

EPFL Nuclear Master's Students

Alex Kirby - 12 November 2025

About Me



Alex Kirby

Nuclear Engineer / Project Manager
Head of Section – Systems and Safety
Sales Manager Nuclear Segment
AFRY Nuclear, Switzerland

10 years of experience in the nuclear industry; specialising in reactor design, safety analysis and technical project management.

EDUCATION AND SPECIALTY

Education:

2013-2015: Certificate of Nuclear Professionalism – Nuclear Technology, Nuclear Safety Case Development, Communications, Technical Leadership

MEng Chemical with Nuclear Engineering, Imperial College London, UK

Languages: English (native), Greek (native), German (basic)

Expertise: Technical Project Management, Technical Communication, Modelling and Simulation, Thermal hydraulics and heat transfer, Software/Methods Development, Verification & Validation, SMR Technologies

SELECTED PROJECT REFERENCES

- 2022-Present: Update to the Beznau Probabilistic Safety Assessment at power and shutdown reports
- 2023-2024: SMR Feasibility Study Finland, AFRY
Responsible for technology evaluation, fuel, waste and decommissioning topics for a study to deploy an SMR by a major industrial company.
- 2023: SMR Research for Dubai, AFRY
Provided an overview of SMR technologies and Country Profiles for the emirate of Dubai. The work included a review of pre-requisites for SMR deployment and suggestions for how Dubai could implement its own programme.
- 2021-2024: Project Manager, AFRY Switzerland
Market research and supplier evaluation in support of pricing for the construction of Akkuyu NPP, Turkey's first nuclear power plant.
- 2021-Ongoing: Member of the SMR business development team at AFRY.
- 2020: Performance Lead, Rolls-Royce SMR
Developed methods and tools to manage engineering data and perform numerical analysis for the final concept design. Responsible for the development of the Emergency Core Cooling System thermal hydraulic model.
- 2015-2019: Thermofluid Engineer, Rolls-Royce
Various roles in thermal hydraulic analysis and modelling during the development of the detailed design for the PWR3 naval reactor.

INTRODUCTION

About us

AFRY provides engineering, design, digital and advisory services to accelerate the transition towards a sustainable society.

We are 18 000 devoted experts in industry, energy and infrastructure sectors, creating impact for generations to come. AFRY has Nordic roots with a global reach, net sales of 27 BSEK (EUR 2.4 B) and is listed on Nasdaq Stockholm.



INTRODUCTION

130 years to be proud of



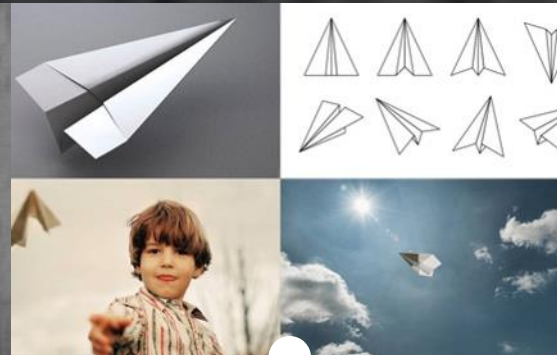
1895

The steam boiler association is founded by owners of steam boilers and pressure vessels to prevent accidents



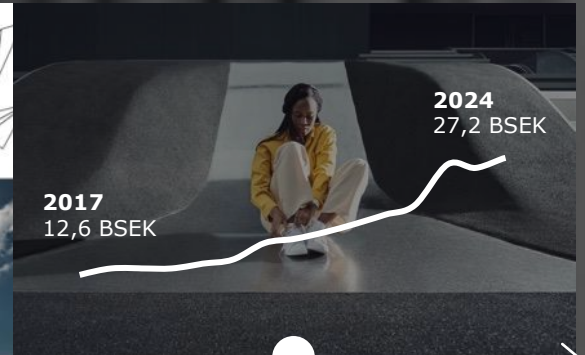
1958

Jaakko Pöyry starts his business with the roots in Finnish forest industries



2019

ÅF and Pöyry join forces, creating a leading company within engineering, design and advisory services



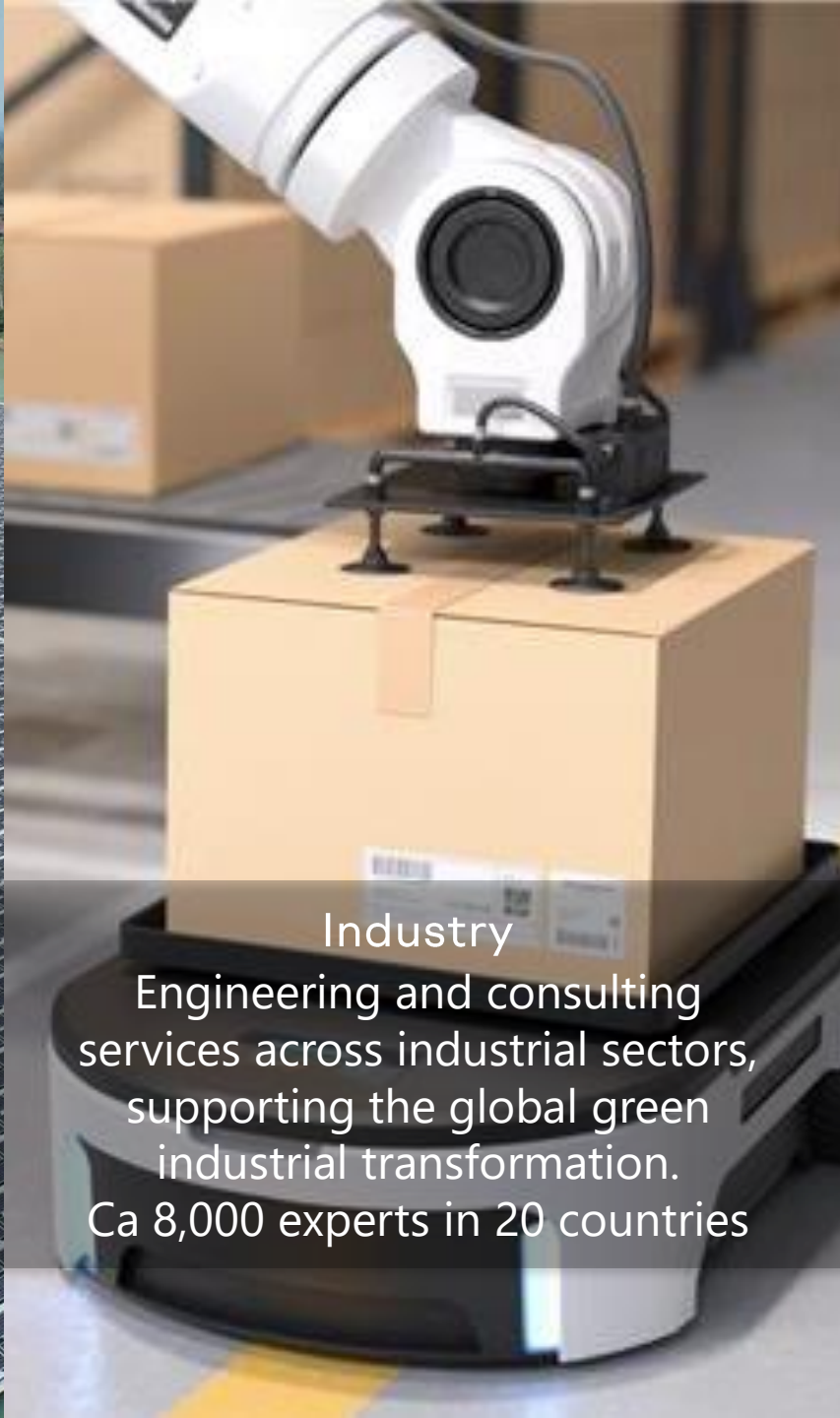
Today

Pioneers of technology and leading partner in the sustainability transition

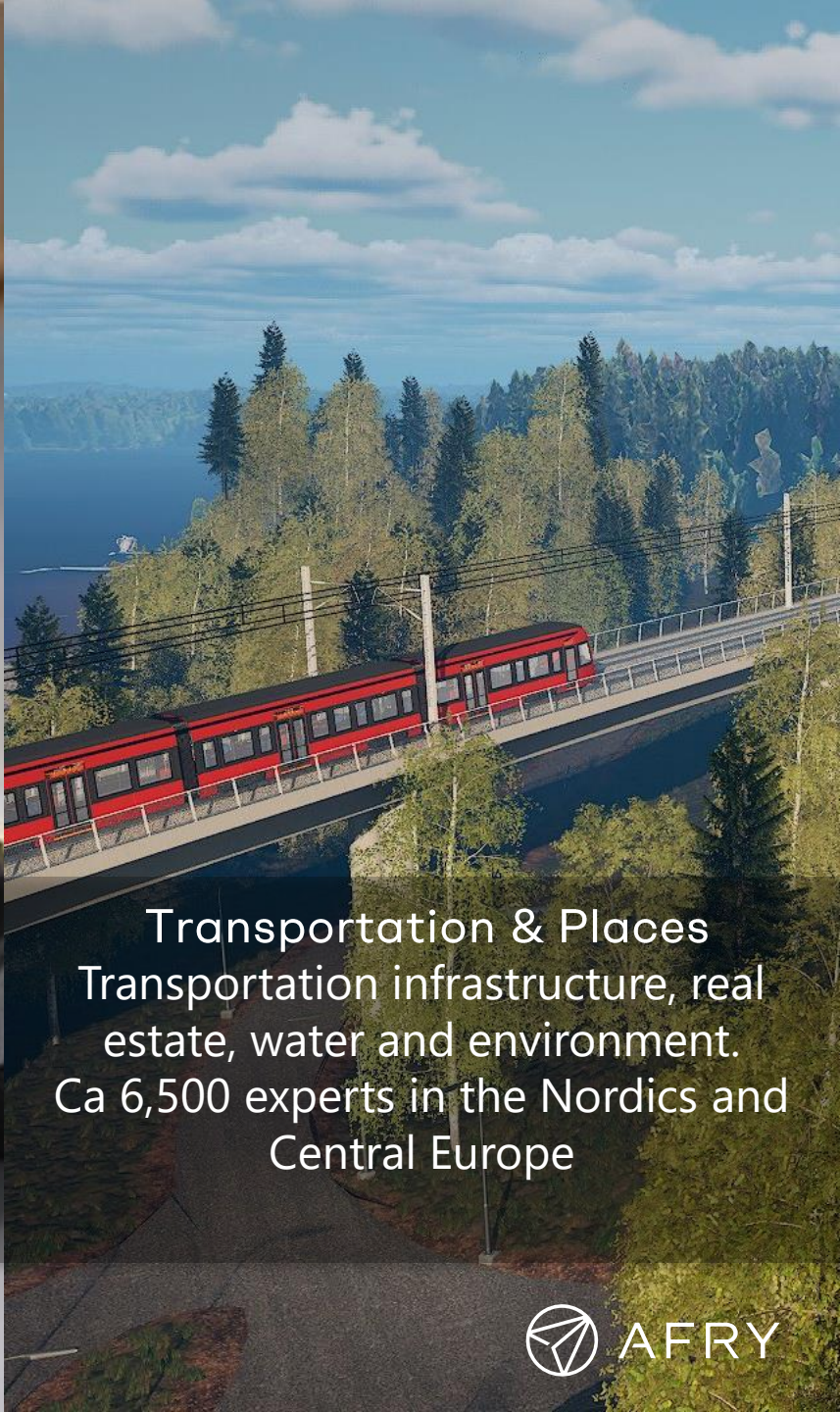


INTRODUCTION

Energy
Solutions in energy production,
distribution, and storage.
Ca 3,000 experts across five
continents



Industry
Engineering and consulting
services across industrial sectors,
supporting the global green
industrial transformation.
Ca 8,000 experts in 20 countries



Transportation & Places
Transportation infrastructure, real
estate, water and environment.
Ca 6,500 experts in the Nordics and
Central Europe



NUCLEAR AT AFRY

Leading projects for in
the nuclear industry
for more than

70
years

Over

1 000
Projects delivered

AFRY's dedicated team of nuclear experts bring a wide range of expertise to serve clients throughout the entire plant lifecycle.

AFRY Nuclear have been working in the nuclear industry since its infancy, successfully delivering thousands of projects internationally

OUR SERVICES

 **Feasibility Studies, Site Selection & Investment Analysis**

 **Technical & Commercial Due Diligence**

 **Nuclear Safety Case, Environmental Impact & Licensing**

 **Additional services covering complete nuclear life-cycle**

OUR EXPERTISE CLUSTERS



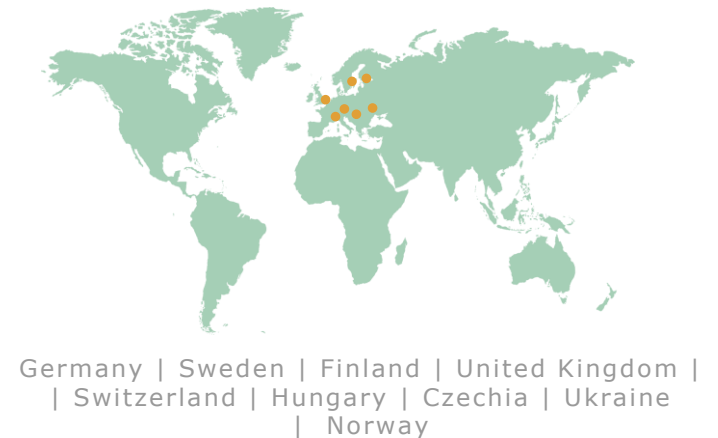
Leading advisor to the nuclear industry for 60+ years

600+ Nuclear Experts & Engineers

AFRY Nuclear is established in seven European countries

Several global projects in regions such as Europe, South-East Asia, Middle East & more

Ranked #7 nuclear design firm globally, according to ENR Sourcebook 2021

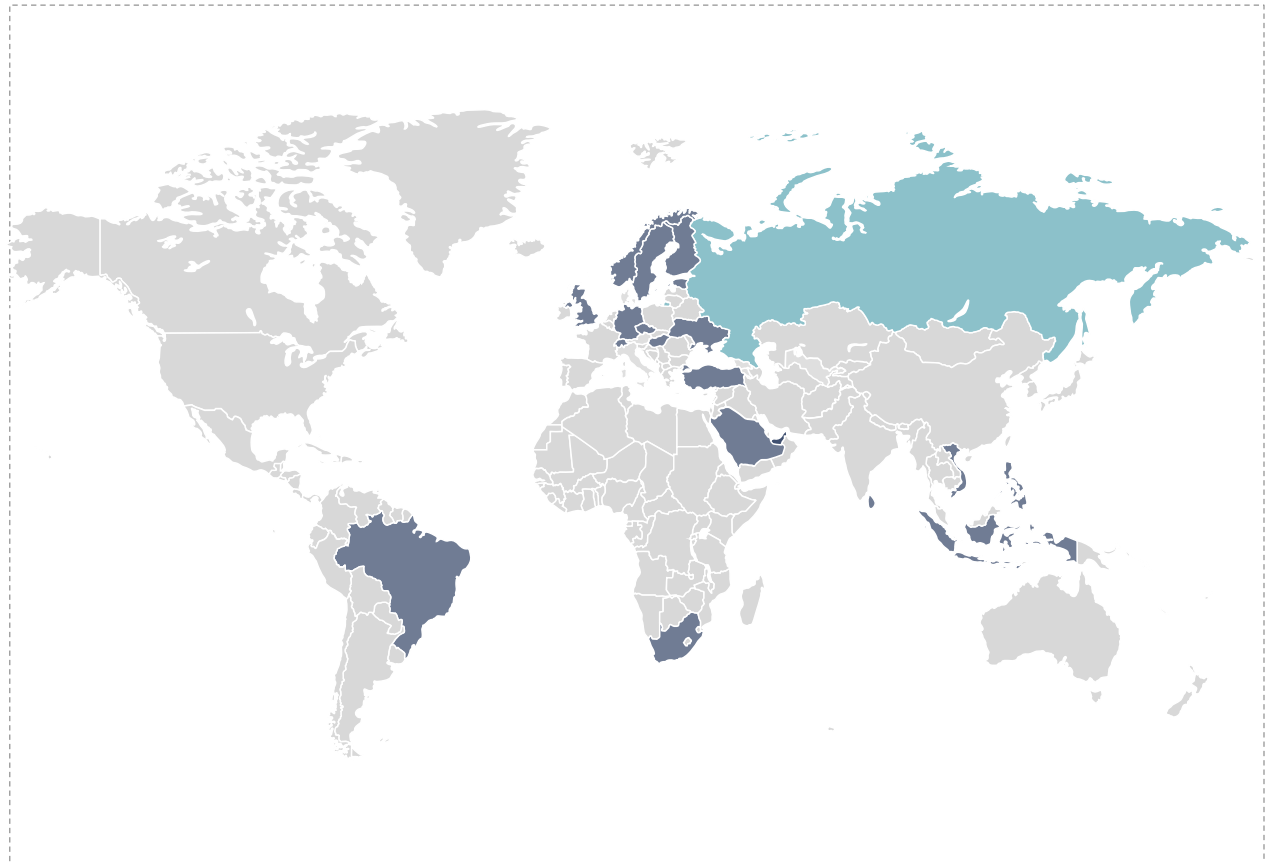


AFRY Nuclear mainly operates within Europe but drives international nuclear development as well

SELECTED CLIENTS WITH NUCLEAR REFERENCE PROJECTS



GEOGRAPHICAL COVERAGE OF DELIVERED NUCLEAR PROJECTS



KEY REFERENCES

AFRY has supported several new build projects across the globe

UK, Hinkley Point C, 2x1,600MWe NPP

Provided advice and support services for creation of licensable organization for delivery of HPC. Also did supporting activities for the delivery of site license and formal application.

Czech Republic, Project David

Project on developing a PWR-SMR in Czech Rep. for the replacement of ageing coal plants. AFRY currently doing concept design.

Saudi Arabia, NPP

K.A.CARE: Roadmap and support for the implementation of a new nuclear program.
Confidential client: Ongoing siting support.

Indonesia, Site Preparation

Developed site and environmental study consisting of investigations and assessments activities to the site selection, evaluation and qualification.

Vietnam, Ninh Thuan 1 and 2 NPP Projects

Support among other things for the site evaluations e.g. review of Site Approval Dossier (SAD) and review of Feasibility Study (FS), site licensing, technology selection, EPC contracting.

Finland, Fennovoima, 1,200MWe NPP

Supported Fennovoima as Owners engineer. Including support in different technical disciplines, nuclear safety and licensing, structural analysis, EIA, site seismic hazard studies, support in owners scope area and expert support in specific areas.

Finland, Olkiluoto 3, 1,600MWe NPP

Support for both TVO and AREVA as well as STUK in various services.

Finland and Sweden, confidential

Supporting two different planned new-build projects in the feasibility study phase.

Hungary, Paks II, 2x1,200MWe NPP

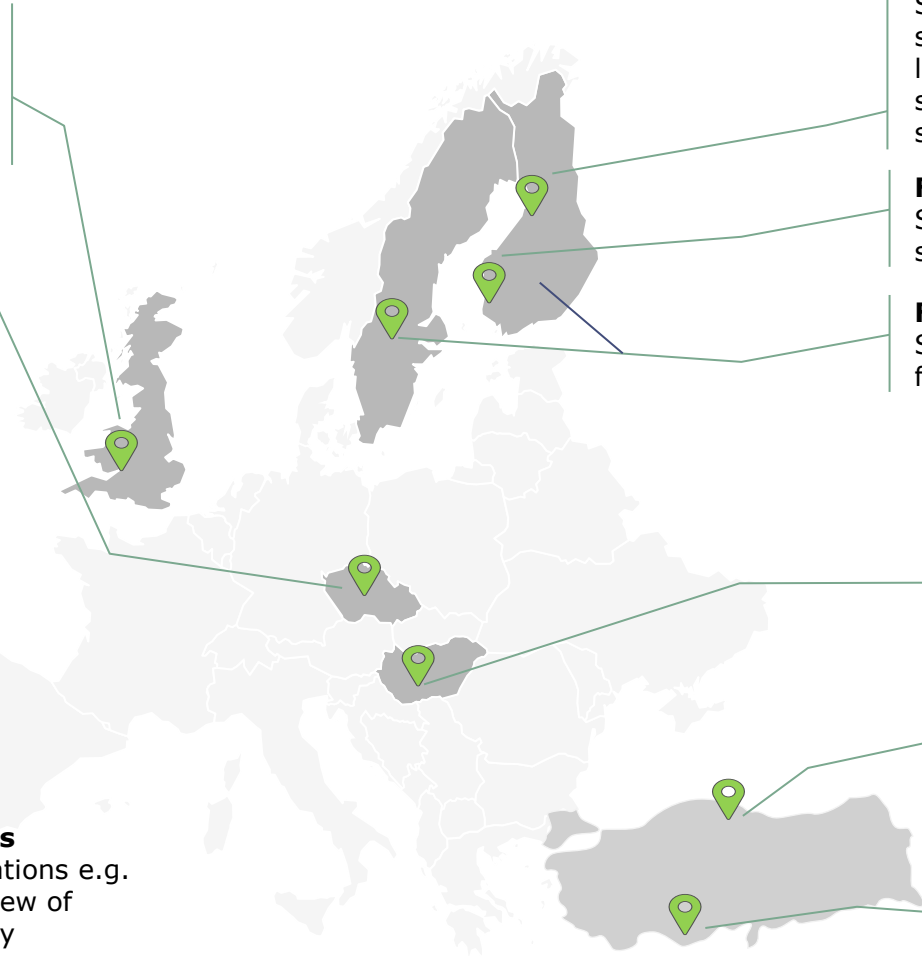
Support the construction at Paks II as vendors engineer. Support includes environmental impact assessment, workforce requirements, licensing strategy, regulatory support, safety studies and transmission/grid-connection requirements.

Turkey, Sinop, 4x1200MWe NPP

Supported development of the Sinop NPP in Turkey as owners engineer for site parameters report and development of overall project framework.

Turkey, Akkuyu, 4x1200MWe NPP

Involved in the construction of the new nuclear plant in Akkuyu, Turkey. Conduct price monitoring of construction materials and evaluation of possible analogue materials meeting the required codes and standards.



AFRY Nuclear in Switzerland

Quick Summary

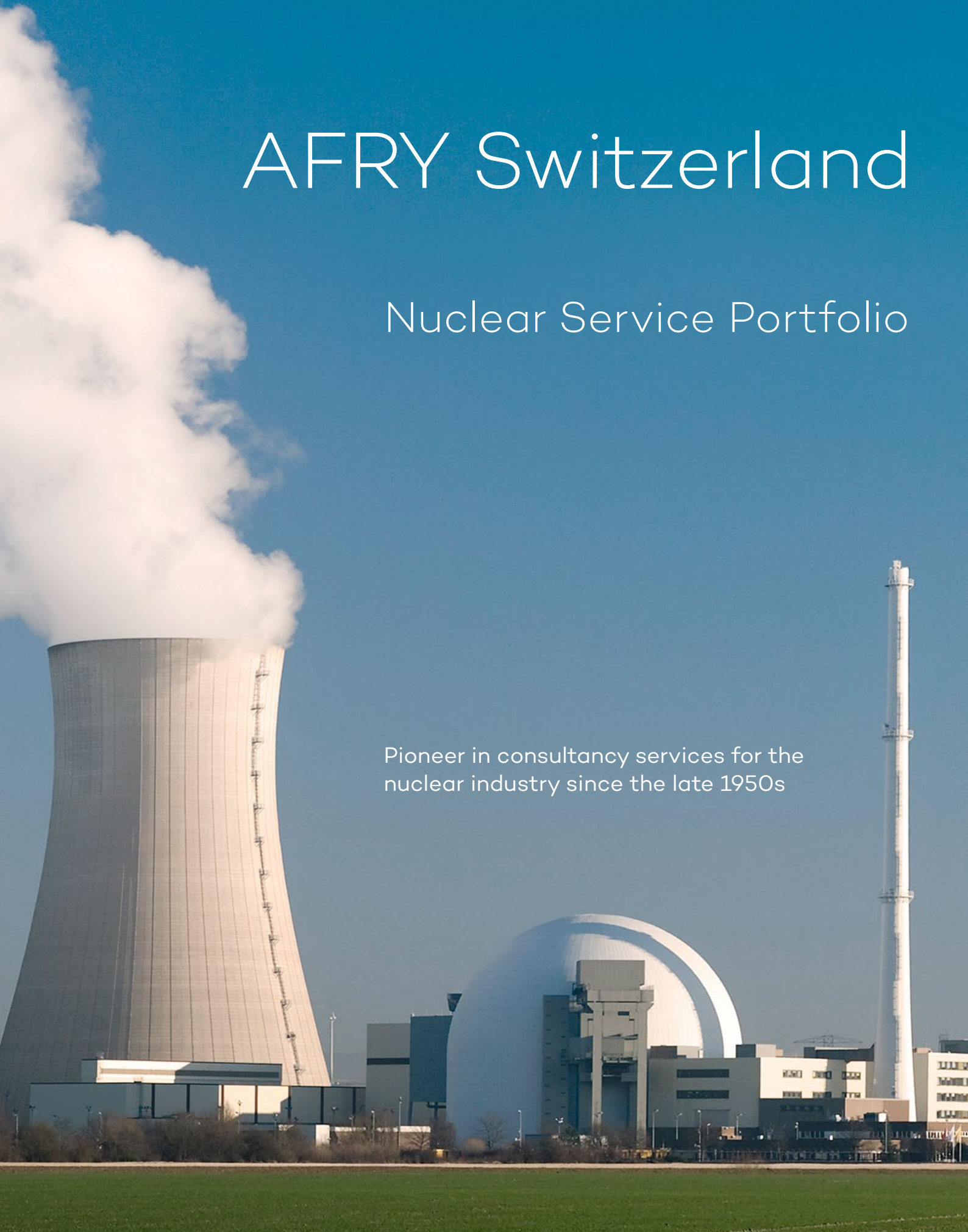
- 2 Teams
 - Systems and Safety
 - Waste Disposal and Hydrogeology
- Systems and Safety
 - Young team
 - Half are graduates of the EPFL/ETH Nuclear Masters
 - Projects in all the operating power plants
 - Flexible working
 - Offices are in Altstetten, Zürich
 - Kaffee und Gipfeli every Wednesday

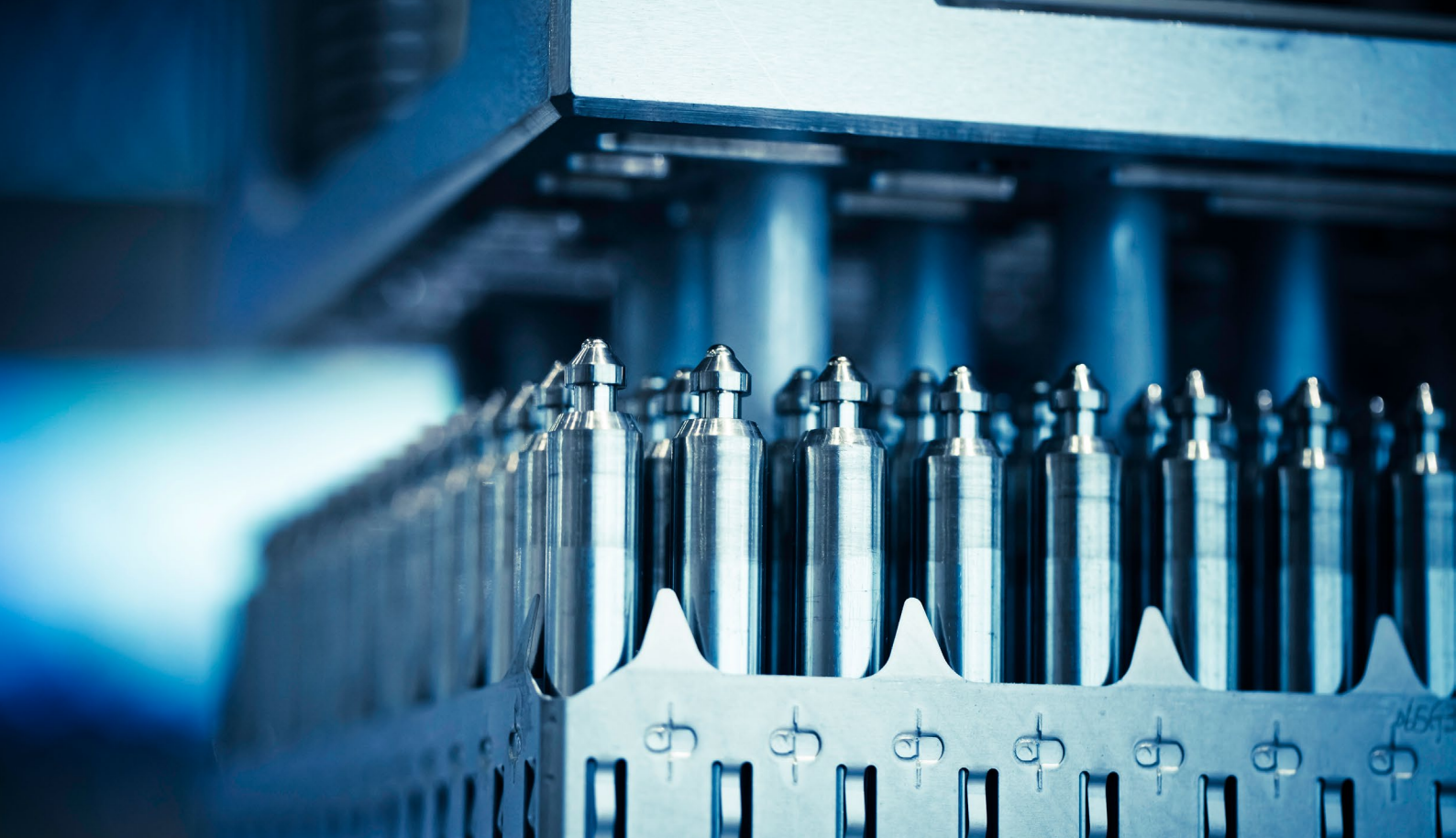


AFRY Switzerland

Nuclear Service Portfolio

Pioneer in consultancy services for the nuclear industry since the late 1950s





Nuclear service portfolio

We have a long tradition as a leading international consultant in the nuclear industry. Our services cover the entire nuclear life cycle of nuclear facilities.

Our portfolio includes support, management, project planning, dismantling and retrofitting of various nuclear facilities and power reactors both in Switzerland and worldwide.

Project planning & construction	Operation	Due Diligence	Dismantling & waste management
<ul style="list-style-type: none"> - Feasibility studies - Nuclear plant design Concept-, basic and detail design - Licensing of nuclear facilities - Requirement specification on legal framework - Procurement & project management - Construction & commissioning - Design & layout of: construction, fire protection, radiation protection, HVAC, piping, E-technology, I&C 	<ul style="list-style-type: none"> - Incident analyses - PSA, DSA, PSAR, FSAR - Project and process monitoring - End-of-life analyses of nuclear components - Operations audit (IAEA) - Safety culture - Non-destructive testing - Quality management system - BIM (Building Information Modelling)/ Digitalisation 	<ul style="list-style-type: none"> - Technical and economic Due Diligence - Environmental impact assessment 	<ul style="list-style-type: none"> - Site selection - Hydrogeological surveys and analyses - Decommissioning of nuclear facilities - Interim storage solutions (wet storage, dry storage) - Encapsulation facility (hot cell, UUVA) - Final repository design - Disposal of radioactive waste (SMA, HLW) - Logistics concepts - Analysis of spent fuel assembly transport and storage casks, and final disposal canisters

Owner's engineering

As owner's engineer, AFRY serves as independent advocate of the project owner. Together we develop and deliver the project, optimizing the outcome and the value gained for the owner. Great care is taken to successfully conclude the project in time and budget with the highest quality standards.

Owner's Engineering services for the entire lifecycle of nuclear facilities

Projects

- Sinop Nuclear Power Plant, Türkiye
- Ninh Thuan 1 and 2 NPP, Vietnam
- Niederram NPP, Switzerland
- Hanhikivi 1 NPP, Finland
- Angra 3 NPP, Brazil
- Paks II NPP, Hungary
- Gösgen NPP, Switzerland
- Lovisa NPP, Finland

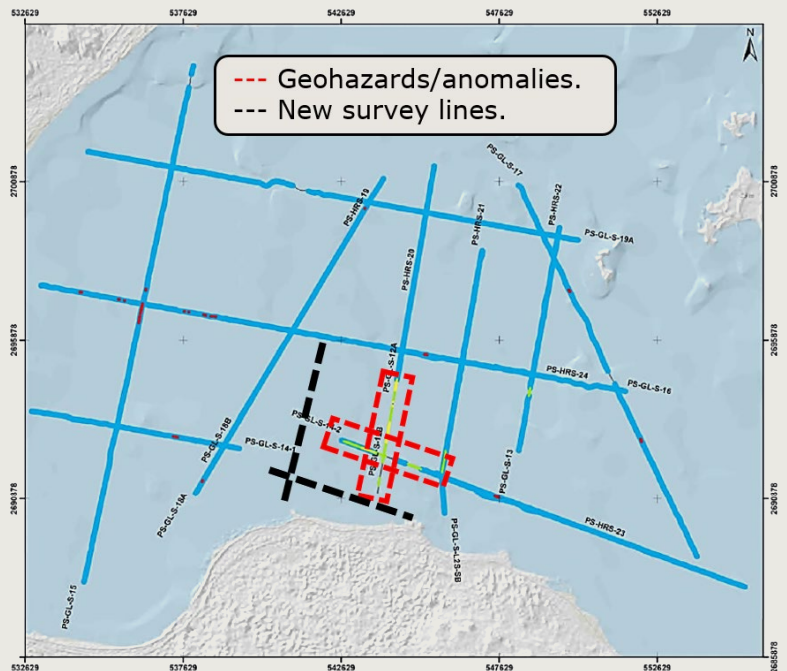
Services

- Project planning and setup
- Preparation and/or review of tender documentation
- Tendering support
- Project management including scheduling, resources and cost management, risk management etc.
- Quality assurance program
- Preparation, review, and management of technical documentation
- Licensing support
- Oversight of vendors and supply chain
- Financing concepts and support securing financing



Site survey, evaluation and characterization

AFRY has supported siting projects for nuclear facilities for decades, in all stages. Site surveys, evaluations and characterizations. We have supported both owners and authorities.

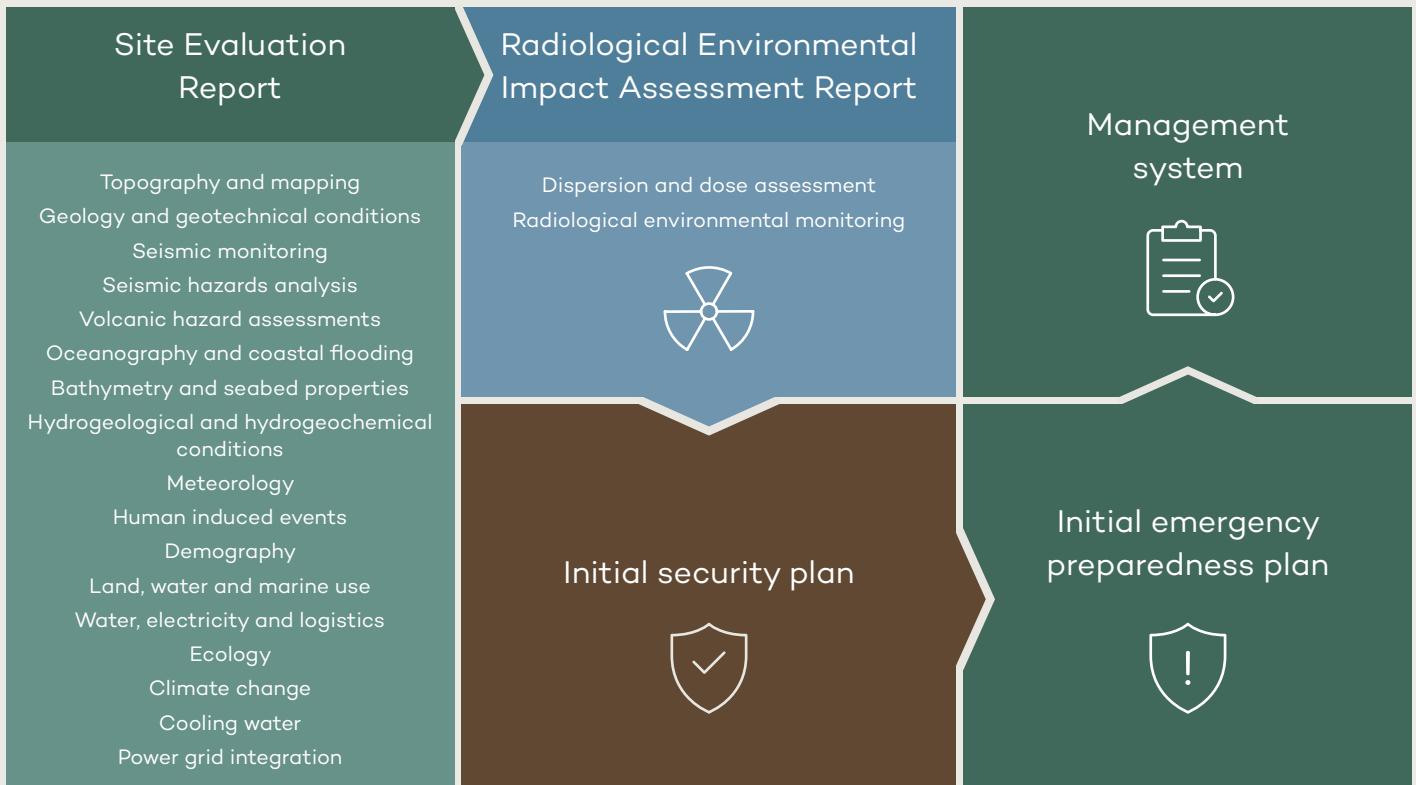


Projects

- Sinop Nuclear Power Plant, Türkiye
- Ninh Thuan 1 and 2 NPP, Vietnam
- Niederramt NPP, Switzerland
- Hanhikivi NPP, Finland
- Angra 3 NPP, Brazil
- Paks II NPP, Hungary
- Gösgen NPP, Switzerland
- LNPP, Saudi Arabia
- Bangka, Indonesia

- Geography and topography
- Spatial planning and infrastructure
- GPS geodetic network and 3G
- Hydrology, oceanography, volcanology, seismology, meteorology, hydrogeology
- Socio-economy and cultural studies, demography
- Human induced events
- Land, water and marine use
- Dispersion
- Dose assessment and background radiation monitoring
- Technical and safety aspects of NPP
- Fuel cycle and waste management
- Environmental impact assessment (EIA)

Services



Small modular reactors and advanced nuclear technologies

AFRY's nuclear consultants provide the full set of expert technical and commercial services across the nuclear energy value chain required to develop and deliver technically and economically successful Advanced Modular Reactor and Small Modular Reactor nuclear power plants.

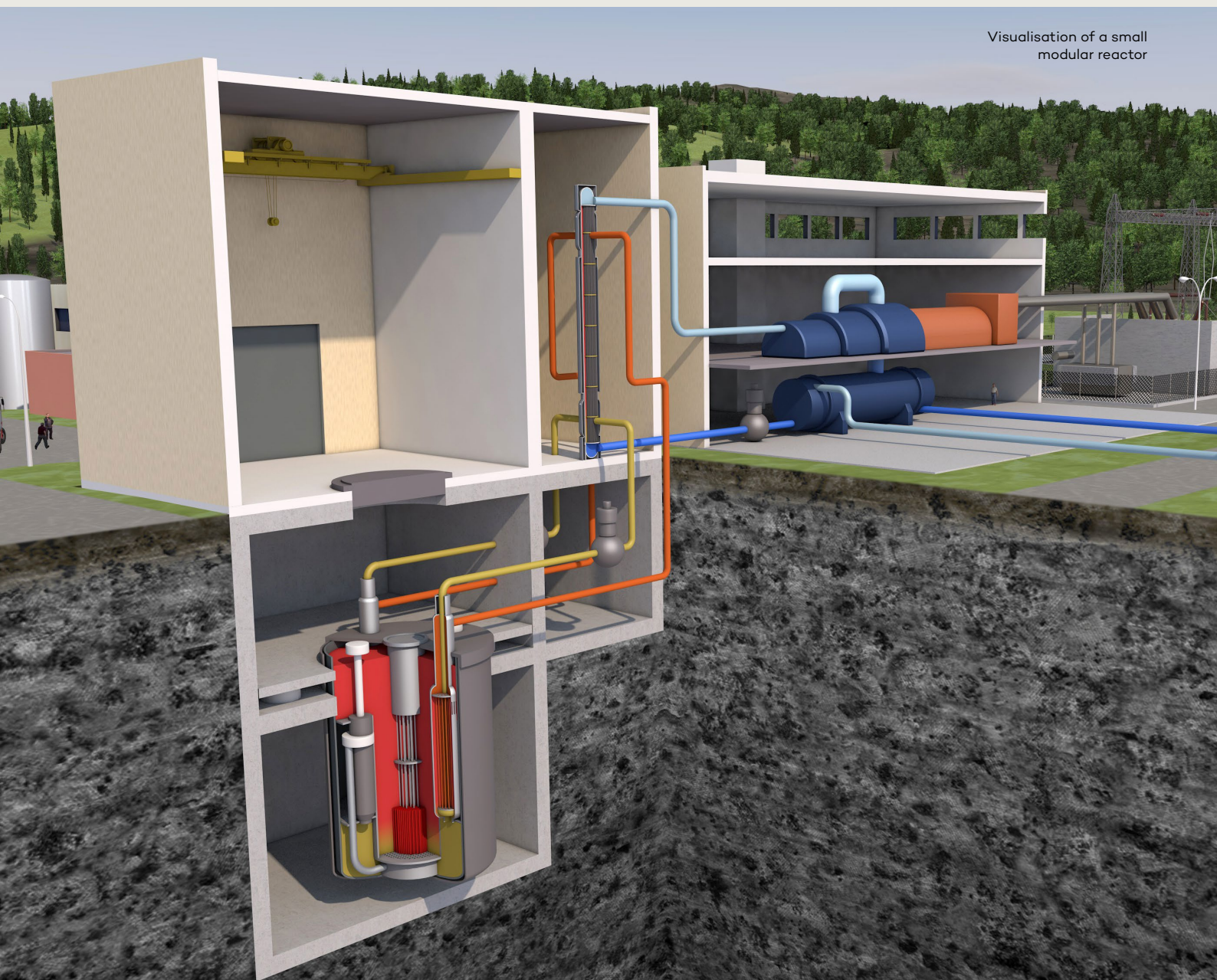
Projects

- SMR district heating study on HOB and CHP-SMR (2022)
- Study on using nuclear power beyond electricity production (2021)
- Conceptual layout and CAPEX estimate for SMR & District Heating plant (2020–2021)
- SMR zoning and environmental licensing study (2020–2021)
- SMR Basic Training/NyTeknik Education (2023–ongoing)

- Small & advanced Modular Reactor Market Study & Red Flag Report (2022)
- Next Generation Nuclear Market Report & Deep Dive (2021)

Services

- Market reports and Due Diligence
- SMR Basic Training
- Feasibility studies, optioneering and selection of technology
- Design review and preparation



Visualisation of a small modular reactor

Supply chain assessment

AFRY has supported vendors and owners in developing local and regional supply chains.

Projects

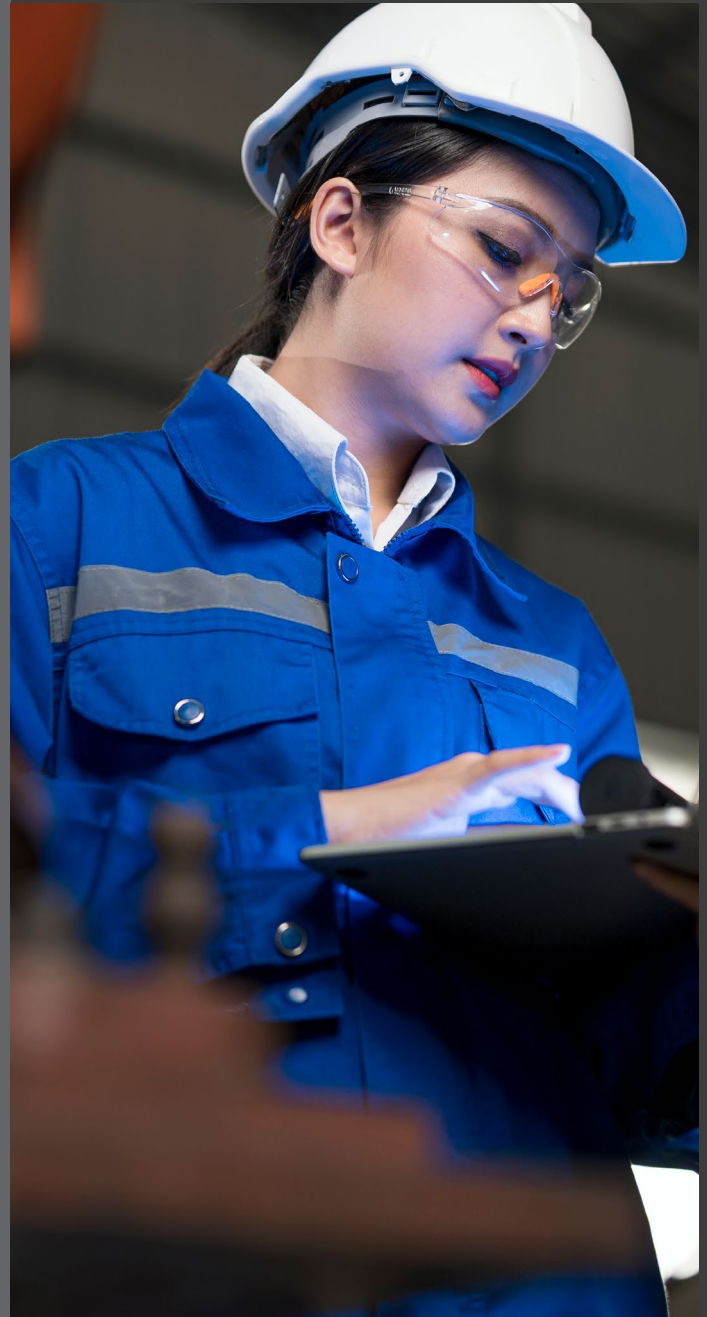
- Akkuyu Power Plant, Türkiye
- SINOP, Türkiye
- Gösgen NPP, Switzerland
- Angra 3, Brazil
- Hahnikiivi 1, Finland

Services

Selection of candidate local companies for the supply chain, incl. price monitoring of materials, components and systems

Support formal qualification, by the reactor vendor, authorities and formal qualifying organisation, of local suppliers in accordance with any international standards:

- Reviewing of local companies processes and manufacturing practice
- Comparison with the required standards in the nuclear field and also with the standards required by the reactor vendors
- Training to meet new requirements
- Oversee the change (processes, manufacturing, engineering)



Licensing support

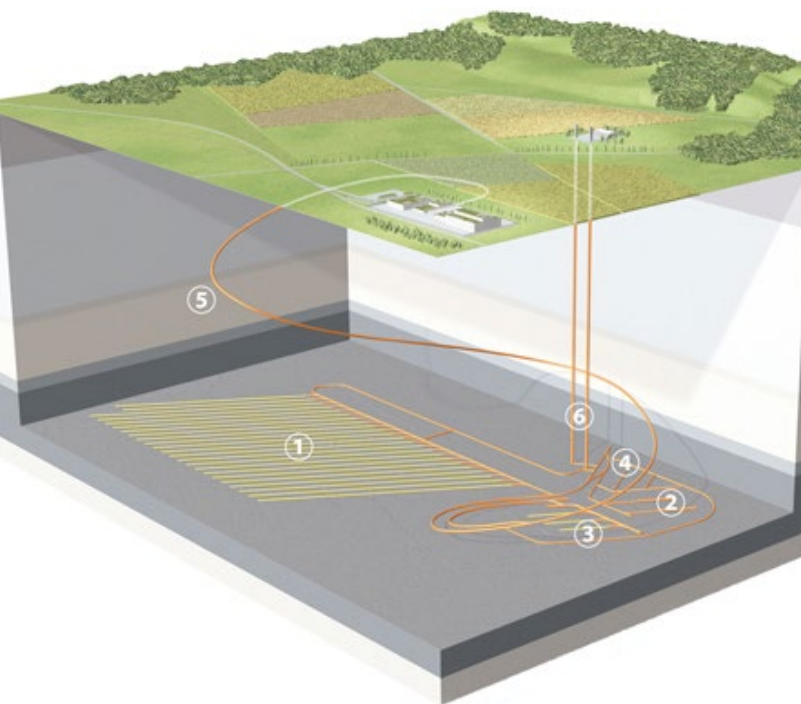
For each country AFRY supports either the Licensee or the Nuclear Regulator, in order to avoid any conflict of interest. Our licensing support and experience stretch over the whole new build project for nuclear facilities from site license applications to decommissioning applications.

Projects

- Updating SAR, PSA for plants in operation, Sweden, Switzerland, UK
- Site License application: Türkiye, SINOP, LNPP/Saudi Arabia, Angka/Indonesia
- Construction License Application; Hahnkivi 1/Finland, Paks II/Hungary, NPP Gösgen/Switzerland

Services

- Licensing plan
- Comparison of technical designs with national and international codes and standards
- Preparation and/or review of licensing documentation
- Interfacing with Regulatory body all through the project
- Project Management and PMO
- Deviations during planning, design and implementation
- Justification and explanation sessions with regulatory body during licensing phase



Safety analyses and NPP documentation

We are a trusted partner of the Swiss NPP utilities. For four decades AFRY has provided expert technical, safety and management support services for Switzerland's nuclear power stations. We support the O&M projects: preparation and update of safety analysis reports, operational manuals, periodic safety reviews, ageing management, cost analyses/cost reductions, project management support in system technology, mechanical engineering, electrical engineering, and control systems.

Projects

Safety analyses report

- SAR Periodic Update (NPP Gösgen, since 2003)
- SAR Periodic Update (NPP Leibstadt, since 2018)
- Support the site license application (Nagra, work is ongoing)

Relevant analyses

- Combination of external hazards (NPP Gösgen, 2018)
- Extreme weather analyses (NPP Gösgen, 2020–ongoing, ZWILAG 2021)
- Aircraft crash frequency analysis (NPP Gösgen, 2020)
- Safety assessment of cranes and lifting equipment (NPP Gösgen, 2020)
- 1D/3D analyses of the flow conditions in the fuel assembly (NPP Leibstadt, 2017–2020)
- Deterministic safety analyses (RELAP5 Input for NPP Beznau, since 2015)
- Probabilistic safety analyses (Update of the operational PSA, NPP Beznau, since 2022)

PSÜ

- System handbooks (NPP Gösgen, 2015–2016)
- System assessment reports (NPP Beznau, 2019–2020)
- System assessment reports (Mechanical und I&C components, NPP Leibstadt, 2020–2022)



Services

- Safety analysis & assessment
- Probabilistic safety assessments for Level 1 & 2
- Preparation of safety reports & operating manuals
- Periodic safety reviews
- Expert non-destructive testing
- Participation in the core team for upgrade projects
- Creation & maintenance of control & instrumentation functions
- Classification according to Swiss regulator ENSI & international regulations
- Cooperation with suppliers
- Technical project management
- Fuel assembly thermo-hydraulic modelling (RELAP5)
- Advanced 3D two-phase flow CFD simulations

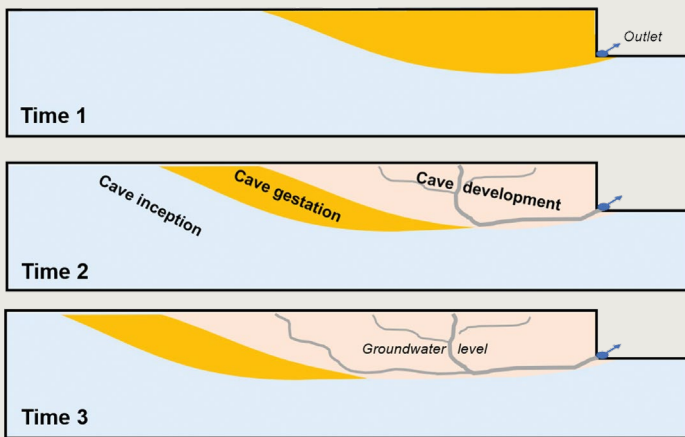
Numerical simulations

Projects

Karst conduit size distribution evolution using speleogenesis modelling, Nagra Switzerland, 2019

One of the critical aspects when modeling groundwater flow in karstic aquifers is to estimate the statistics of the size of the conduits, in conjunction with the connectivity of the karst conduit network. Statistical analysis can be performed on data gathered by speleologists, but a significant fraction of the karst conduit networks is not directly reachable, and therefore, the resulting statistics are incomplete.

An alternative method to evaluate the inaccessible areas of a karst conduit network is to simulate numerically the speleogenesis processes. AFRY used a coupled reactive-transport model to simulate the evolution of a vertical section of a fractured carbonate aquifer and investigate how the statistical distribution of the fracture apertures evolves. The numerical results confirm that the karstification proceeds in different phases that were previously hypothesized and described (inception, gestation, development). These phases result in a multi-modal distribution of conduit aperture. These outcomes can help better characterize the statistical distribution of karst conduit apertures including the inaccessible part of the network.

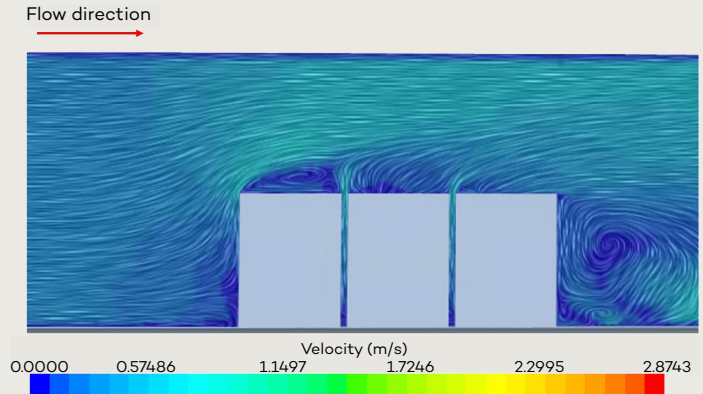


Conceptual model for the development of karst conduit network: (1) inception, (2) gestation, and (3) development

Ventilation of a repository gallery (AtEx atmosphere)

AFRY supported Andra (FR) with long-term safety calculations of an underground nuclear waste repository. Several ventilation scenarios with a focus on hydrogen concentration in the air were performed using the software Star-CCM+ accounting for multiphase flow conditions. The simulations were aimed at the safety assessment of the gallery in the underground repository after its closure when the nuclear waste generates hydrogen gas by radiolysis. The specific objectives are to simulate the development of an initial hydrogen concentration for several ventilation scenarios including:

- Steady state with mechanical ventilation
- Transient simulation of removal of hydrogen after the resume of mechanical ventilation following an unplanned interruption.
- Transient simulation of inerting of the gallery with carbon dioxide.



Visualisation of air flow (forced ventilation) in a gallery hosting waste containers

Impact assessment of the Cigéo repository on the flooding surrounding river basins (FR)

The main objective is to assess the impact of Cigéo surface infrastructure on the risk of urban flooding linked to a direct overflow of rivers in basins where the repository is located.

The assessment is carried out by considering the current land use conditions, the changes induced by the construction of Cigéo and the implementation of measures to reduce peak flows. The main results of the study were:

- Hydrological simulation of the rivers that produces hydrographs at the points of interest for the study
- Hydraulic simulations to estimate the depth and horizontal extent of the flood on the minor and major river beds
- A comparison between different scenarios to determine the impact of the construction of Cigéo and the reduction measures on the flood risk.



River network in the study area

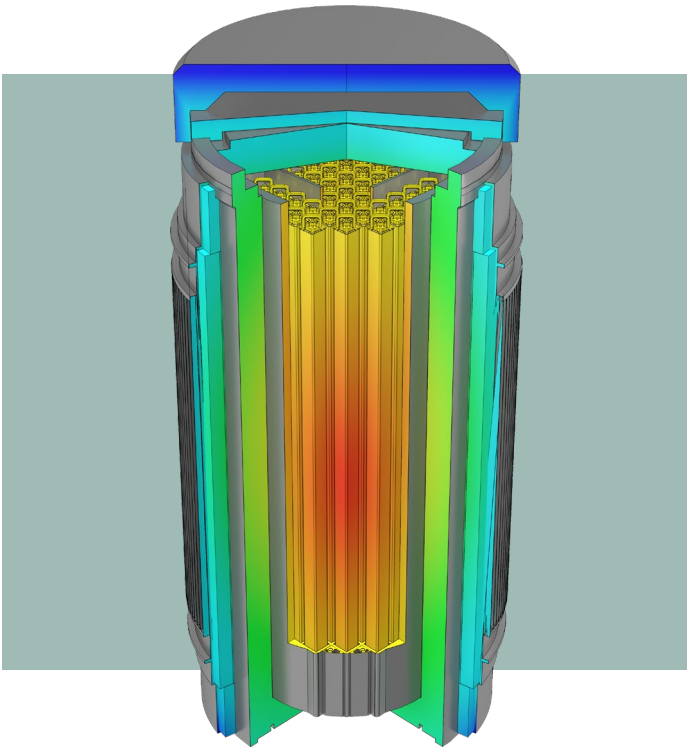
Services for the nuclear industry

- Numerical simulation of surface water flows
- Numerical simulation of groundwater flow and reactive transport
- Numerical simulations of multiphase flow

Interim storage

AFRY Switzerland has experience in the design of dry and wet storage facilities. Our technical experts and project managers helped implement the final design and construction of a first-of-its-kind wet storage facility with passive cooling system for the Gösgen nuclear power plant.

We have experience in the safety analysis, thermal, shielding and criticality calculations, feasibility studies for spent fuel transport and final disposal canisters.



Projects

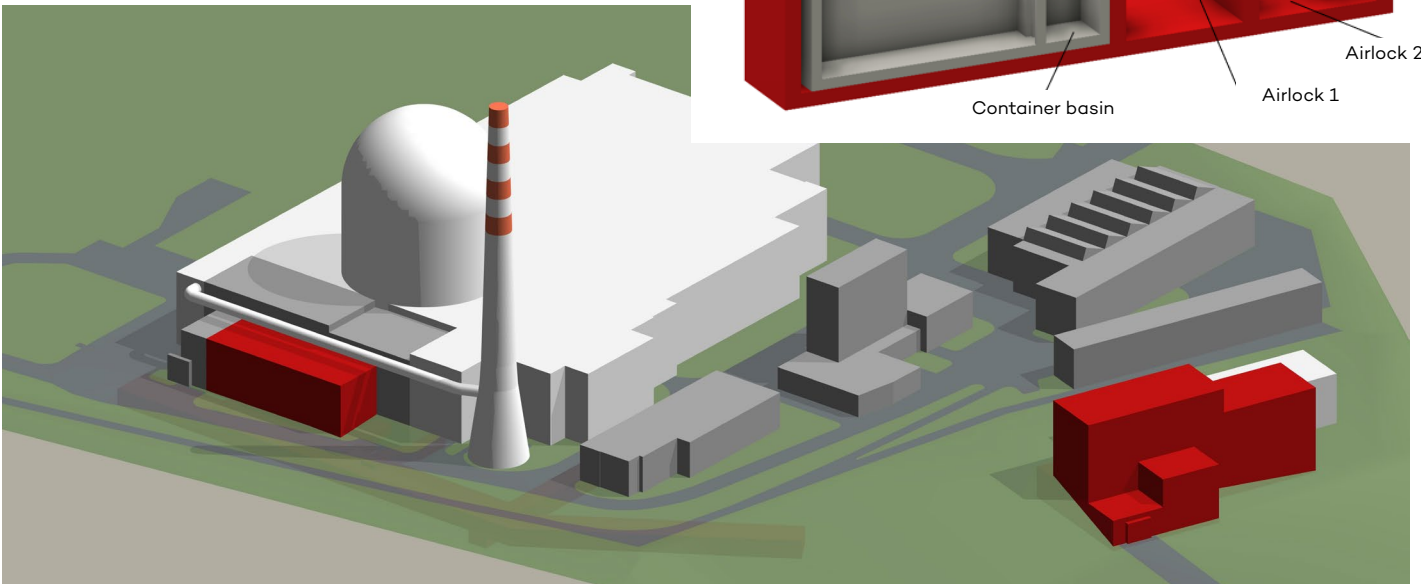
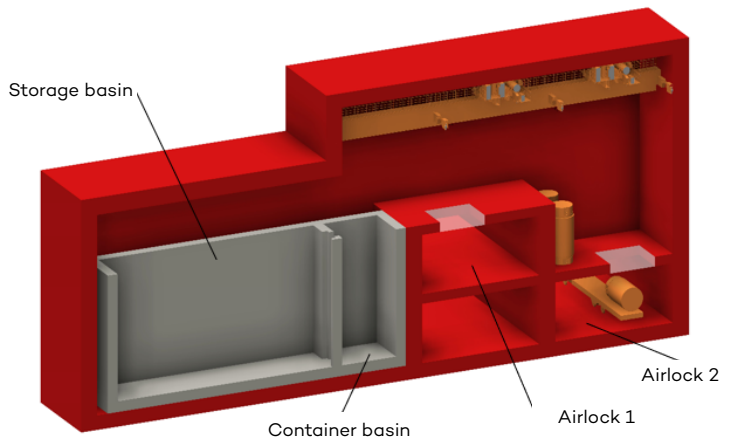
- Interim storage facility Zwiilag, Switzerland – Architect Engineer for the waste conditioning plant and the auxiliary building
- Owner's Engineer for the wet storage facility at NPP Gösgen, Switzerland
- Detailed design of the wet storage facility in Brazil
- Feasibility Study of the wet storage facility at NPP Leibstadt, Switzerland
- Fire analysis in a repository for radioactive waste, Nagra
- Safety Analysis Calculations for Transport Casks (Clients: NPP Gösgen, Axpo, Nagra)

Services Interim Storage

- Project management
- Feasibility study
- Preliminary and final safety analysis report
- Tendering support
- Concept and detailed design
- Licensing Support
- Site supervision
- Commissioning

Services Transport Cask

- Feasibility and safety studies
- Full 3D models
- Thermal calculations
- Fuel source determination



Final disposal surface facilities & encapsulation plants

Our technical experts have developed a design for a fuel assembly encapsulation facility and a surface facility for the Nagra in Switzerland. The plant design enables safe repackaging of high-level radioactive waste from transport and storage casks into final disposal canisters.

Projects

Encapsulation facility:

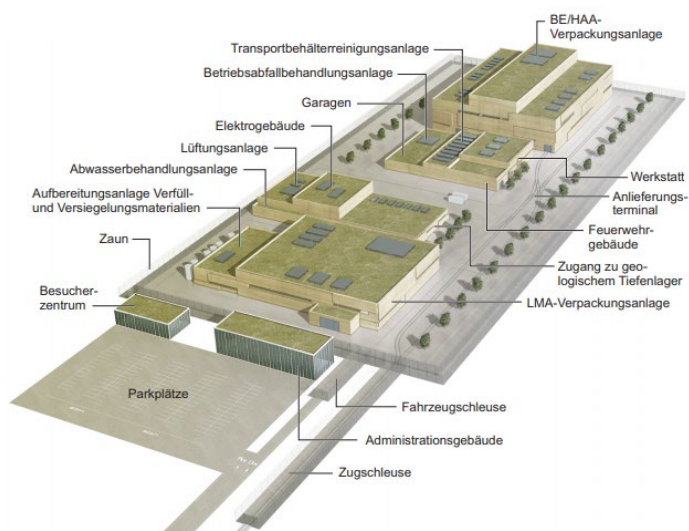
Adaptation of the complete fuel assembly encapsulation plant design to the current regulatory requirements

NAGRA surface facility:

Conceptual design of the surface facility for repackaging and disposal of radioactive waste for three sites in Switzerland.

Services

- Feasibility study, concept planning, safety analyses
- Design of the nuclear and non-nuclear buildings, e.g. shaft head facility, ventilation building, electrical building, etc.
- Preparation of the higher-level report on all specialist disciplines
- Preparation of a preliminary safety assessment
- Planning of the logistics concept
- Development of the BIM model



Surface facility for storage and repackaging of radioactive waste



Deep geological repositories

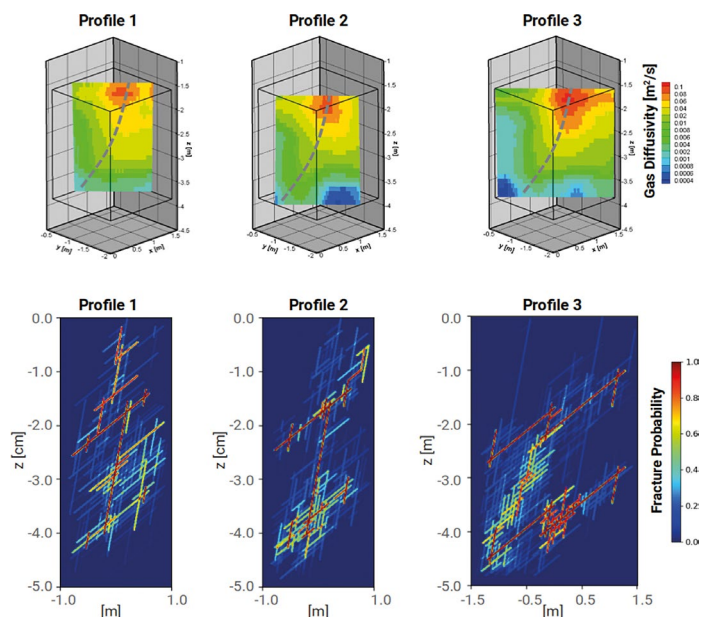
Our technical experts have extensive experience in the characterization of deep repositories for low-, intermediate- and high-level radioactive waste. To support our work, we use qualified software accepted by the nuclear authorities.

Projects

- **Deep drilling program of Nagra:** Hydraulic characterization of Opalinus Clay and confining units in deep boreholes up to 1400 m; Design and analysis of hydraulic packer tests and fluid logging
- **Hydraulic test design and analysis in the Underground Research laboratory of Andra:** Analysis of hydraulic and pneumatic borehole tests conducted in Callovo-Oxfordian Clay by means of numerical modeling as well as hydraulic tomography, predominantly for the hydrogeological characterization of the spatial and temporal evolution of the excavation damaged zone (EDZ)
- **Characterization of the sedimentary overburden of the Asse Salt Mine, German Federal Office for Radiation Protection (BfS):** Advisory and support services for the authority including hydrogeological exploration and development of monitoring strategies, conceptual model development and safety analysis
- **Advanced CFD simulation of the deep geological repository:** e.g. scenarios for ventilation during operation phase; intrusive borehole hazard after closure

Services

- In situ characterization of potential host rocks and their confining units in deep boreholes and in underground research laboratories
- Design and analysis of packer tests and fluid logging in deep boreholes
- Design and analysis of advanced cross-well testing procedures in underground research laboratories comprising hydraulic and pneumatic tomography
- Development of hydrogeological conceptual models based on geoscientific field and laboratory tests
- Safety analysis
- Groundwater flow and radionuclide transport simulations in porous media and fractured rock
- Simulations for spent fuel canisters
- Underground waste repository modeling
- Flood risk simulations



Decommissioning services

Our team has extensive experience in successfully managing the unique challenges associated with decommissioning of nuclear facilities. We are proficient in the regulatory and operational requirements. From post-operational conditions to greenfield site restoration, we are fully equipped to provide comprehensive support to our clients throughout the decommissioning process.



Projects

- Framatome Siemens AG, France, Germany (2000): Decommissioning cost assessment of 23 nuclear fuel cycle sites
- PSI, PROTEUS (2014): Assistance in disposal of radioactive materials and fuel
- EPFL, LOTUS (2014): Study on possible shutdown and decommissioning strategies; activation measures/sampling; cost study for decommissioning and reuse strategies
- PSI, PROTEUS (2022–ongoing): Preparation of the final decommissioning report for the regulatory release from the nuclear licence
- WAK GmbH Karlsruhe, KNK II, FBR (2008–2013): Planning, technical interfaces; technical specifications, tendering, procurement; acceptance tests for equipment dismantling; declarations, waste management procedures and processes; transport concepts, shielding calculations; scheduling, controlling and strategy

Services

- Scheduling and cost estimates (by IAEA standards)
- Licensing procedures
- Contracting, tendering and procurement
- Project management
- Design, evaluation (and creation) of the project organisation
- Conceptual & detailed planning for decommissioning
- Calculation of activated structures (by verified international code)
- Sampling and measuring programs
- Classification of wastes and their amounts
- Volume reduction and separation procedures, logistics
- Definition and design of waste packages
- Buffer and interWstorage locations of produced waste
- Shielding calculations and dose evaluation
- Definition of materials, waste and personnel routing
- Decontamination procedures
- Designing, pre-dimensioning, calculations
- Follow-up of activities and costs
- Acceptance tests – testing procedures
- Supervising the order-specific production and commissioning
- Quality assurance, paperwork/ documentation

Our clients

We foster long-term customer relationships founded on trust and openness. We are delivering economically successful projects for our clients with a focus on increasing utilization rates, improving operating availability and raising levels of safety.



Interns at AFRY



Roman Andermatt

Emeline Beltjens

Salome Daehn

Javier Orive-Soto

Mathis Barth

2015

2017

2020

2022

2023

Intern 6 months
Master Thesis

Intern 6 months

Intern 6 months

Intern 3 months

Intern 3 months

hired

hired

hired

hired

Interns at AFRY



Eduardo Baldo

2024

Intern 3 months



Marcin Behrendt

2025

Intern 3 months

Interns at AFRY

- System Handbooks for the safety systems of KKG
- Feasibility study of a calorimeter to measure the decay heat of spent fuel (Master thesis. Fig. 1)
- Contribution to the Project Dynamic Analyses of a fuel assembly with RELAP5 (supporting BELDO)
- Data analyses of seismic activity on the KKG site (Fig. 2)
- Contributing to the DABKO project (Digitally optimised cutting and packing of activated concrete structures in Konrad-containers during the dismantling of nuclear facilities) (Fig. 3)
- Feasibility of SMRs for non-electrical markets (Fig. 4)
- Utilizing Artificial Intelligence to bring order into the SMR jungle
- Modernize the development of safety case documentation
- +International Project Work

Fig. 1

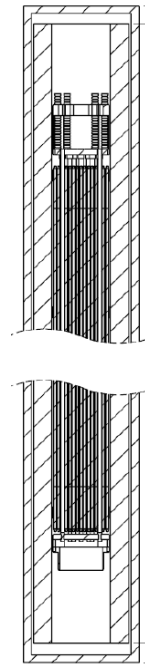


Fig. 2

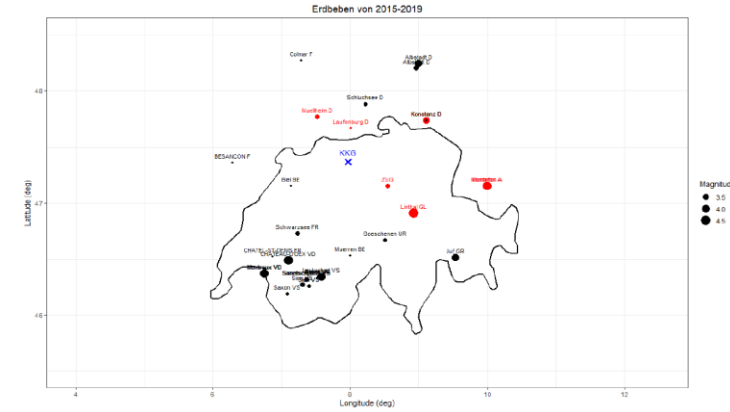


Fig. 3

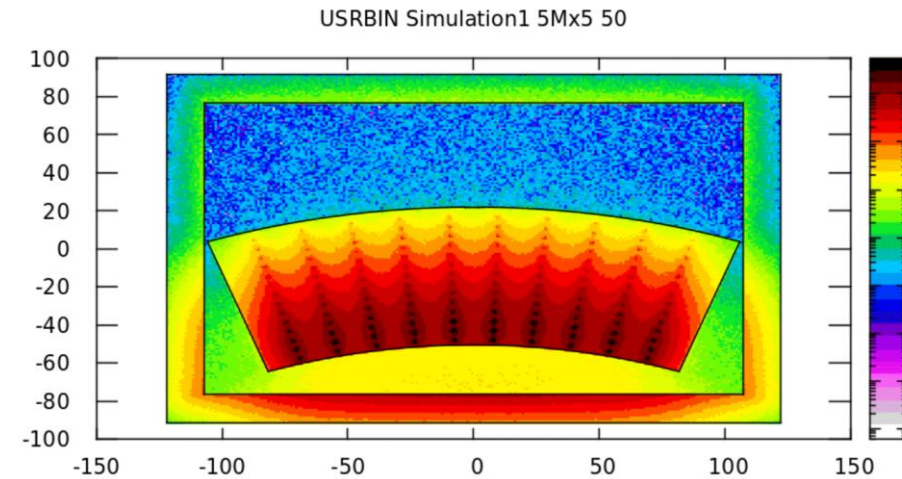


Fig. 4

