Control rod cutting at Ågesta NPP

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NEA-EGRRS Webinar

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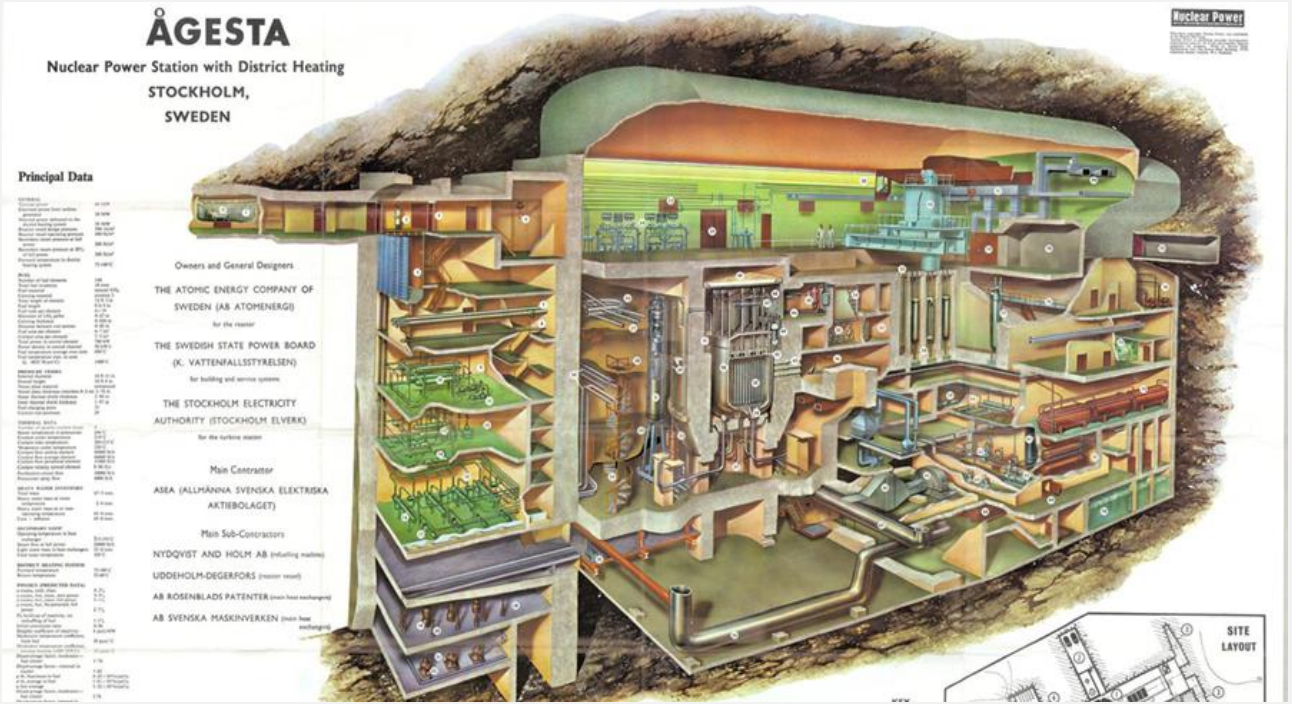
Control rod cutting at Ågesta NPP

About Ågesta NPP

- First commercial reactor in Sweden
- Heavy water cooled and located in an underground rock
- In operation between 1964 and 1974
- Fuel and heavy water were removed after shutdown.
- Sleeping Beauty until 2019.



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Control rods

Coarse control rods Ågesta – data

- Number: 27 units
- Length: 5.1m with the absorber in the non-deployed position
- Absorbers control length: 3m
- Largest diameter: 182mm
- Weight: approximately 400kg
- Absorber composition: inner and outer tube made of stainless steel and a mid-layer comprised of silver, indium and cadmium.
- Dominating nuclides: The isotopes which provide the highest contributions to dose rate are Ag-108 and Co-60. ■

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The challenge at Hand

- No suitable ‘ready to use’ concepts for on-site segmentation, conditioning or transport.
- Expected dose rate 35-1000 mSv/h), up to 30mSv/h at a range of 1m.
- Original transport cask not in use for 30+ years.
- Need for segmentation to enable transport and to separate activated parts from the rest..
- Manual segmentation deemed unsuitable
- Limited space in reactor hall – and outside.

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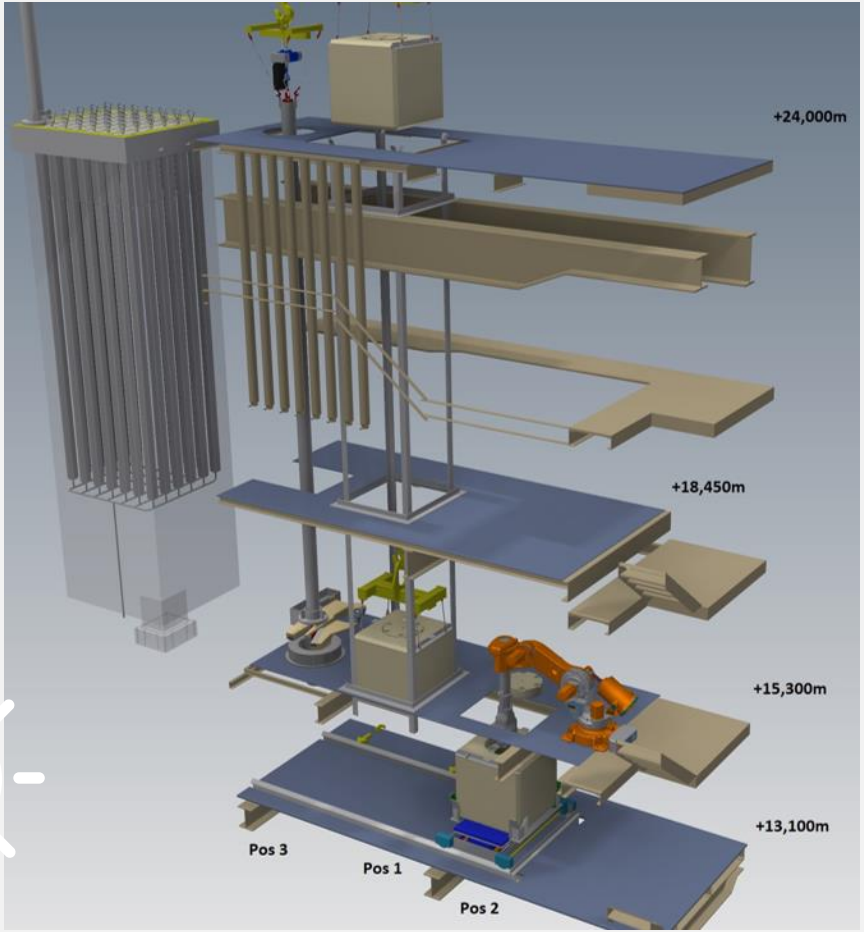
Selected Approach

- Two main options identified and compared — off-site segmentation and in-situ segmentation
- Vattenfall's Business Unit Nuclear Decommissioning (BU.ND) decided to proceed with in-situ segmentation.
- Project initiated to continue development of concept and design of equipment for handling and segmentation of control rods (cutting rig).



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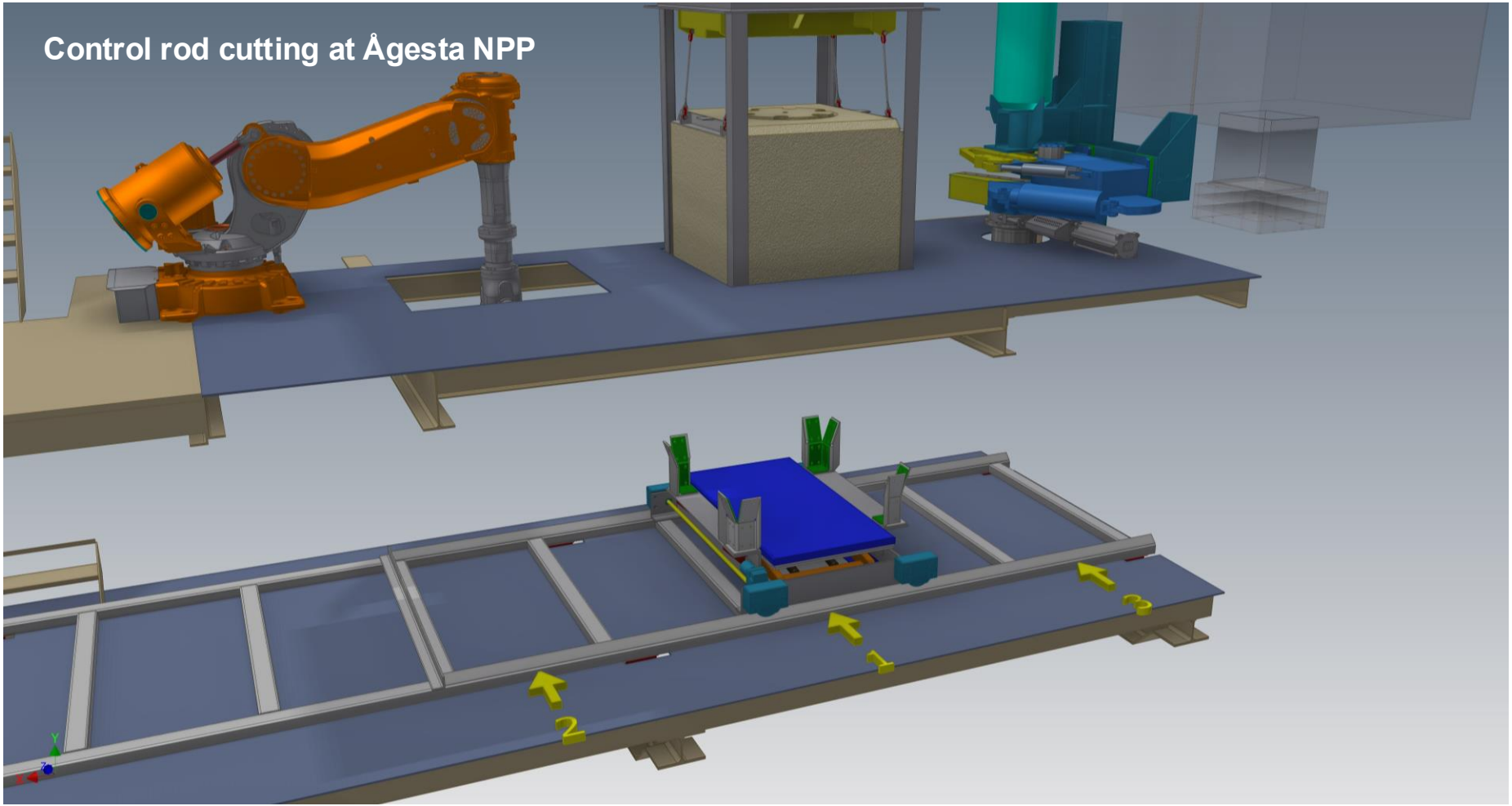

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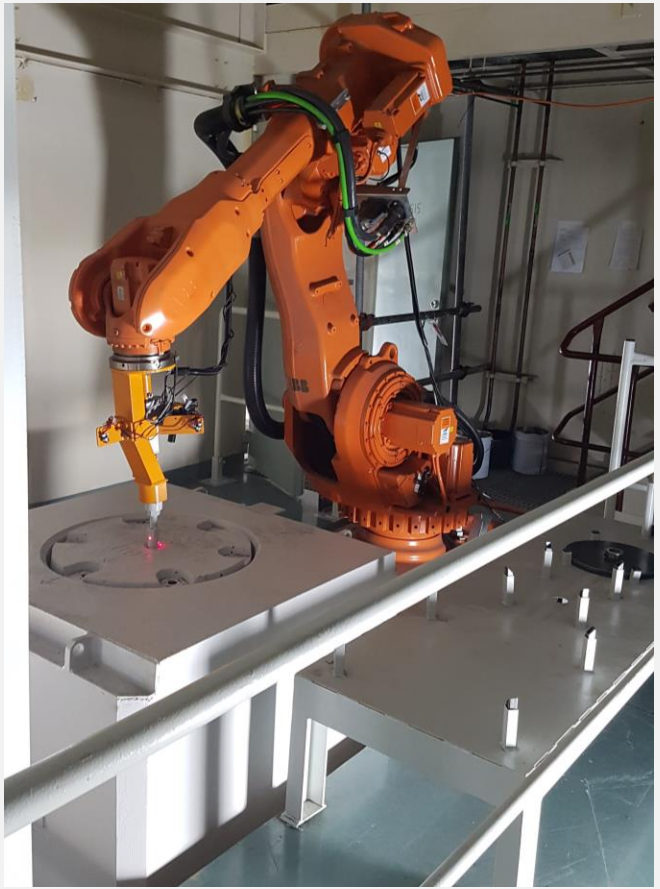
Preparation of concrete mold



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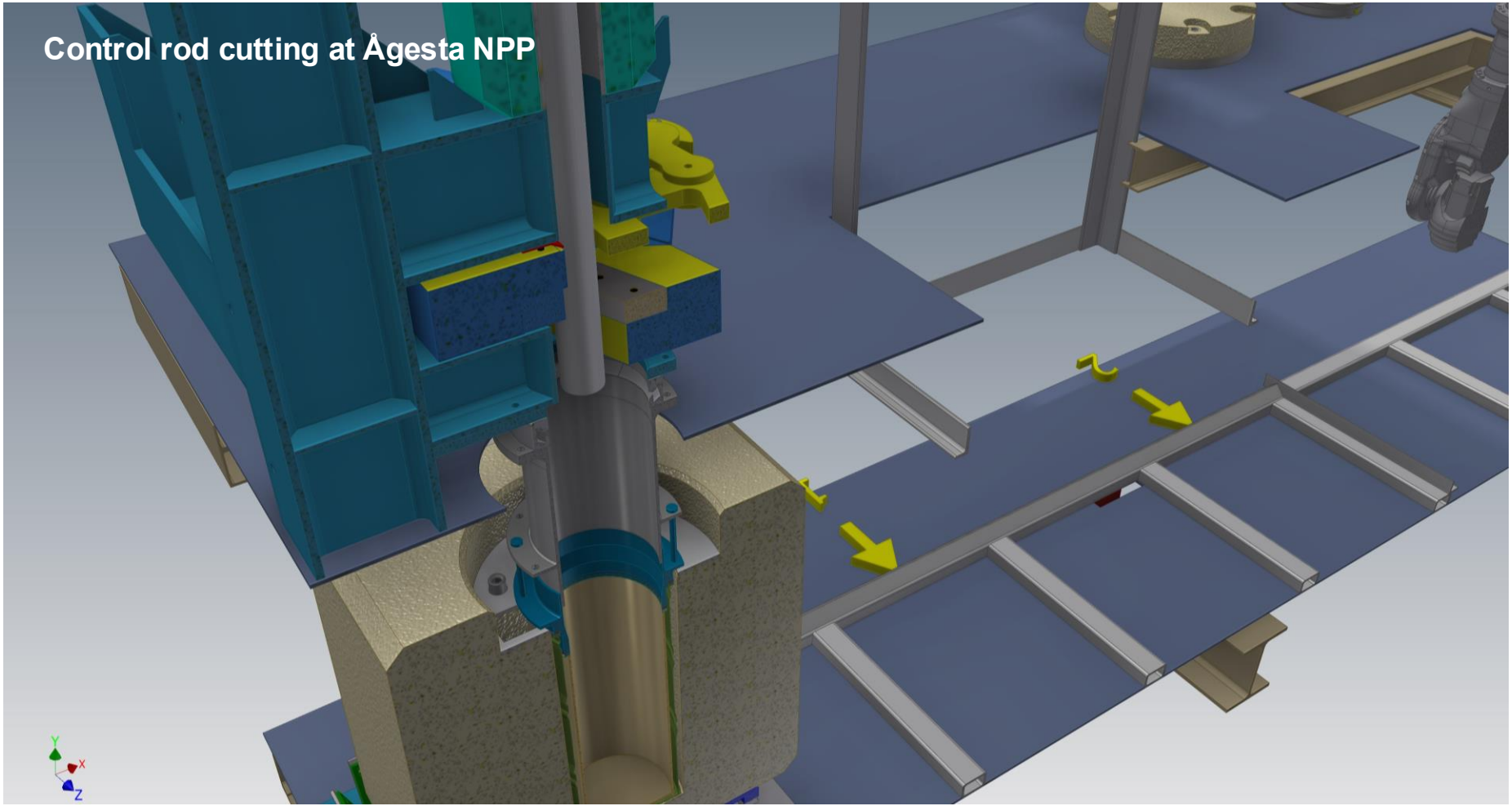

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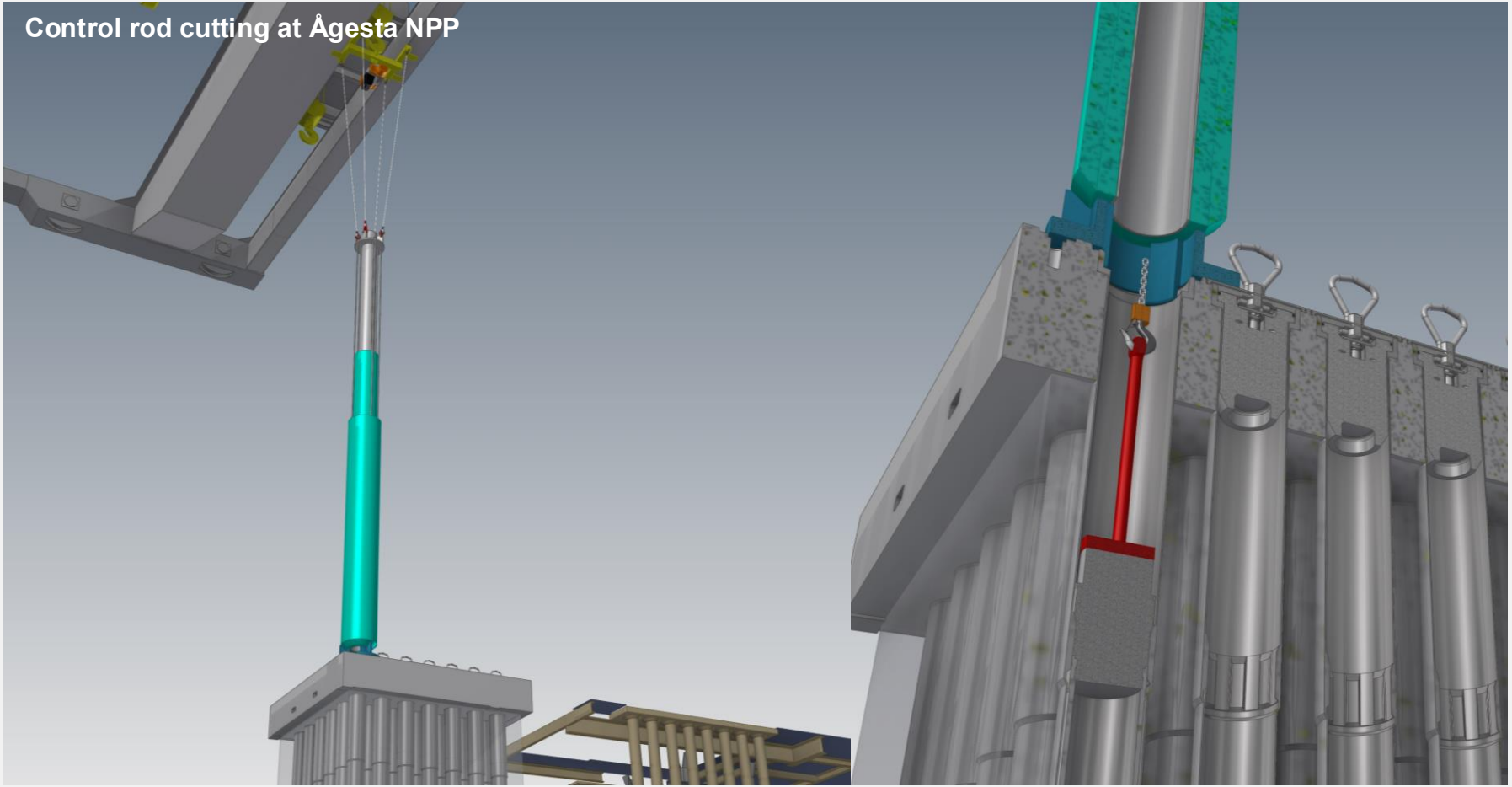

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Lift and transfer of control rod

- Docking ring placed on the position with the control rod
  → stabilizes the heavy radiation protection tube
  → enables safe manual connection of telfer

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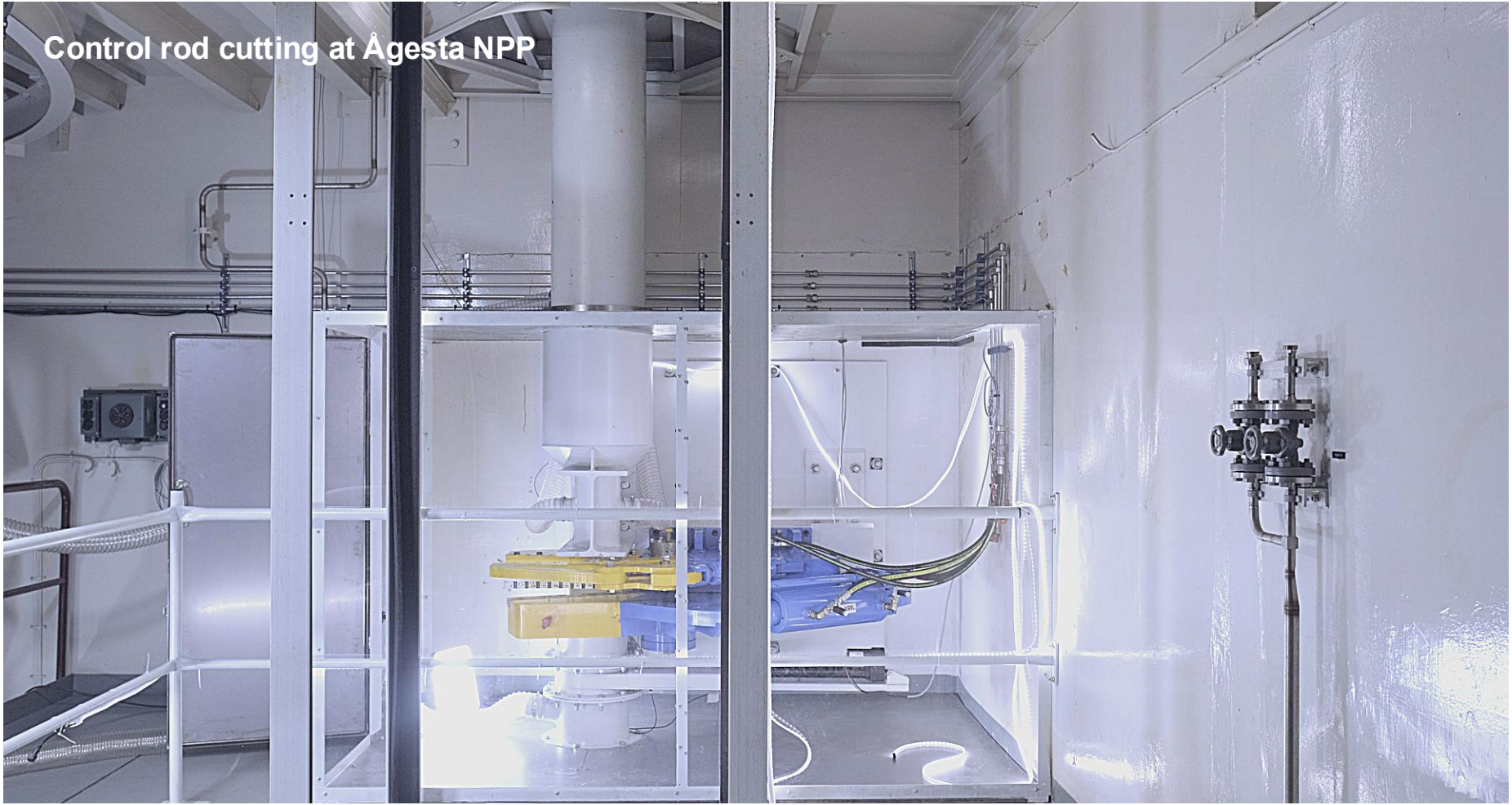

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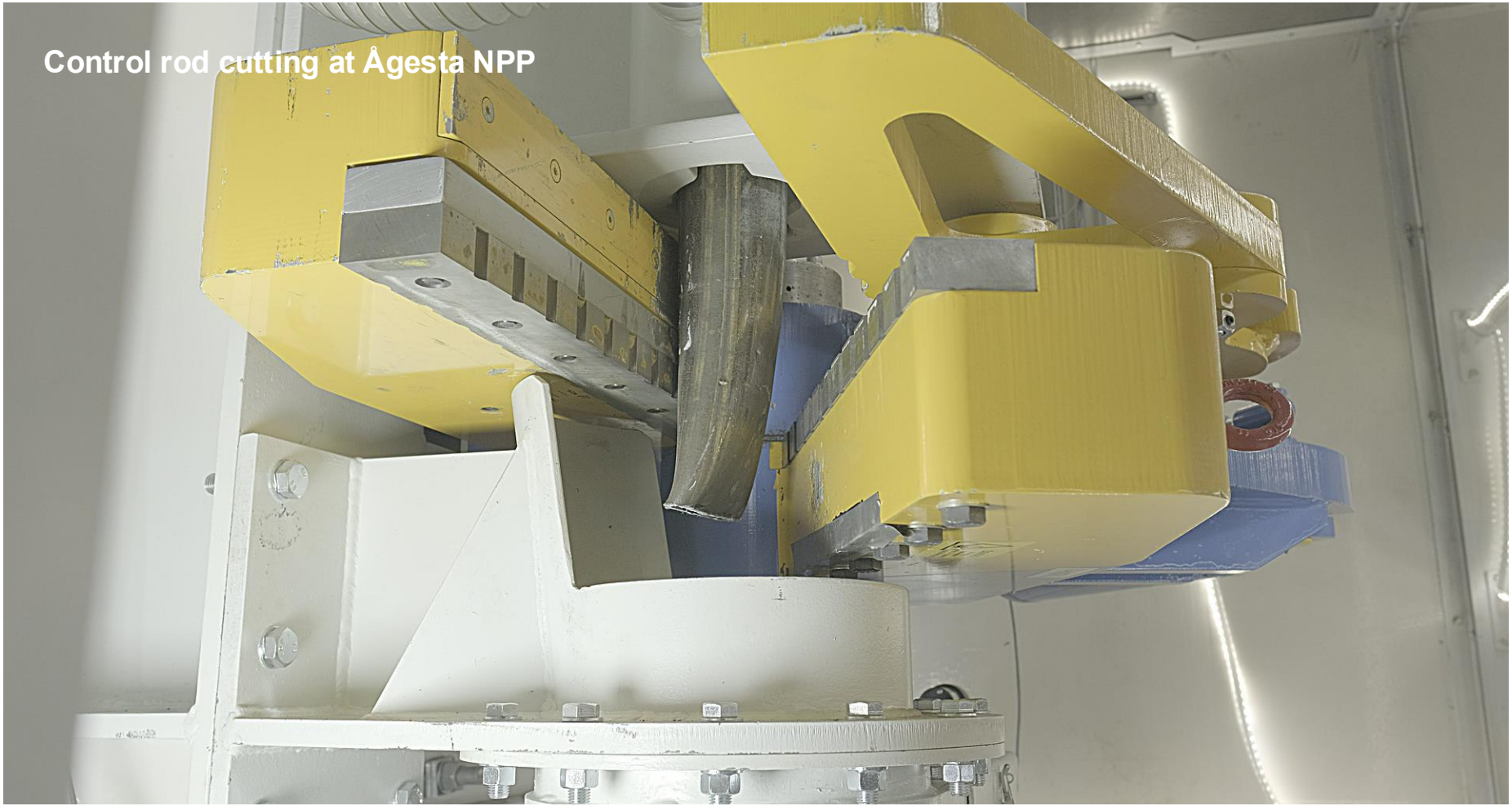

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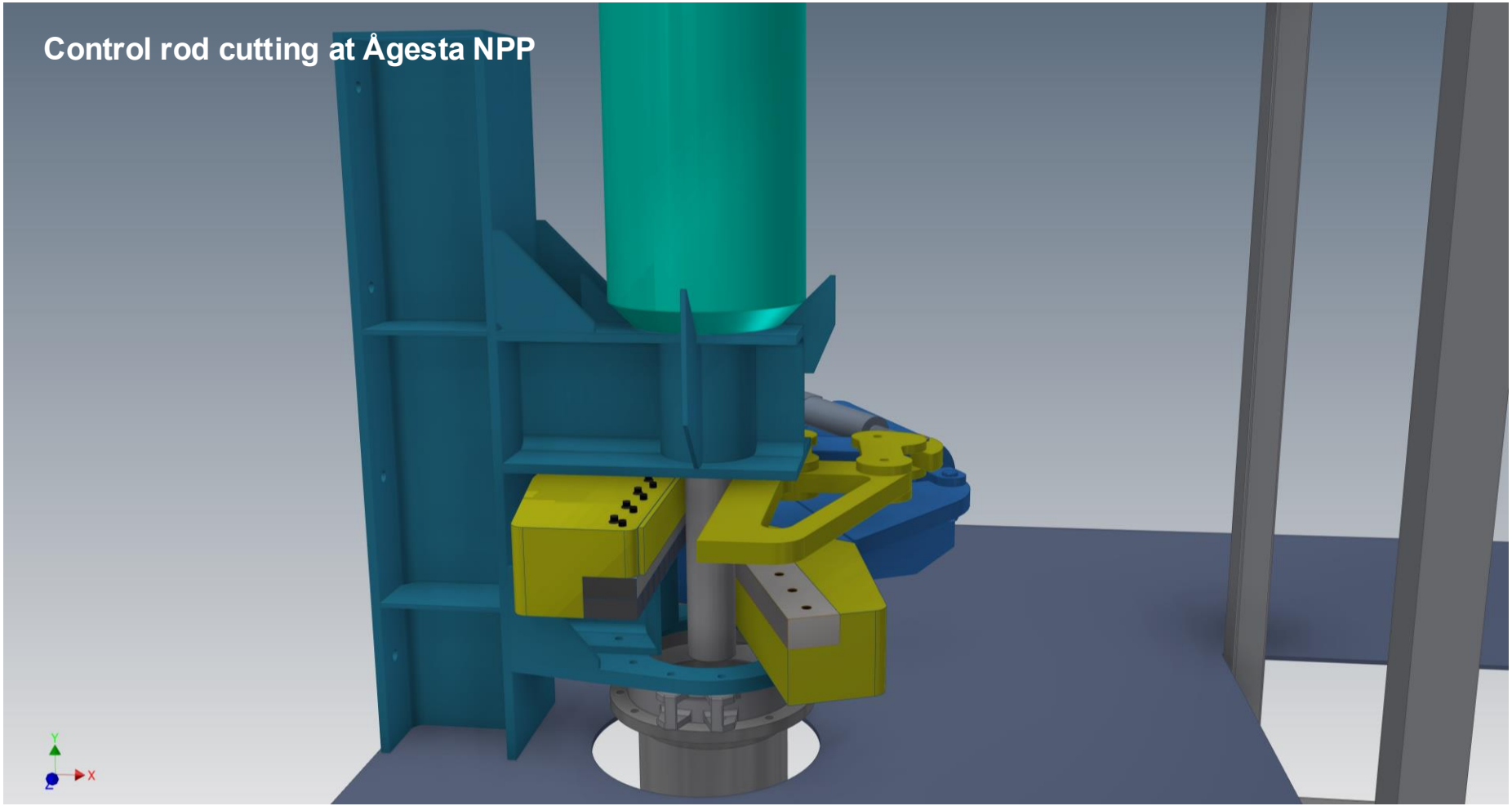

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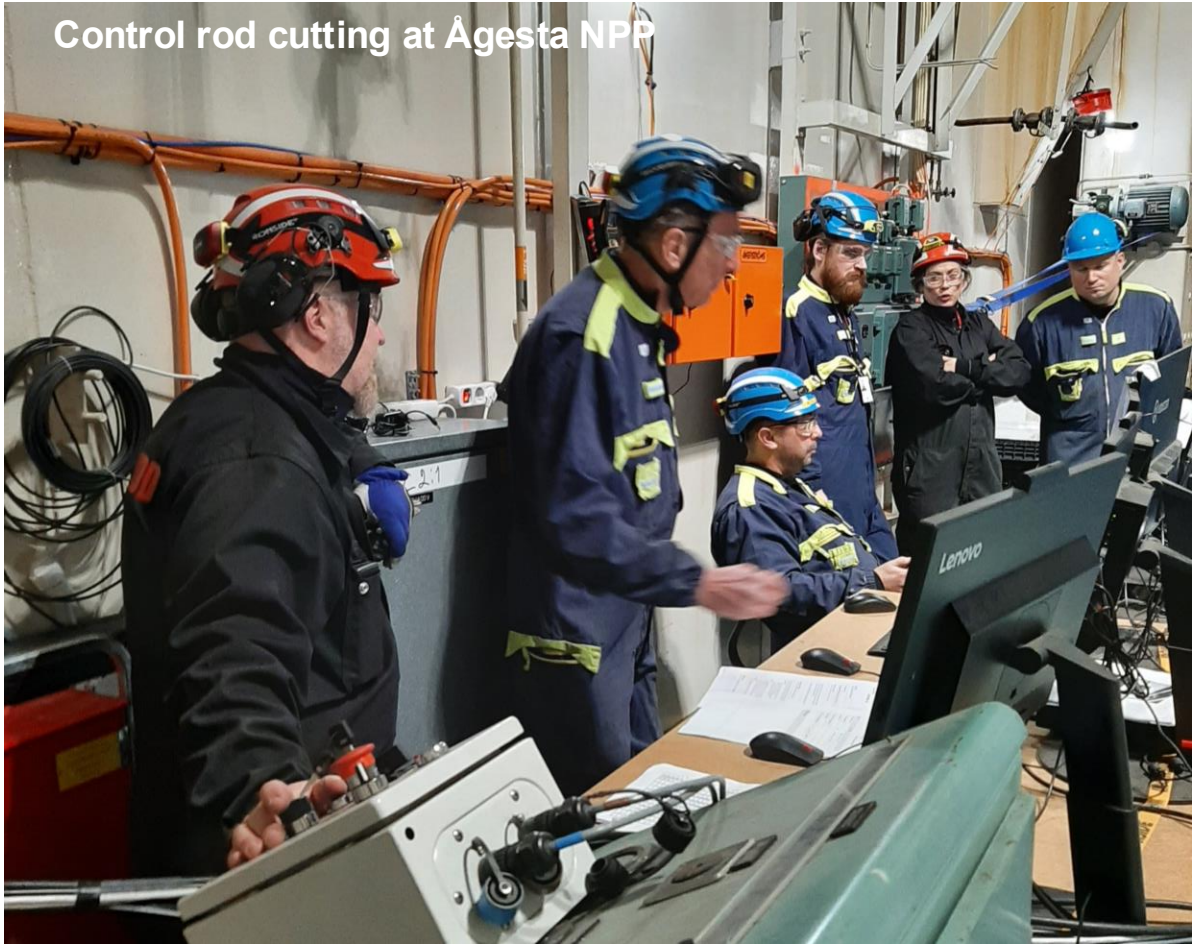

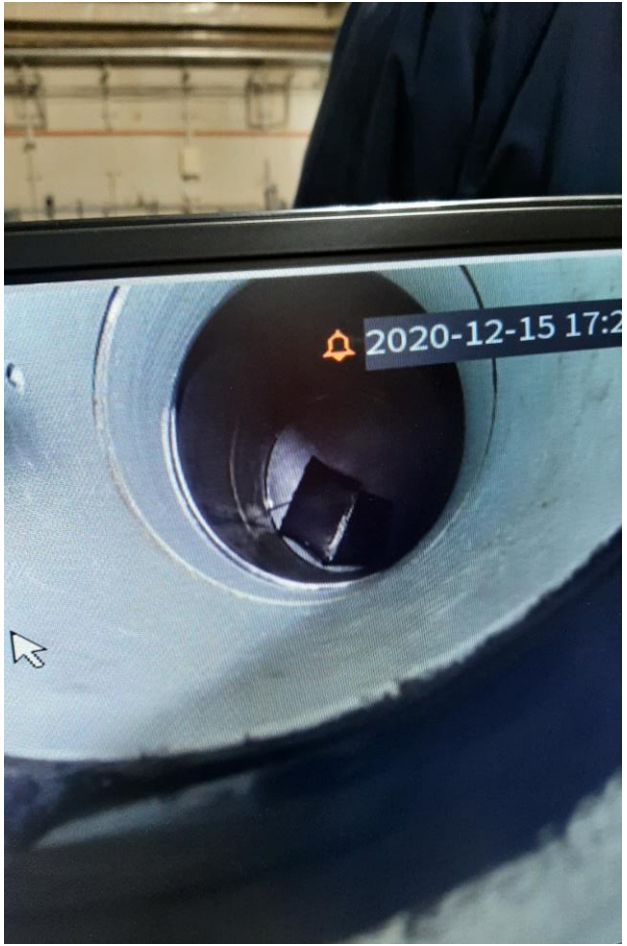

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Remote control – view from operator

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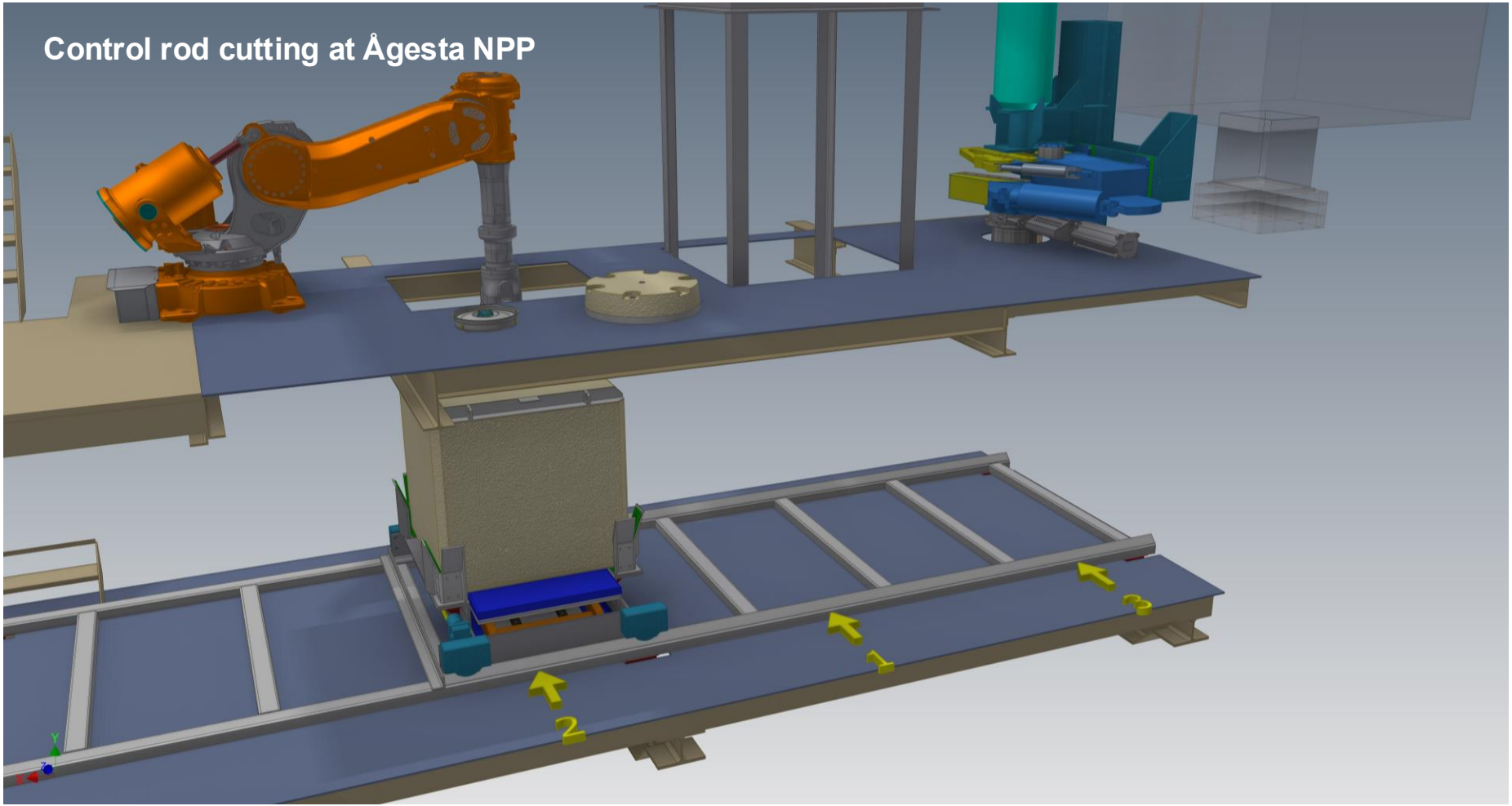

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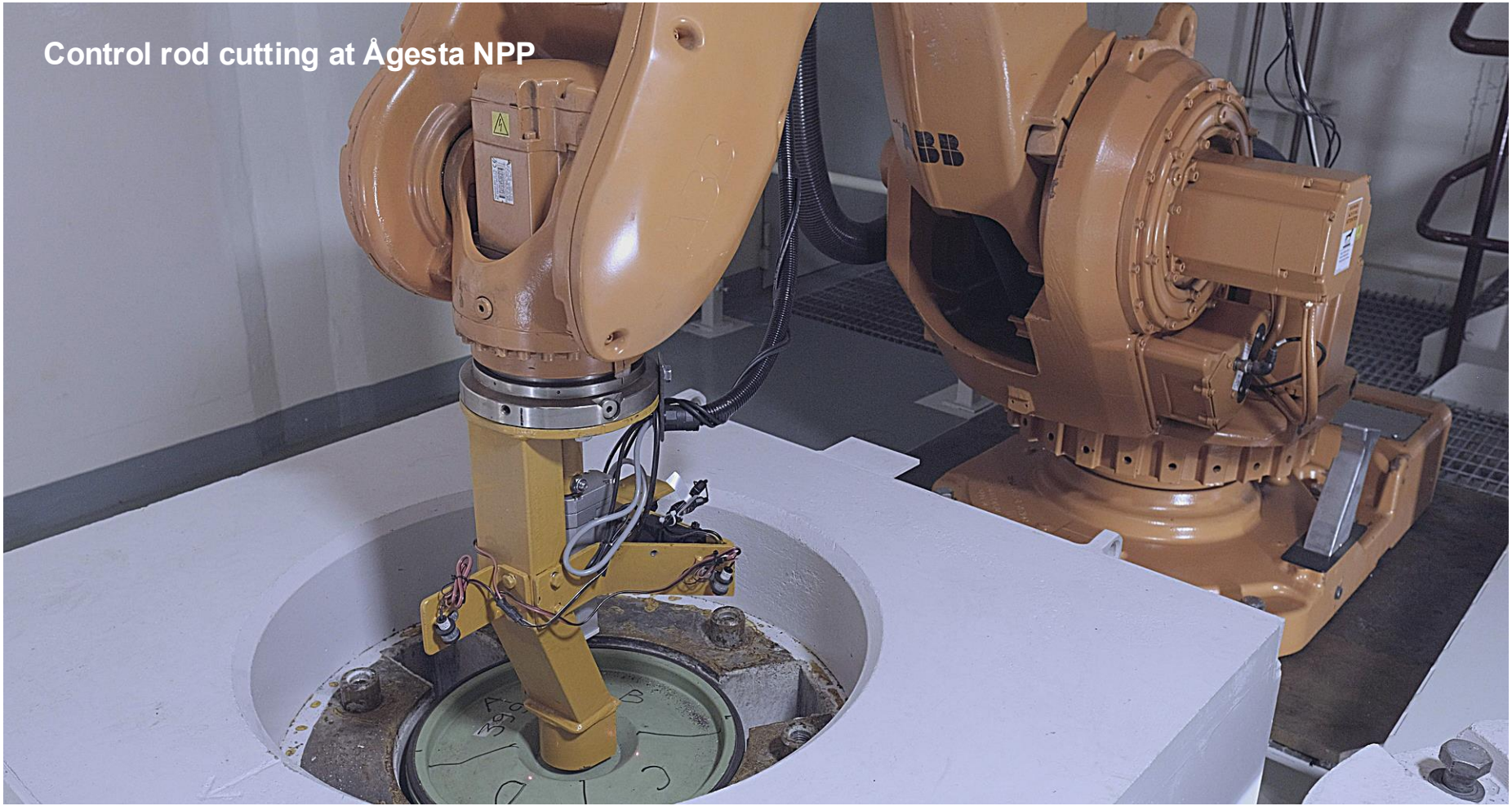

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Loading at Ågesta NPP

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Reloading at facility AB Svafo (Studsvik)

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Design Principles & Success factors

- Utilize the facility's inherent structural characteristics as design assets.
- Short lifetime, limited number of cuts → adjusted design approach. (The art of avoiding the full construction standards applied in operating NPPs.)
- Manual handling avoided - ALARA
- Simple and robust preferred.
- Control cabinets and hydraulic units placed outside cutting area → facilitates repair
- Standard components (e.g. cameras) often sufficient where replacement is manageable.
- Close contact with manufacturer during testing

Lessons learned

- Challenging to use robotics and full automation when part of the equipment is not tailored for automation from the beginning. (lid outer measures, hole pattern in mould etc.)
- Plan for repeated testing and adjustment before on-site installation. A nearby manufacturer is an advantage for quick adjustments and support.
- Small and dedicated core team made the collaboration effective.
- When possible, use inactive testing to evaluate identified theoretical risks before taking measures to avoid the risk. We ended up creating a real problem (too narrow design above the scissors) by changing the design in response to an identified risk (theoretical risk of oscillation and difficulties in positioning the absorbent in the right place before cutting).
- Overall assessment: By using a tailor-made arrangement of proven equipment and technology, it was possible to develop a technical solution to enable the in-situ segmentation of control rods.