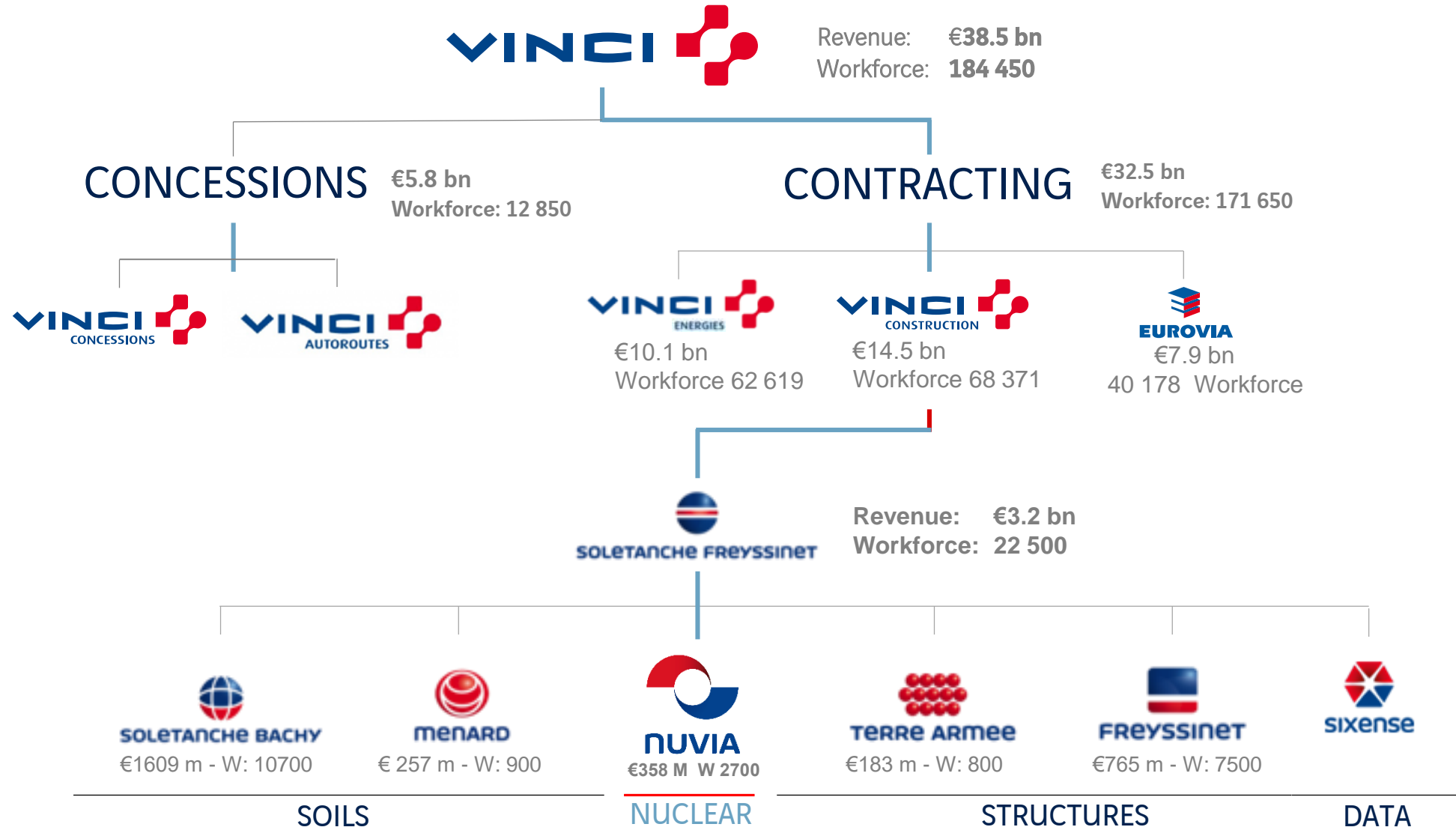




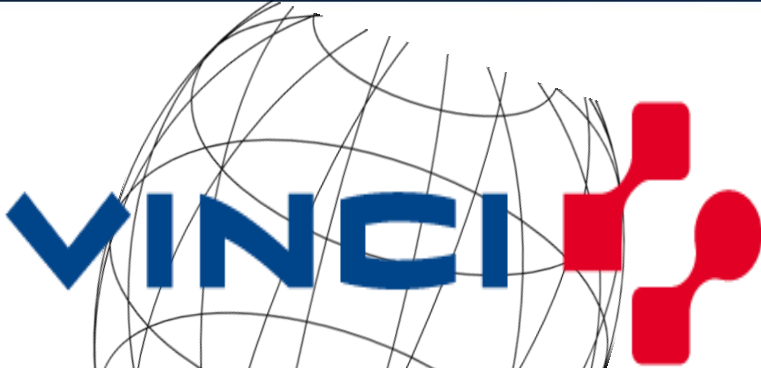
## Nuvia Experience in Decommissioning




Technical Meeting 'Experience of Reactor Dismantling' Ingalina NPP, Lithuania,  
18 October 2018

# Vinci and Nuvia

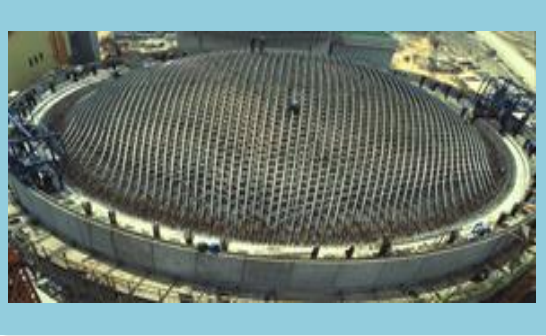
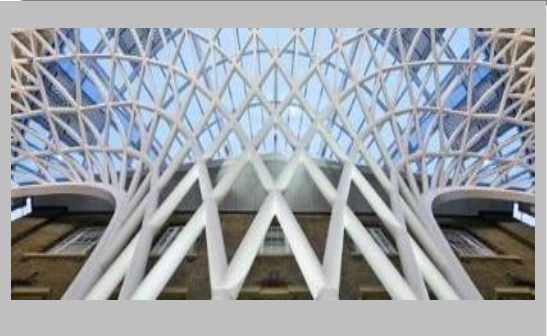


# VINCI: The world's leading construction & concessions company



-  VINCI is the largest construction & concessions company in the world
-  Vertical integration allows us to provide turnkey solutions and supporting operations
-  Nuvia is the Nuclear arm of VINCI Construction, providing international capability

In nuclear civil engineering, VINCI offers substantial expertise around the world, from design and construction of containments to dismantling of these structures.

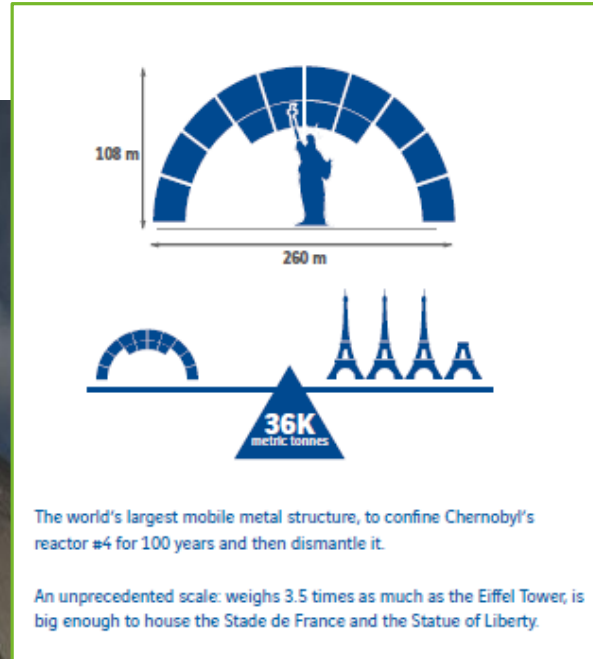
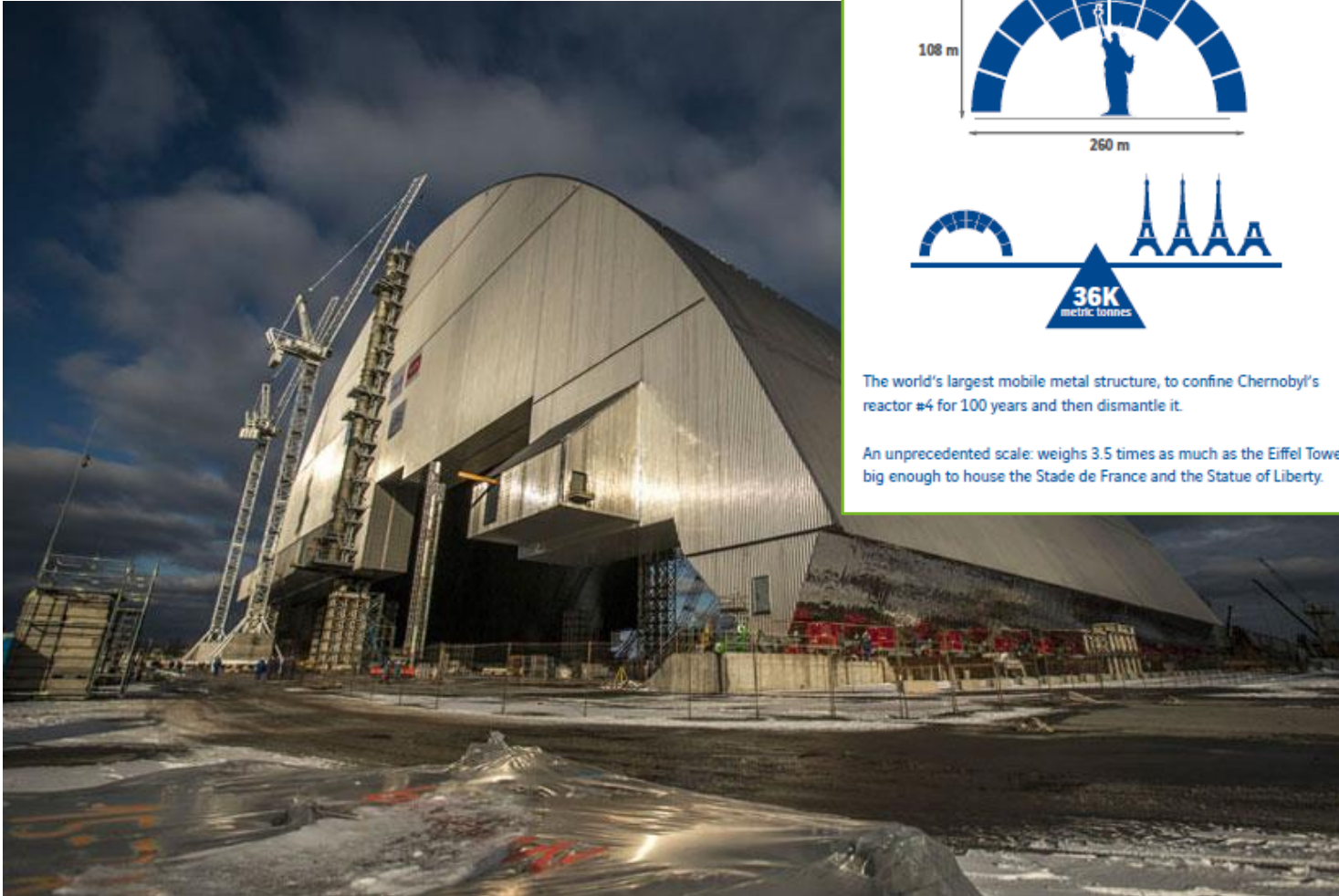


Contracting  
32.5 bn €

Concessions  
5.8 bn €



# Containment and Decommissioning Facility - Chernobyl



## Scope

- Design and construct the New Safe Confinement and position over the Chernobyl reactor
- Delivered by Novarka – the French construction consortium formed by VINCI Construction and Bouygues Construction
- 1.5Bn EUR Project

## Challenges

- Construction performed away from the reactor
- Construct the largest moveable land-based structure ever built
- An unprecedented scale: weighs 3.5 times as much as the Eiffel Tower, is big enough to house the Stade de France and the Statue of Liberty.

## Outcome

- Shelter has now been successfully moved into place
- Airtight seals and equipment tests to be completed in 2017 ready for final handover.

Nuvia

# Business Sectors



# Nuvia Group

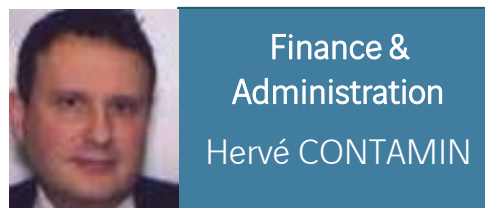
Nuvia is an international organisation with offices located across the globe

We have a diverse, international client base, which all have unique challenges

Our global outlook enables us to invest our resources to best support our clients



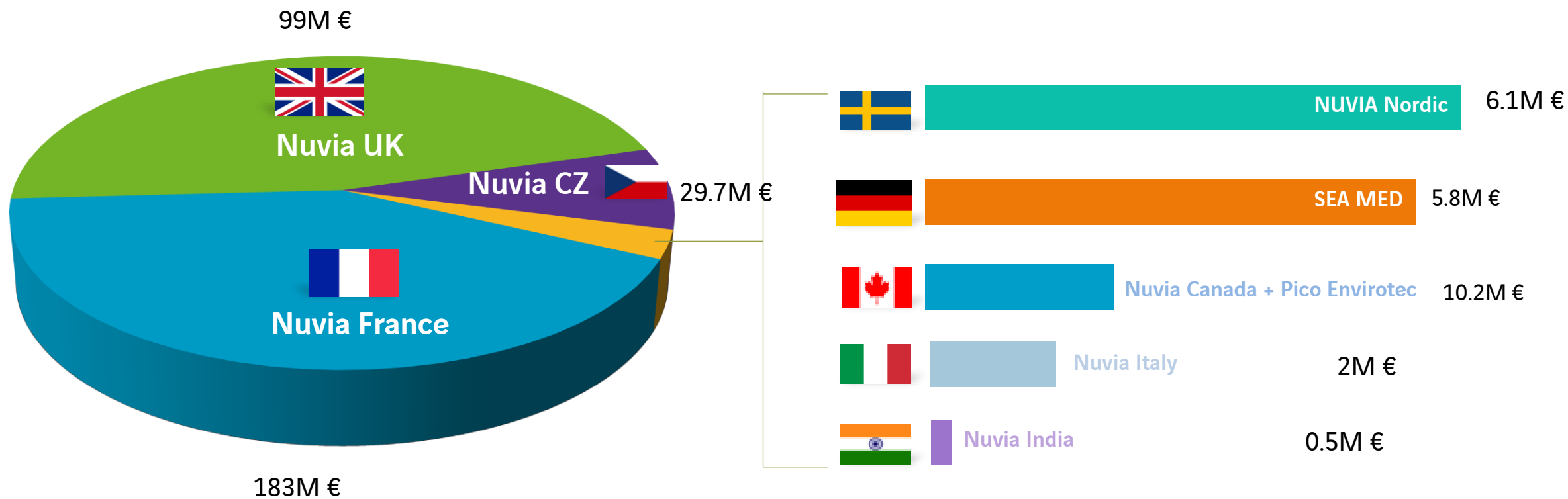
# Nuvia Group Corporate Structure





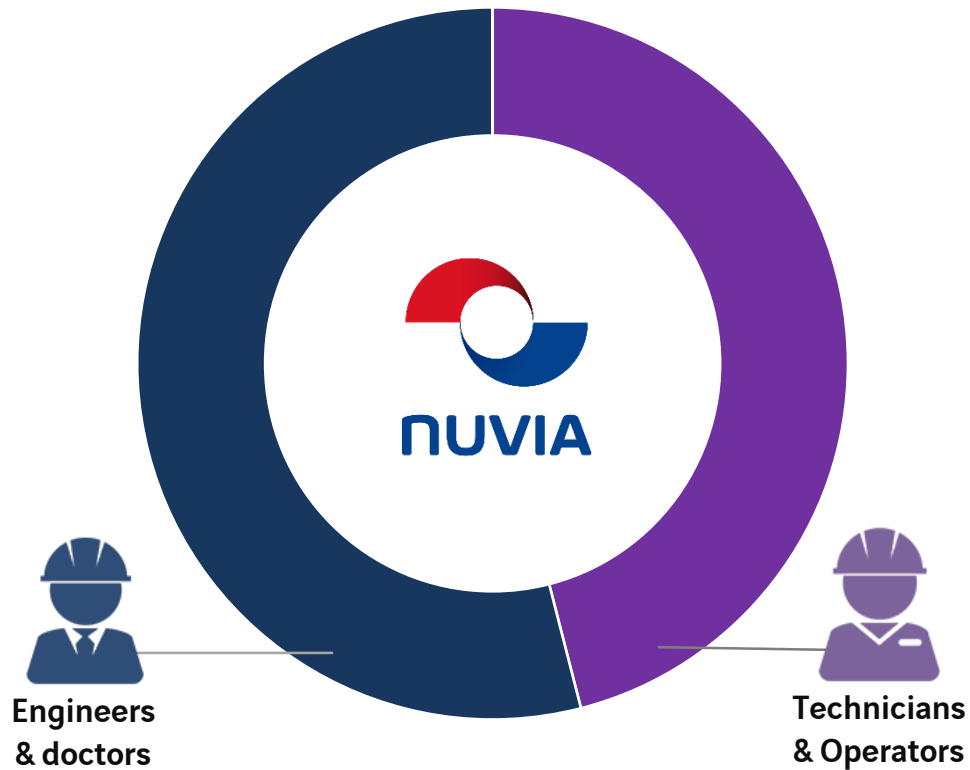
# Nuvia Group Key Figures

2017 Revenue  $\approx$  335M €

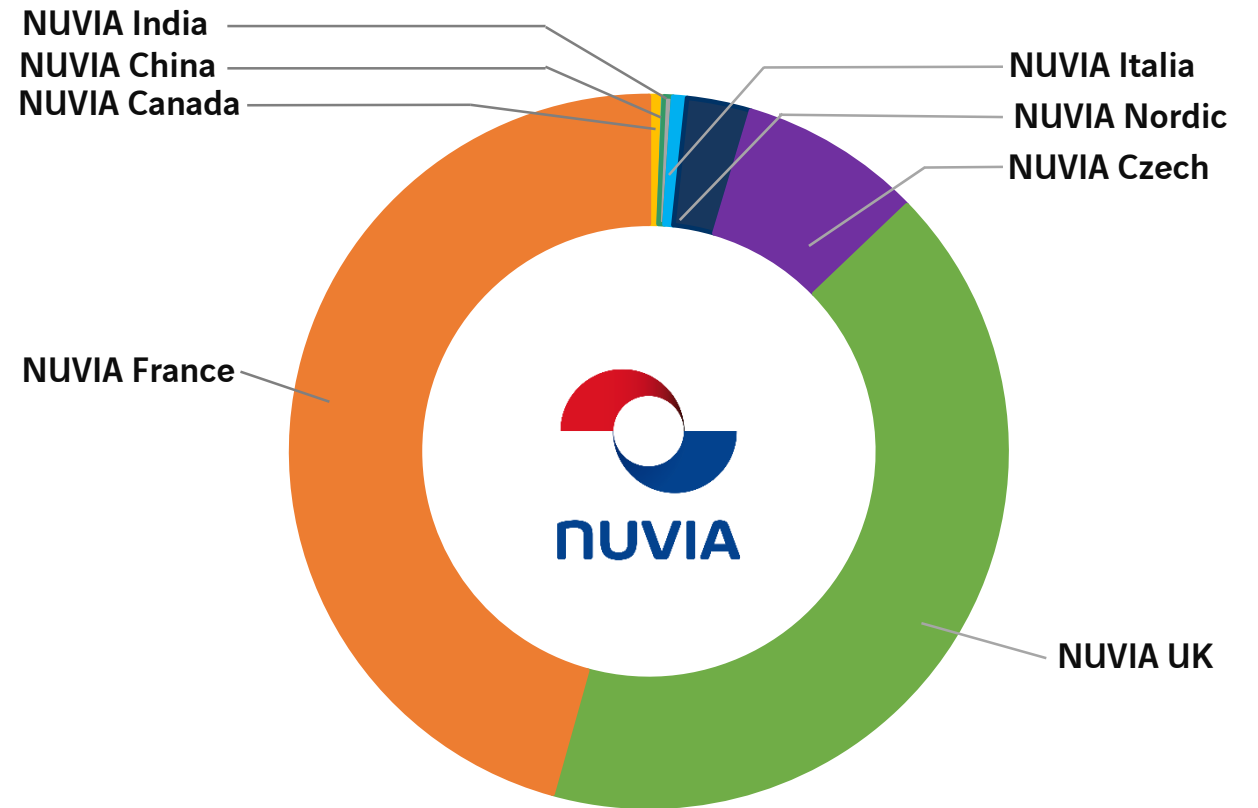


# Nuvia Group Workforce

Breakdown by category

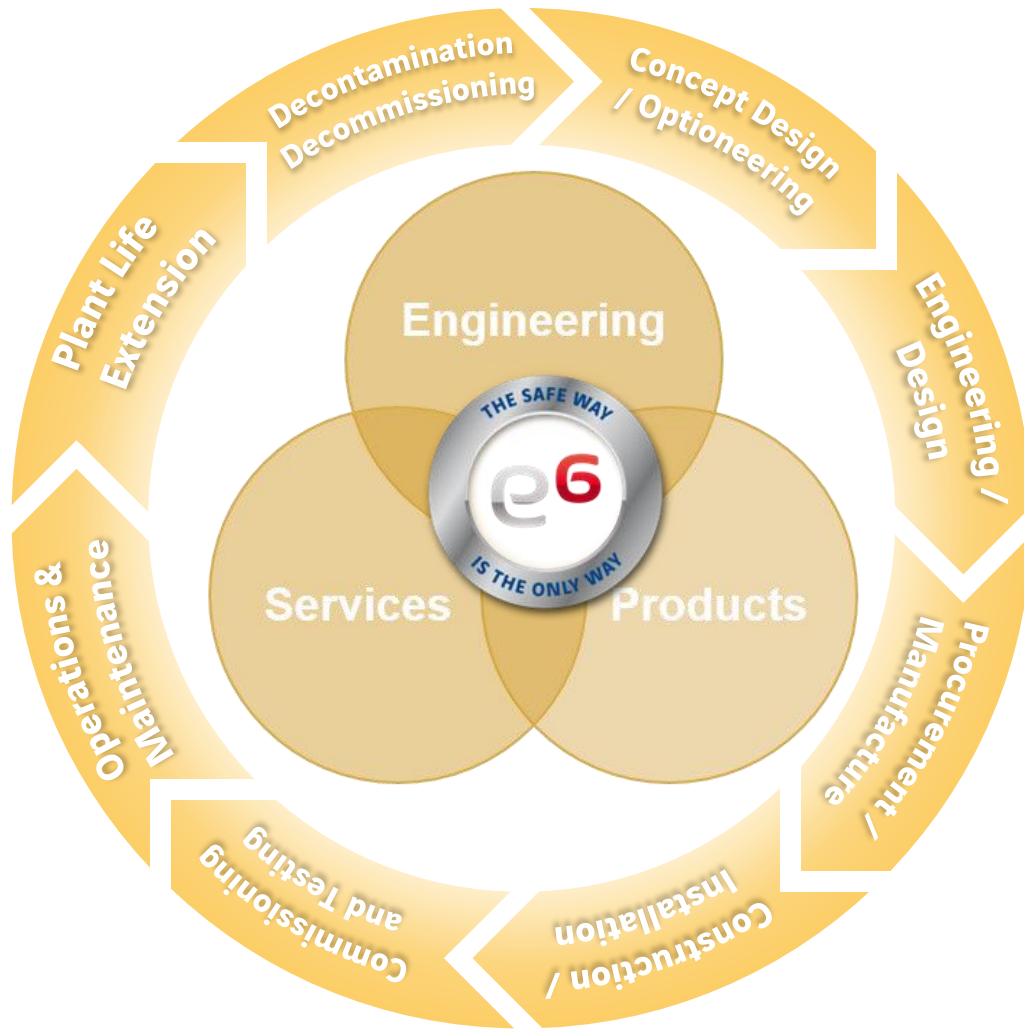


NUVIA GROUP  
Workforce  $\approx$  2 700











## Nuvia Group Core Business

# Supporting the full project lifecycle



## Key Areas of Activity:

-  Consultancy
-  Design and Build
-  Plant Life Extension
-  Operations and Maintenance
-  Decommissioning
-  Radiation Protection
-  Waste Management
-  Products



# Core Business



 PROGRAMME MANAGEMENT  
UK Global Threat Reduction



 FULL EPC 'TURNKEY'  
Modular Active Effluent Treatment Plant, UK



 OPERATIONS  
Cruas & Dampiere NPP: Balance of Plant, France



 DECOMMISSIONING & WASTE MANAGEMENT  
SGHWR Decommissioning, UK



 PRODUCTS  
Taishan EPR, China



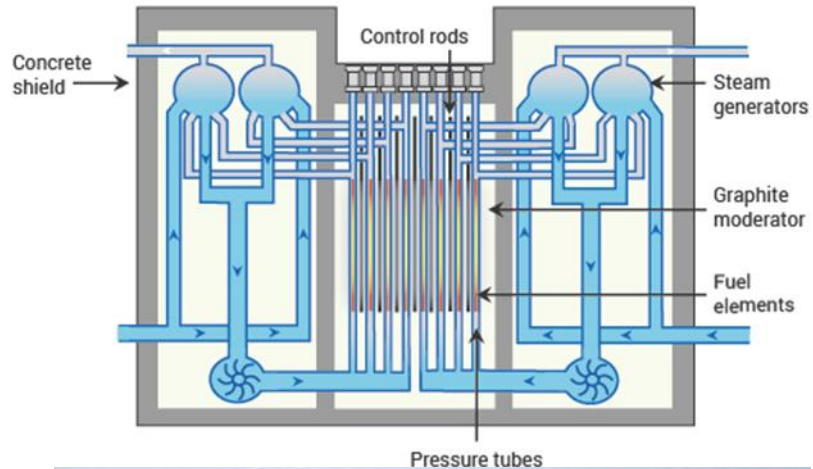
 RADIATION MONITORING  
Sellafield & Dounreay, UK





# Nuvia Understanding of RBMK Reactors

A Light Water Graphite-moderated Reactor (LWGR/RBMK)



## RBMK Reactor

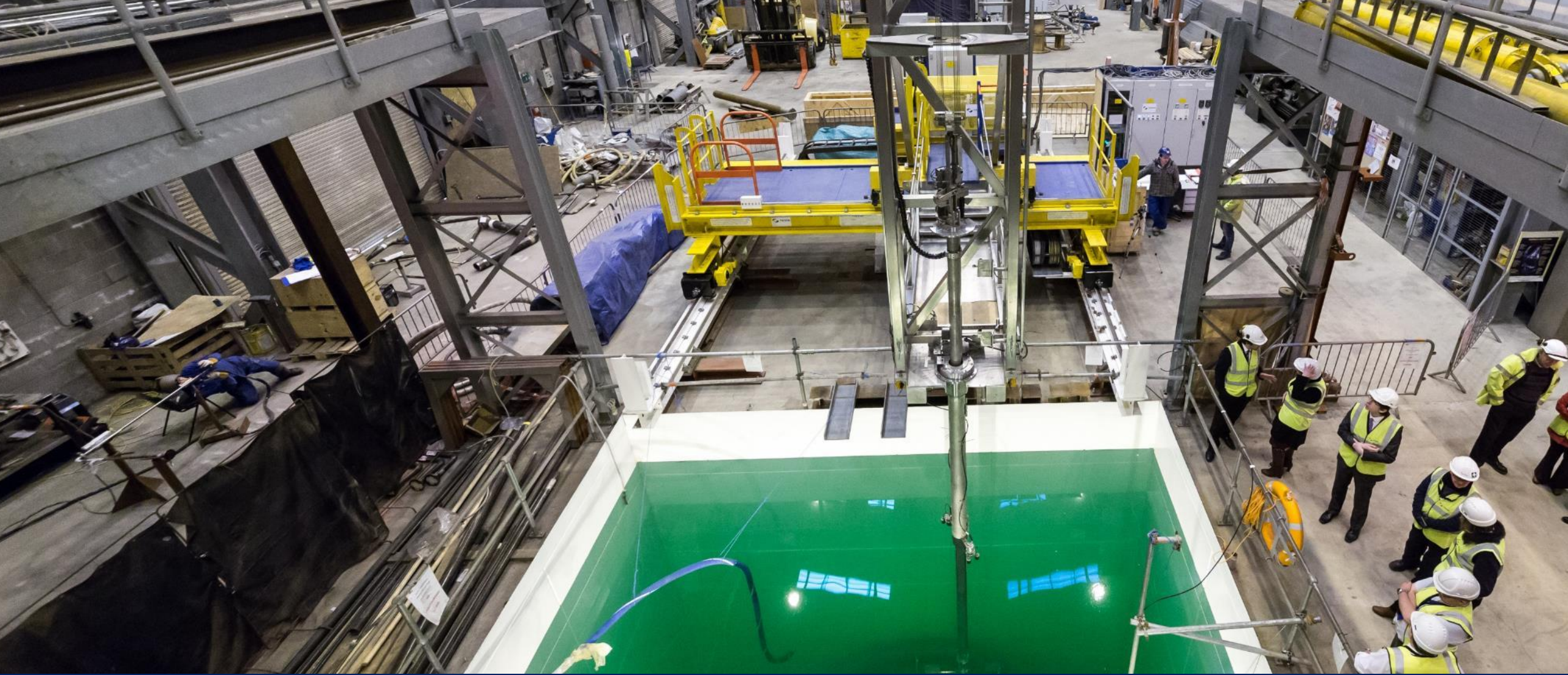
The RBMK is an unusual reactor design, one of two to emerge in the Soviet Union in the 1970s.

The Soviet-designed RBMK is a pressurised water-cooled reactor with individual fuel channels and using graphite as its moderator.

It is also known as the light water graphite reactor (LWGR). The combination of graphite moderator and water coolant is found in no other power reactors in the world.

Decommissioning of these reactors therefore represents a significant challenge, one which Nuvia is well equipped to under take. Nuvia's wide experience of graphite and other reactor types, a long history in decommissioning projects and extensive capability in waste management is represented in the following projects.





# Ignalina NPP: Fuel Handling Systems

Full EPC supply of Fuel Handling Systems



# Ignalina NPP: Fuel Handling Systems



## Scope

- Design build test, install and commission the fuel handling systems along with operator training
- Two Fuel Bundle Handling machines (FBH) for under water handling of fuel bundles in both active reactor units
- Cask transfer bogie, seal and shield hatches, in-cell handler with interchangeable grabs, integrated control system, CCTV system and cell HVAC system

## Challenges

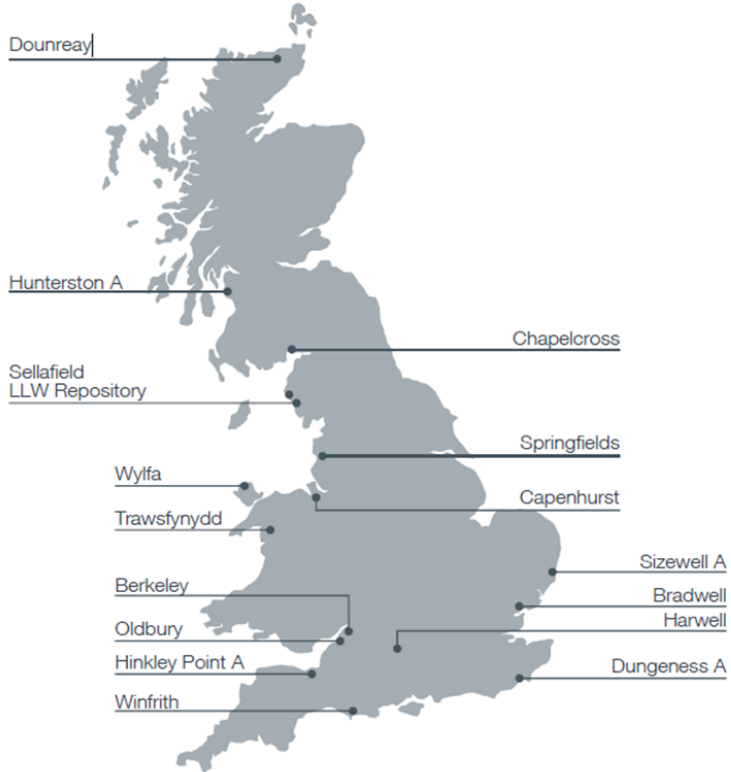
- High levels of inspection, NDT, and management of the assembly and test of specialised equipment required
- Multinational supply chain and stakeholders

## Outcome

- Nuvia successfully completed the design, manufacture, integrated testing, supply, installation, commissioning and operator training of the FBH machines

NDA Supply Chain  
Export Award  
Winner

Fuel handling systems for the loading and repackaging of spent fuel storage casks for interim storage



Decommissioning activities in UK including Magnox Reactors with Graphite Cores

France has a fleet of graphite core reactors undergoing decommissioning

Site	Type	MWe	Operational
Marcoule G1	UNGG/GCR	2	1956-68
Marcoule G2	UNGG/GCR	40	1959-80
Marcoule G3	UNGG/GCR	40	1960-84
Chinon A1	UNGG/GCR	70	1963-73
Chinon A2	UNGG/GCR	200	1965-85
Chinon A3	UNGG/GCR	480	1966-90
Saint-Laurent A1	UNGG/GCR	480	1969-90
Saint-Laurent A2	UNGG/GCR	515	1971-92
Bugey 1	UNGG/GCR	540	1972-94

UK also has a fleet of 14 AGRs with decommissioning is due to start in 2022.

# The Decommissioning Challenge

## Managing Graphite Reactors

# Managing Graphite Reactor Cores



During the Heysham 1 (HYA) Reactor 1 2013 statutory outage, an unexpected result was found from the 'Teletest' inspection (which checks the boiler spines' structural integrity) of the 1D1 Boiler Spine. This anomaly indicated a discontinuity to the boiler spine; the main structure supporting one of the boiler pod

Nuvia supported Rolls Royce with their scope of the EDF Fleet Critical programmes Project by providing personnel to carry out (within Reactor Pressure Vessel (RPV)) cleaning and subsequent inspection of the Boiler Spine of Boiler 1D1 with the objective to provide justification for continued operation of the reactor.

## Project conclusion

A team of qualified and trained Nuvia personnel were deployed to site. The cleaning and inspection activities were delivered by our site team.

## Heysham 1 Boiler Spines Inspection





# Kozloduy NPP Decommissioning

Project Management Consultant



# Project Management Consultant to SERAW, Bulgaria



Plasma Melting Facility



Size Reduction and  
Decontamination Facility

## Scope

- Programme of work includes projects to facilitate the decommissioning of the four reactor units
- Provision of expert roles including; decommissioning, engineering, licensing, quality and commercial

## Challenges

- Developing facilities for processing of ion exchange material, solid and liquid radioactive wastes, evaporator concentrate and waste disposal
- Delivery of the Radiania LLW repository

## Outcome

- Nuvia continues to provide support on the management of existing and procurement of new projects to enable decommissioning successfully completed the design, manufacture, integrated testing, supply, installation, commissioning and operator training of the FBH machines

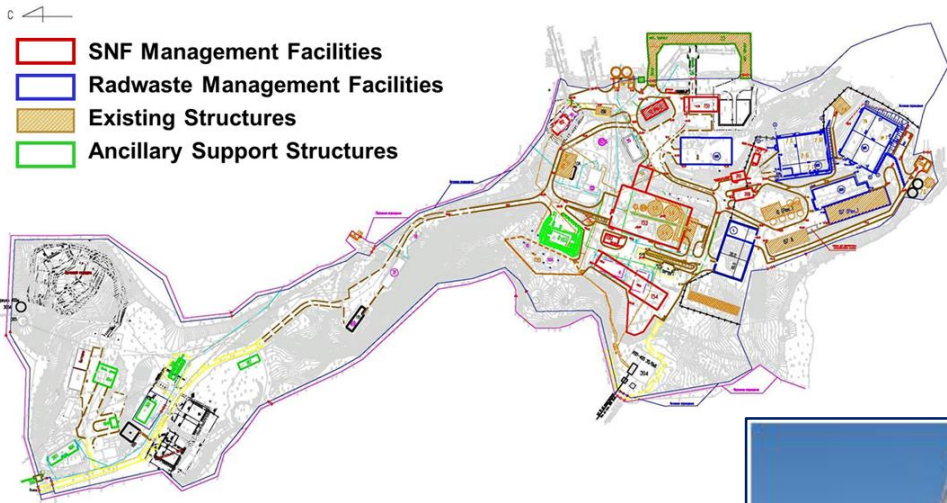




# Project Management Consultant

Dealing with the legacy of the Soviet nuclear fleet in North West Russia

# PM Consultant for the EBRD NDEP Support Fund



Management of Spent Nuclear Fuel at Andreeva Bay



Submarine Dismantling

## Scope

- Risk identification, regular update and management of the project risk register
- Development of a procurement plan, modes of procurement and realistic time schedules
- Preparation of tender documentation
- Reporting on the risks during the Project implementation
- Training of Client's PMU personnel

## Challenges

- Working on difficult sites
- Security considerations
- Introducing western project management processes

## Outcome

- Nuvia continues to provide in- country and external support on the management of the projects to enable progress on the safe management of legacy spent nuclear fuel





Decommissioning SuperPhenix



# Decommissioning Superphenix at Creys- Malville



## Scope

- Secondary circuit decommissioning
- Construction of decommissioning workshop & structural modifications
- Removal of BCC & PBT

## Challenges

- 1500 tons material with Sodium contamination
- Robotic cutting of heavy components
- Reconfiguration of internal structures

## Outcomes

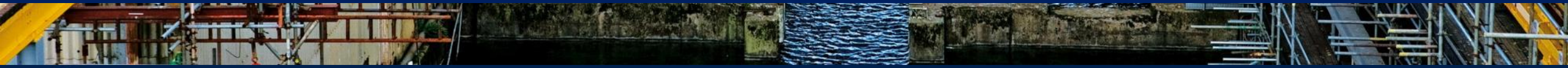
- Successful cutting of secondary circuit
- Trials on BCC & PBT removal
- Planning for implementation in 2018





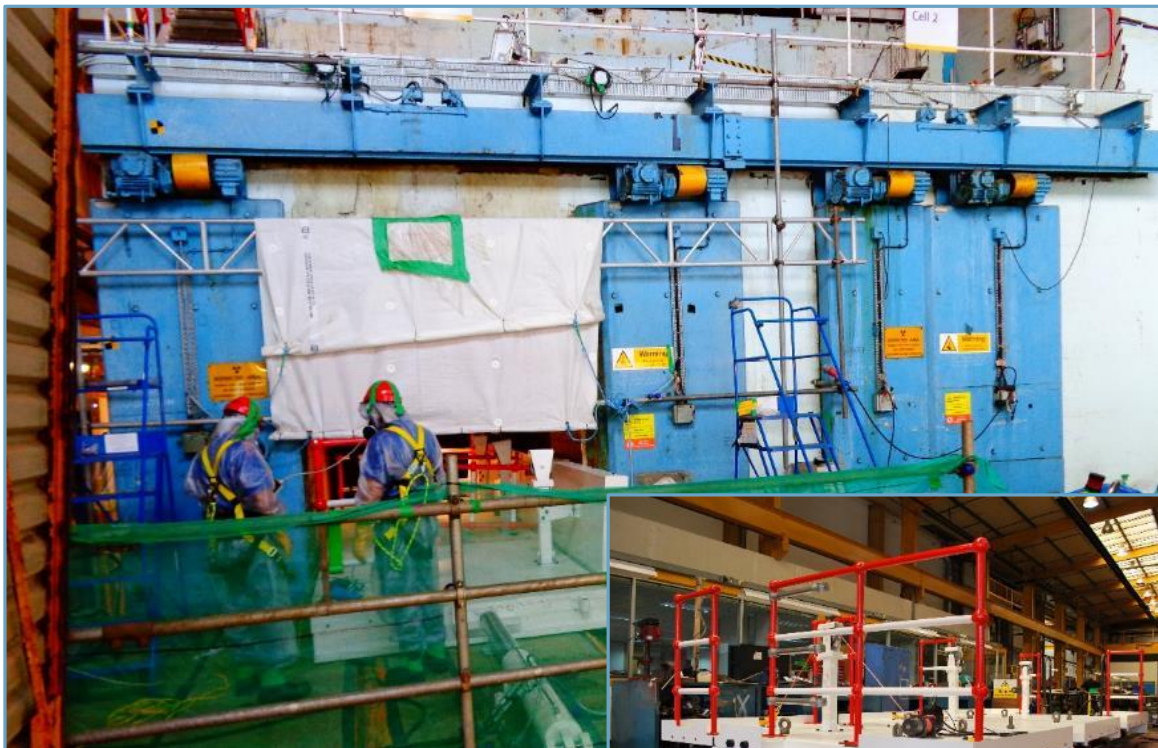
# First Generation Magnox Storage Ponds (FGMSP) Export Facility, Sellafield

High profile NDA and ONR project, with a requirement for first class performance and quality





# FGMSP Export Facility, Sellafield



## Scope

- Design, procurement and installation of all export equipment
- Design, build and manage testing of all critical machines (lid lift, flask fill/empty, skip hoist, skip bogie, flask bogie) at an off site integrated test facility
- Integrated trials
- Removal of redundant equipment in high hazard environment to enable installation on site
- Installation, test and inactive commission of new export plant and equipment on site
- Training for operational personnel

## Challenges

- Constrained timescales to meet Client deadline
- Significant background dose rates
- Limited building access
- Significant background dose rates
- Multiple stakeholders

## Outcome

- Over 250k Hrs worked without Report of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) or Lost Time Accident (LTA)
- Innovative self-shielding bogie design
- Successfully transformed the building
- Client exported first skip in April 2016 during Active Commissioning.
- Plant handed over to client for operations to reduce long term nuclear hazard at Sellafield

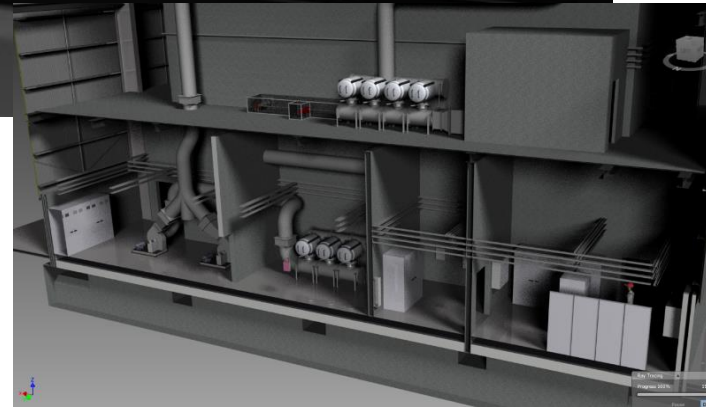
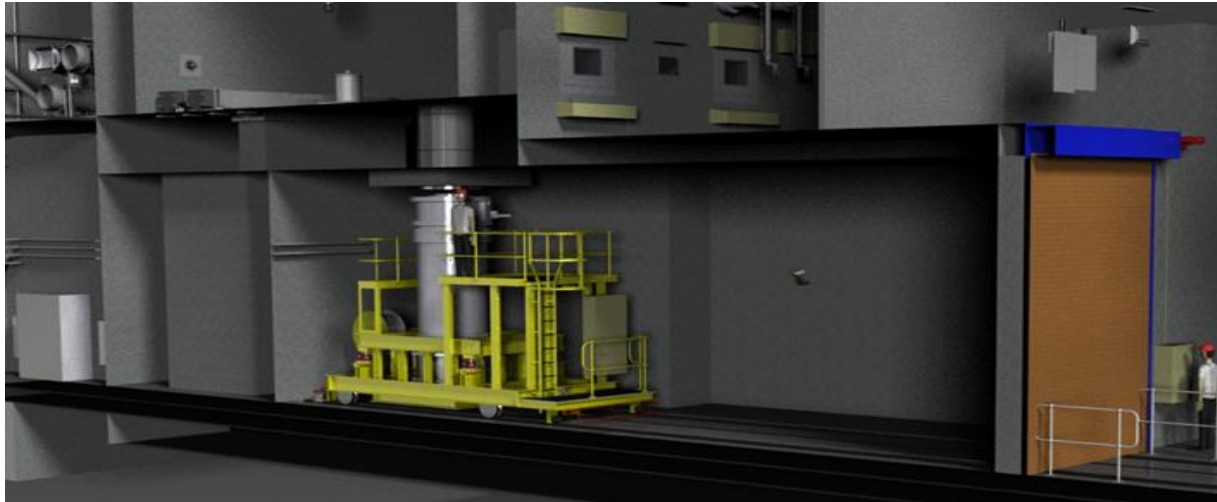
Refurbish the existing inlet building to enable safe and reliable export of the pond waste inventory

# Design of a Flask Loading Facility





# Concept and Scheme Design of a Flask Loading Facility



## Scope

- To complete a concept and scheme design of a Facility to transfer fuel in Irradiated Fuel Containers from site flasks to road/rail transport flasks for onward transfer.

## Challenges

- Separated by a distance of 550+ miles the integrated team needed to work closely and efficiently.
- Fixed project timescales despite changing requirements
- Changing Client requirements brought many new stakeholders into the project requiring good stakeholder management.

## Outcome

- Excellent Client feedback received
- Economic materials such as aluminium cladding were selected to maximise the opportunities offered by a short plant life.
- Plant infrastructure reduced to a minimum, full advantage being taken of aspects such as natural ventilation where possible.
- Space envelopes give the design flexibility to incorporate additional capabilities should the need arise as the unknowns in the baseline data reach maturity.

## Design of a Flask Loading Facility

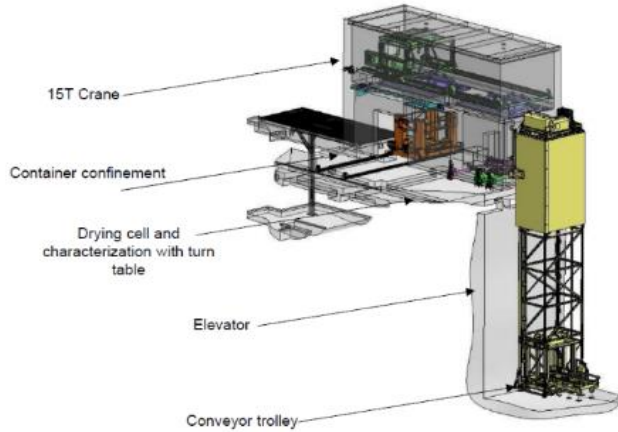




# Reactor Decommissioning: Chooz A

Decommissioning and dismantling of a Reactor Pressure Vessel (RPV)

# Reactor Decommissioning: Chooz A, France



First Pressurized Water Reactor, Reactor Pressure Vessel to be decommissioned in France

## Scope

- Preparatory Work including design of decommissioning approach. Design of the hot cell & full-scale testing
- Civil Works – building reconfiguration
- Underwater vessel cutting
- Remote handling & dismantling
- Waste management
- HVAC & electricity reconfiguration

## Challenges

- Waste volume reduction & optimisation
- Integration of many different specialities – civils, engineering, radiation protection etc
- Access constraints as the Reactor Pressure Vessel is in a small underground cavern

## Outcome

- Successful completion of preliminary studies in 2012
- Certification and proving trials complete in 2014
- Civil engineering progressing well, due for completion in 2016

## Decommissioning and dismantling of a Reactor Pressure Vessel (RPV)





Updates of Preliminary Decommissioning Plans for OPG Waste Facilities



## Scope

Update of Preliminary Decommissioning Plans (PDPs) for waste management facilities.

## Challenges

Checking existing documents against recognised international standards as well as Canadian domestic standards  
Identifying gaps and agreeing modifications with client

## Outcome

Upon acceptance of the recommendations from Nuvia's Gap analysis, the PDPs were revised and submitted to the client for acceptance

# Updates of Preliminary Decommissioning Plans for OPG Waste Facilities





Decommissioning: Dragon High Temperature Gas Reactor

# Nuvia is undertaking the detailed design and build of plant and equipment to carry out reactor core segmentation, waste packaging and disposal operations

- Ventilation Plant
- EC&I Systems
- Radiological Assay Systems
- Cranes & Hoists
- Shield Doors
- Waste Packaging & Export Plant



## Scope

- Detailed, Design and Build (DD&B) of Mechanical and EC&I systems, plant and equipment to deploy, carry out and/or support core segmentation and waste processing operations.
- Shield doors.
- Cranes, hoists, plant and tooling.
- Radiological assay systems.
- Waste packing and export plant.
- Ventilation plant.
- EC&I systems.
- Technical support during commissioning and operations

## Challenges

- Remote removal of reactor core from the inside out, and top down, operating through the neck of the Reactor Pressure Vessel (RPV).
- Assay of the waste as it is removed to provide assurance that the waste is within the defined limits for transport and disposal.
- Remotely packing of ILW components unsuitable for packaging in 6 m<sup>3</sup> boxes (e.g. the fuel spikes) into cans and export in the Modular Flask.
- Remote packaging and grouting ILW into 6 m<sup>3</sup> boxes.

## Objective

- Successful design of systems and key interfaces to enable reactor decommissioning. (Ongoing Project)



# Decommissioning Planning for UK Nuclear New Build Funded Decommissioning Programme



## THE ENERGY ACT 2008

Funded Decommissioning Programme  
Guidance for New Nuclear Power  
Stations

December 2011



### • Scope

Technical authorship of the decommissioning activities and associated costs for Moorsides AP1000s.  
Acted as the independent verifier of the decommissioning activities and costs for the Wylfa ABWRs.

### Challenges

- Avoiding preferential engineering and excessive detail
- Stakeholder management of several interested parties
- Understanding how to cost for waste disposal decades into the future, including waste repositories that are not yet build

### Outcome

- Wylfa Project – Successfully delivered an independent verification report to support the FDP. The report has been passed to UK Government as part of the FDP
- Moorside Project – Successful chapter authorship, cost estimations and risk reviews delivered.

Applying experience and knowledge of Decommissioning to support the UK New Build Programme





Andrew Graham



The Library, Harwell, Oxfordshire, UK



+44 1235 515699



Andrew.graham@nuvia.co.uk



[www.nuvia-group.com](http://www.nuvia-group.com)