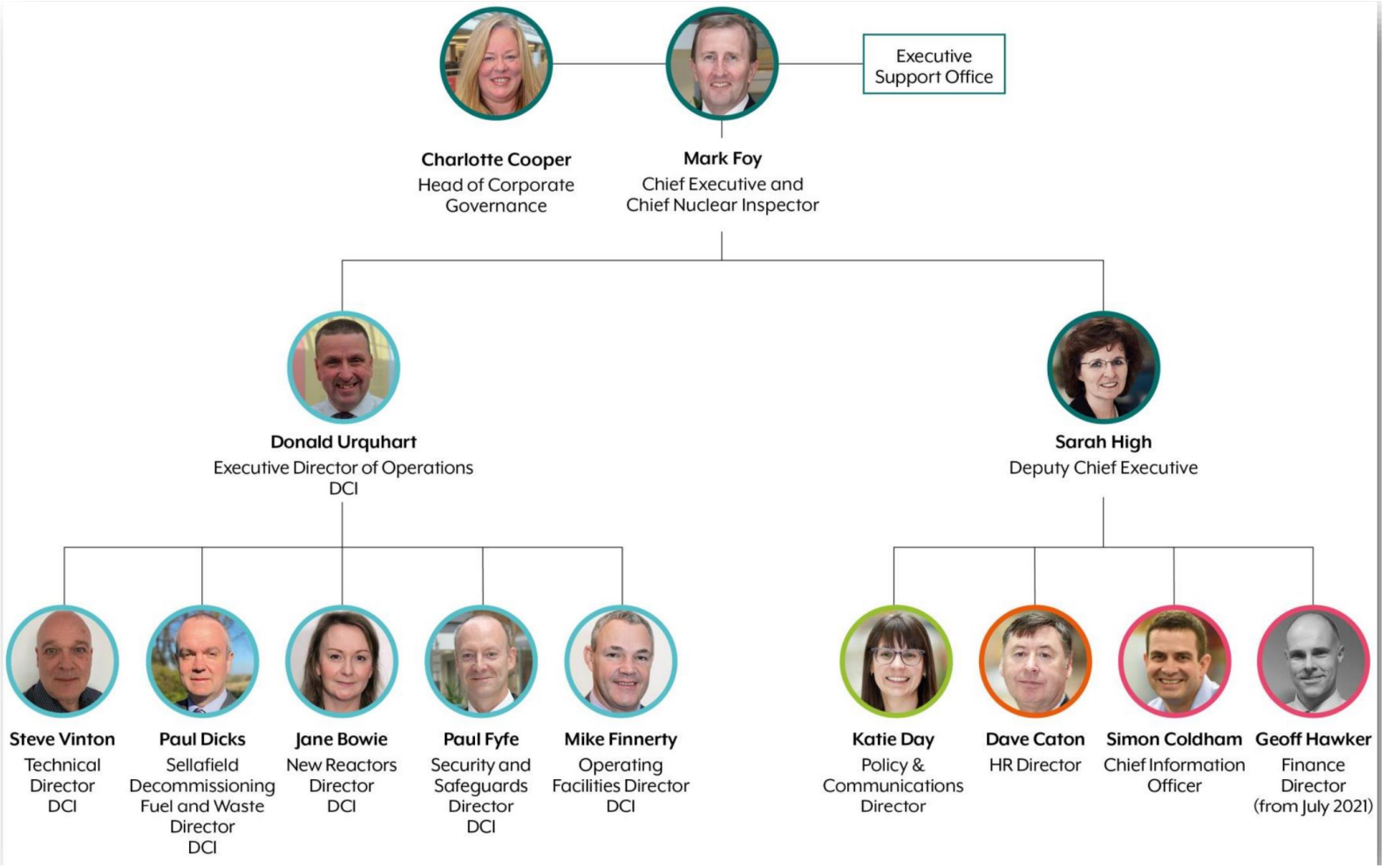
ONR NGO Forum meeting
26 May 2021

Chief Nuclear Inspector update

Topics of Interest

- ONR leadership update
- Latest ONR position on COVID-19
- Movement of higher activity waste from AWE to Sellafield
- Bullying, harassment, and discrimination at Sellafield
- Hinkley Point C silo collapse
- Latest developments at Hinkley Point B and Hunterston B
- Sizewell B outage
- Enforcement activities over the last quarter

ONR leadership update



Latest ONR position on COVID-19

- Ensuring safe nuclear operations has remained our priority
- We remain satisfied with industry's response and continue to monitor the situation
- Focus on staff/public wellbeing and regular engagement with dutyholders
- Now returning to 'near normal' operations across all areas of regulation
- Updated guidance for site inspections, supported by antigen testing
- Embedding opportunities for new ways of working, based on learnings from the pandemic
- Post-incident review (post June 2021)

Movement of Higher Activity Waste from AWE to Sellafield

- ONR has permissioned the export of Higher Activity Waste (HAW) from AWE Aldermaston to Sellafield
- Up to 5,000 drums will be transported over the next 8 years
- It will be processed with similar Sellafield wastes and placed into long-term storage, pending disposal
- First shipment was completed successfully in April
- Key enabler to hazard and risk reduction at the Aldermaston site

Hinkley Point C (HPC) silo collapse

- Ground Granulated Blast-furnace Slag (GGBS) silo collapsed suddenly on 10 June 2020
- Situated off the nuclear licensed site, but on the wider construction site
- Silo not being used to supply GGBS to batching plant at the time of the event
- Following preliminary enquiries, we were satisfied that further investigation was not warranted:
  - No one was injured
  - No harm or potential for harm to the public
  - No nuclear consequences or impact on the permanent plant
  - No similar silos at HPC
  - No similar events at HPC
  - Confidence in licensee's approach to investigations
  - Content with scope of licensee's investigation
- ONR has engaged closely with the licensee since the event and throughout their investigation

Hinkley Point C (HPC) silo collapse

ONR engaged closely with the licensee since the event and throughout their investigation

ONR is satisfied with the licensee's response:

- Exclusion zone implemented immediately
- Structure reduced in size promptly to mitigate risk of further collapse
- Evidence carefully preserved
- Thorough investigation instigated by the licensee, including independent members
- Learning to be shared via Collaborative Reporting for Safer Structures (CROSS-UK)

Hinkley Point C (HPC) silo collapse

- Key findings from the licensee's investigation:
  - Silo was not being used at the time of the failure
  - No evidence of maloperation or misuse
  - Failure likely occurred from overloading of a bolted joint in the cone section
  - The cause of overload was poor design of the silo
- No further ONR action likely
  - No implications for the HPC permanent plant and no other similar temporary structures at HPC
  - Licensee's investigation robust – based on a review of investigation report and engagement with licensee over last 11 months
  - Learning to be shared by HPC/its contractors through an appropriate route

Bullying, harassment and discrimination at Sellafield

- We carried out a detailed intervention on site (March 2021) and found no evidence of a link with safety and security at this point in time
- We have judged that Sellafield's Equality, Diversity and Inclusion (EDI) programme and proposed measures are appropriate to address the reported issues
- Sellafield staff across various groups (including BAME, LGBT+, Safety Reps) are supportive of these measures and reported good progress
- ONR is satisfied there is no validity to the BBC suggestion that safety might be affected, however a continued focus/commitment to cultural improvements is needed
- A new Regulatory Issue has been raised and ONR will follow up and monitor the outcomes, including results of the next EDI survey

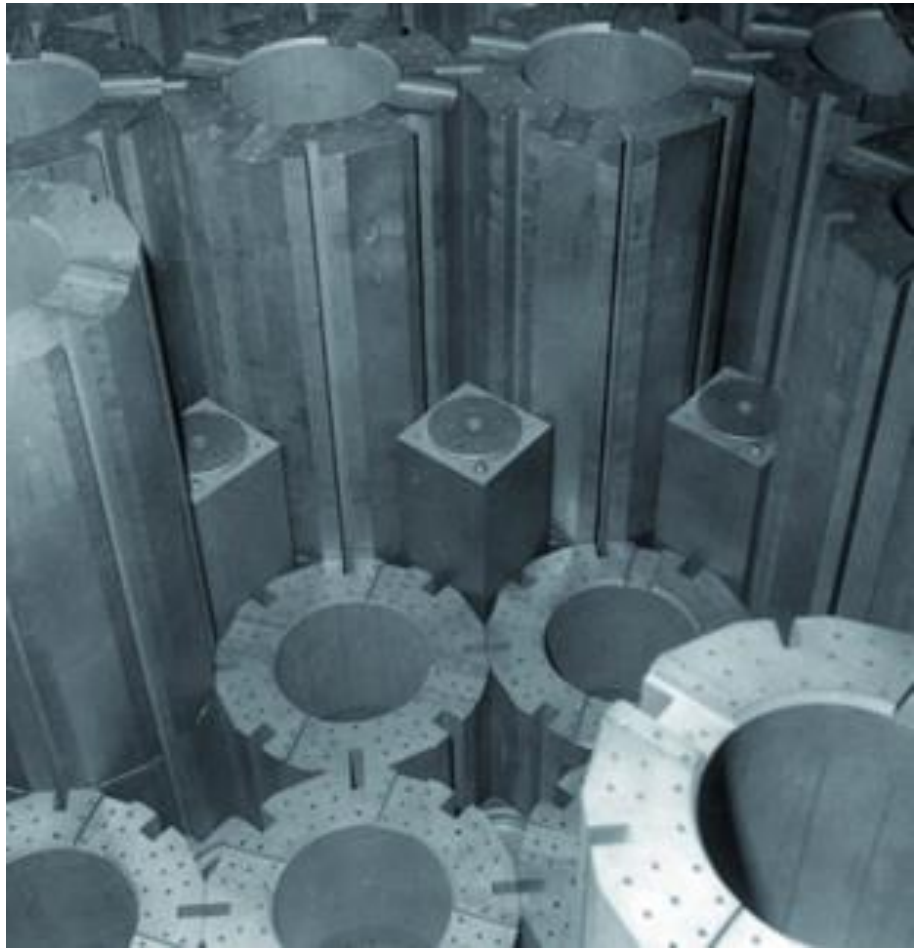
Hinkley Point B & Hunterston B Update

Hunterston B

- Agreed to Reactor 3 return to service in August 2020 and in September 2020 for Reactor 4
- Reactors operated safely for approximately 6 months after over 2 years being shutdown
- Both reactors required to shutdown for further graphite inspection
- ONR granted permission on 13 April 2021 for Reactors 3 and 4 to return to service for a further limited period of operation
- Reactor 3 is currently operational; Reactor 4 is currently undergoing graphite inspection
- Both reactors will be shutdown permanently by 7 January 2021

Hinkley Point B

- Reactor 3 shutdown in February 2020 and Reactor 4 in June 2020
- Granted permission on 17 March 2021 to operate to higher core burn-up
- EDF announced end of generation by 15 July 2022



Sizewell B Outage

- Sizewell B entered its period of statutory outage last month
- Removal and inspection of the RPV head was undertaken
- It identified an issue with control rod drive mechanism (CDRM) thermal sleeves – with movement evident
- EDF developing a solution to repair the CRDM thermal sleeves
- ONR will examine any proposed solution to ensure that the integrity and safety of the reactor is maintained
- The period of the outage will be extended to enable a repair to be implemented

Enforcement Activities over the last quarter

- Enforcement Letters – 5 Issued
  - 3 to Sellafield
  - 1 to Hinkley Point C
  - 1 to AWE
- Direction – 1 issued (EDF)
- Improvement Notices – 0 Issued
- Investigation – 0

Thank you

Questions and Discussion

Refreshment Break

Office for Nuclear Regulation

What are the prospects for small modular nuclear reactors?

Professor Steve Thomas
Emeritus Professor of Energy Policy, Business School, University of Greenwich, London

Greg Jaczko

Advanced nuclear has become the catch-all for the knight-in-shining-armor reactors that promise to address issues that have kept nuclear a marginal electricity player since its inception. But we need more than this open-ended definition. The Biden administration should support projects only if they can compete with renewables & storage on deployment cost & speed, public safety, waste disposal, operational flexibility & global security. There are none today.

Gregory Jaczko, Former Chair US Nuclear Regulatory Commission, Feb 2021

Admiral Hyman Rickover (1970)

An academic reactor has the following basic characteristics

1. *It is simple*
2. *It is small*
3. *It is cheap*
4. *It is light*
5. *It can be built very quicky*
6. *It is very flexible in purpose*
7. *Very little development is required. It will use mostly 'off the shelf' components*

A practical reactor has the following characteristics

1. *It is being built now*
2. *It is behind schedule*
3. *It is requiring an immense amount of development on apparently trivial items. Corrosion is a problem*
4. *It is very expensive*
5. *It takes a long time to build because of engineering development problems*
6. *It is large*
7. *It is heavy*
8. *It is complicated*

What are Small Modular Reactors (SMRs), Advanced Nuclear Technologies (ANTs) & Advanced Modular Technologies (AMTs)?

- IAEA defines SMRs as smaller than 300MW (cf Hinkley Point C, 1600MW)
- SMRs comprise range of technologies from scaled-down versions of the type widely built, Pressurised Water Reactors (PWRs), through designs built as prototypes but not commercially offered (High Temperature Reactors), to designs never built Lead-cooled Fast Reactor (LFRs)
- Comprise a range of sizes from 4MW (U-Battery) to 470MW (Rolls Royce SMR)
- UK government invented Advanced Nuclear Technologies to cover SMRs of whatever size – to include Rolls Royce? UK uses SMR to cover only PWRs
- Advanced Modular Reactors are expected to operate at 800+C to make hydrogen & other fuels. PWRs operate at about 300C
- Modular can mean factory built & transported to site for assembly, and/or built as a cluster of, say 12 reactors sharing central facilities. UK government does not mention latter meaning

What is their rationale?

- Building components in large numbers on production lines will make them much cheaper, more than compensating for lost economies of scale, ie building bigger
- Doing more of the work in factories means quality is easier to control & schedules & costs less likely to overrun
- Building in clusters means capacity can be added incrementally according to demand needs reducing financing needs
- Will the safety requirements be less because they are small, eg evacuation zones, sharing of facilities?

The 10-point plan (Nov 2020)

- £385m for Advanced Nuclear Fund, comprising £215m for SMRs and £170m for Advanced Modular Reactors plus £40m for supply chains & regulatory capacity
- First SMRs & AMRs to come online by early 2030s
- Previously announced £222m to build a fusion reactor by 2040 plus £184m for infrastructure/skills
- 3 AMRs receiving funds, U-Battery (4MW high temperature reactor), Westinghouse (450MW lead-cooled fast reactor) & Tokamak (fusion)
- According to Gen IV International Forum, AMRs unlikely to be available before 2045 if ever.

The Rolls Royce SMR

- RR design announced 2016, in early development phase. Claimed modular construction but no mention of clusters. Appears to be standard PWR design, eg not integral, not passive safety

- Consortium comprises: Assystem, Atkins, BAM Nuttall, Jacobs, Laing O'Rourke, National Nuclear Laboratory, Nuclear Advanced Manufacturing Research Centre, Rolls-Royce & TWI.

- Slightly larger than the first unit at Fukushima (470MW vs 439MW) & double Trawsfynydd reactors, 250MW

- Will only proceed if risk to RR money is minimal. That means RR will only put effort into design development with government guarantees given now, before design exists, before it has been reviewed by ONR, before a demo plant has been completed and before costs are known

- Rolls Royce estimated it would cost about £2bn to develop the design to point of ordering then £1.8-2.2bn per unit (16 = £35bn)

RR’s guarantee demands

https://old.parliament.uk/business/committees/committees-a-z/lords-select/science-and-technology-committee/news-parliament-2015/nuclear-research-technology-report-published/

- Exclusive access to UK market
- Matched funding (minimum) up to end of Generic Design Assessment
- Sharing of costs for production line facilities (to produce 2 reactors per year)
- Guaranteed orders for 7GW (16 reactors)
- The first plant must be made using production lines so all 16 reactors must be ordered now so no demo plant
- By the time the first is completed, another 8 will be on their way
- No interest in the RR SMR outside the UK

Costs & Times

- RR claims construction time of 4 years & costs (after 5 units) of £1.8bn (£4700/kW). Power cost £40-60/MWh
- Hinkley Point is currently expected to take about 10 years to build and cost £27bn (2020 money), (£8400/kW), £111.7/MWh
- 40-45% of the time and cost of Hinkley. Is that plausible?
- Who would own the plant? Utilities not interested, RAB unlikely, so UK government?
- Only about £18m from government approved, next phase much more expensive
- RR claims first reactor ***soon after*** 2030 but hard to see how this can be achieved

NuScale SMR

- Jan 2021, UK company, Shearwater, announced partnership with US NuScale to develop 3GW hybrid off-shore wind/SMR plant to produce electricity & hydrogen
- Details vague but Wylfa seen as ideal location
- Hydrogen touted as replacement for natural gas in heating & as a transport fuel
- But wholesale price of electricity is 3 times that of gas & nuclear is not cheap electricity so hydrogen produced will be very expensive

NuScale SMR

- NuScale SMR more advanced PWR than RR (eg integral), development since 2003
- Designed as cluster of 12 interdependent reactors
- Initially 45MW, then 50MW, then 60MW, now 77MW so cluster = 924MW
- Major US government funding ($0.5+bn) plus support for demo project
- 50MW version submitted to US regulator in 2017 & approved in 2020 but many issues outstanding
- It didn’t matter because 50MW version not marketed and 77MW version needs major new investigation

NuScale SMR

- Only potential project Utah Associated Municipal Power Systems (UAMPS). USDOE funding for part of the project but not sufficient investors yet for rest of project

- Target cost $2800-3600/kW, power price $50/MWh, first power 2030

Thank you

Questions and Discussion

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Summary and Close

Katie Day and Dr Jill Sutcliffe