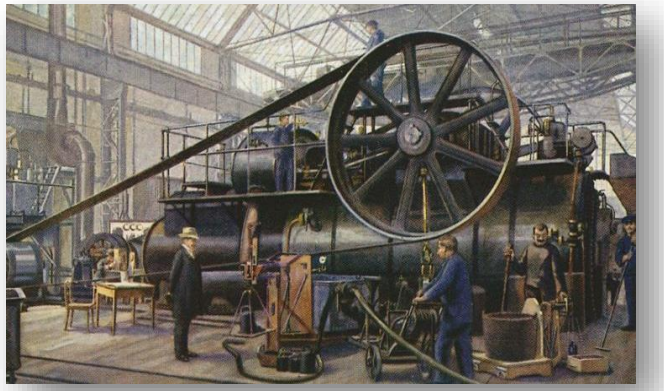
TÜV NORD NUCLEAR –
SERVICE PROVIDER IN THE FIELD OF NUCLEAR ENERGY

TÜV NORD EnSys GmbH & Co. KG

150 YEARS OF CONTINUOUS EVOLUTION

PRODUCTS & SERVICES FOR SAFETY & SECURITY

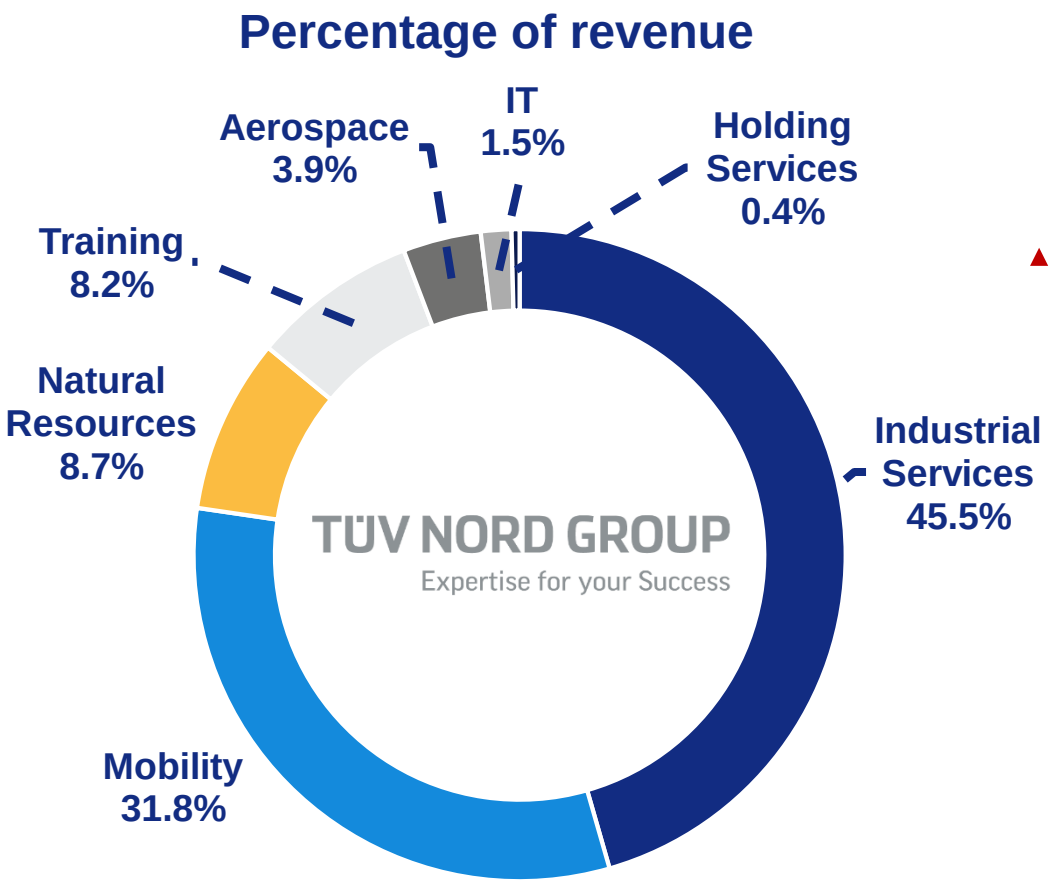
- 19th century: Foundation of various TÜV associations
- 1869 **TÜV NORD:** first steam boiler inspections
- 1903 First inspection of ***motor vehicles*** in Schleswig-Holstein & Hannover and first driver‘s license exam
- 1908 First inspection of ***elevator installations***
- 1911 First ***mining industry*** inspection of electrical installations

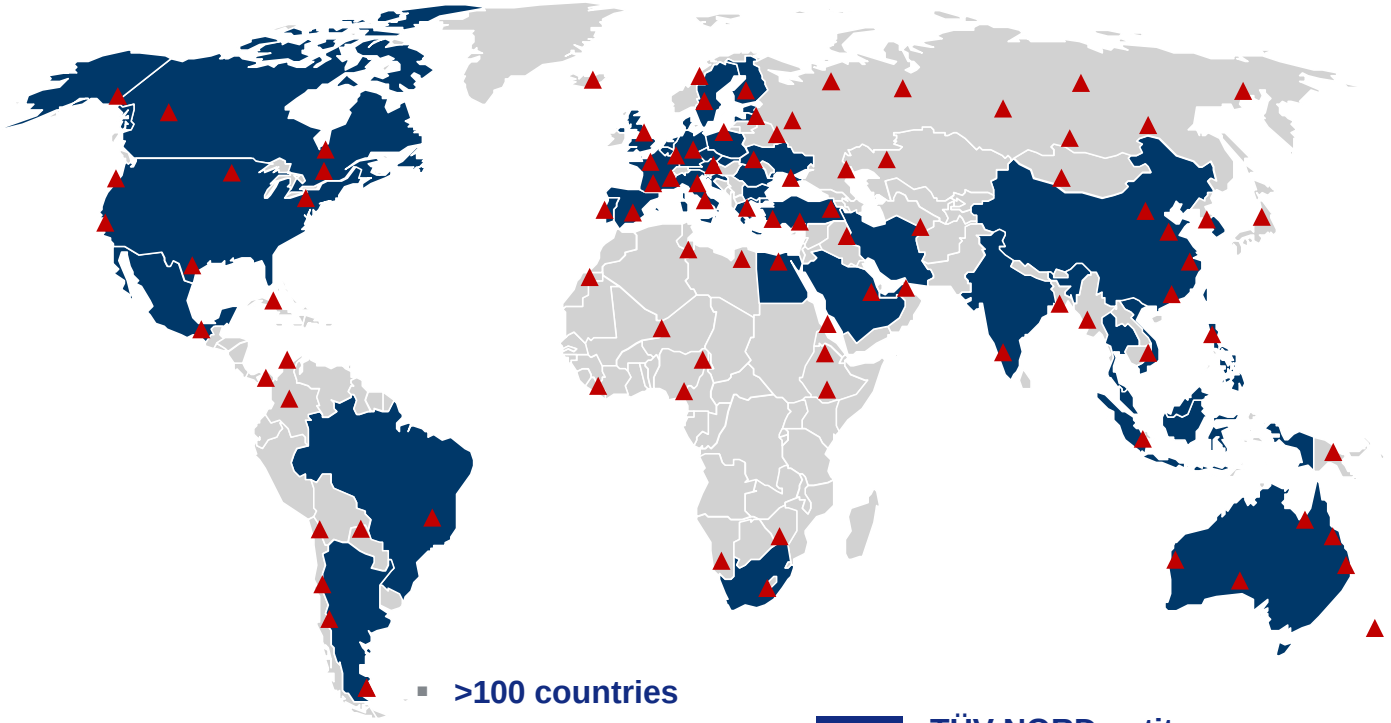


- 1927 First recurring ***motor vehicle*** inspections (voluntary)
- 1948 Foundation of the ***materials engineering*** and ***manufacturing control*** departments in Hamburg
- 1957 Start of work in nuclear safety - Geesthacht 1 research reactor

Today, TÜV NORD Group is one of the largest principle TSOs in Germany and an international network of TÜV NORD entities operating worldwide

TÜV NORD:
A GROWING BUSINESS - WORLDWIDE





- >100 countries
- 150 companies
- 1.3 B€ revenues
- 14,000 employees

TÜV NORD entity

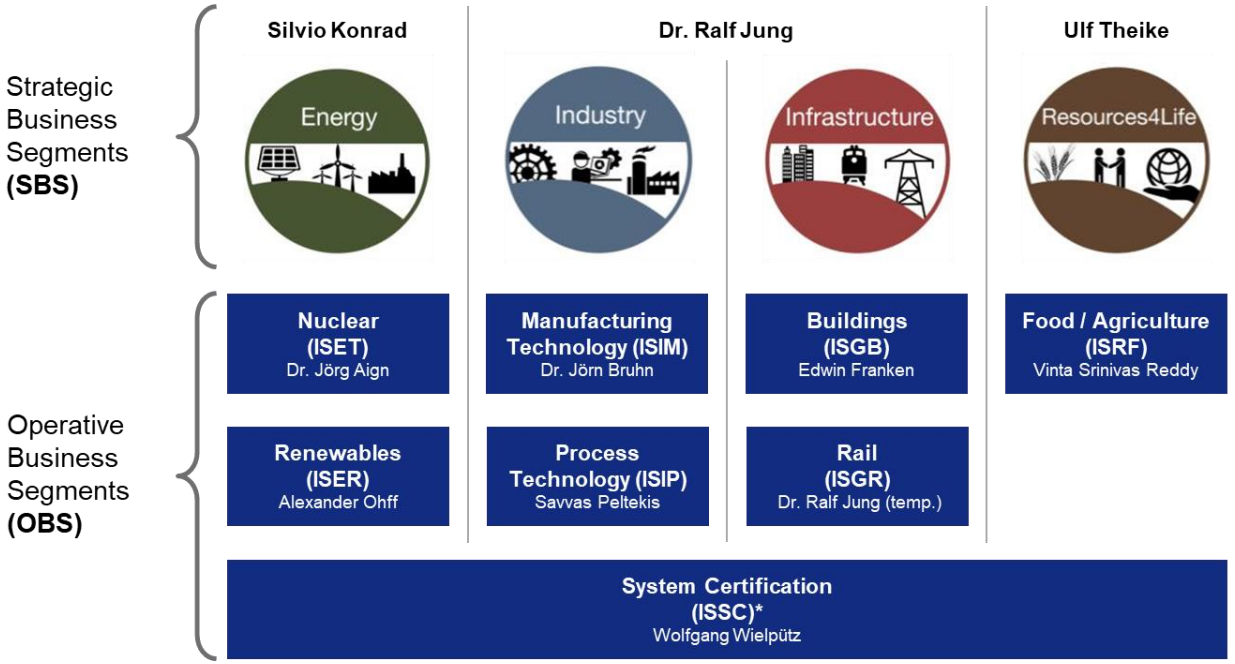
TÜV NORD project

TÜV NORD GROUP:
AN ANSWER TO ALMOST ANY TECHNICAL QUESTION - WORLDWIDE

TÜV NORD AG						
Business Unit Industrial Services	**Business Unit Mobility**	**Business Unit Natural Resources**	**Business Unit Training**	**Business Unit Aerospace**	**Business Unit IT**	**Group Services**
TÜV NORD Systems, TÜV NORD EnSys	TÜV NORD Mobilität	DMT	TÜV NORD Bildung	ATN	TÜViT	TÜV NORD Service

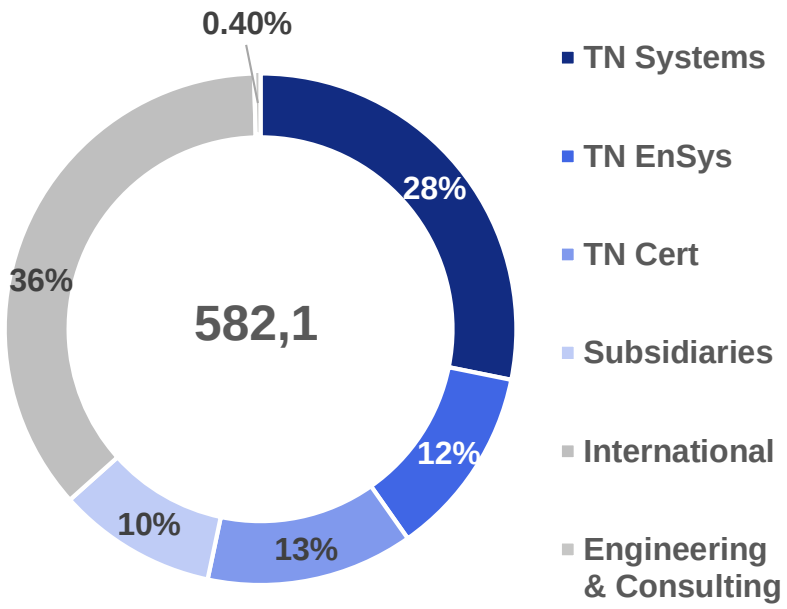
TÜV NORD Nuclear:
Embedded in the* TÜV NORD Group*,
TÜV NORD Nuclear *consists of* EnSys
as well as several international subsidiaries

BUSINESS UNIT INDUSTRIAL SERVICES



582,1 Mio € REVENUE

373,7 million national
208,4 million international



6197 EMPLOYEES WORLDWIDE

2940 national
3257 international

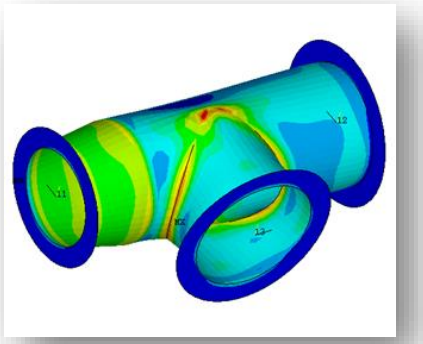
TÜV NORD NUCLEAR –
A PARTNER FOR OPERATORS, REGULATORS & MANUFACTURERS

TÜV NORD Nuclear

- **Services and products** bespoke to meet **international market** needs.
- Independent inspections and consultancy to **operators, regulators & manufacturers**.
- **Strategic alliances** & **innovative partnerships**.
- Continuous expansion of **capacity & competence** to execute orders for international clients.

TÜV NORD

WE PROVIDE A FULL-SCOPE OF COMPETENCE IN NUCLEAR INSPECTION AND CONSULTANCY

TÜV NORD Nuclear

Safety assessment, design review, documentation review for nuclear regulators

Neutrality
Independence
Competence

Consultancy and inspection services for utilities, suppliers and manufacturers

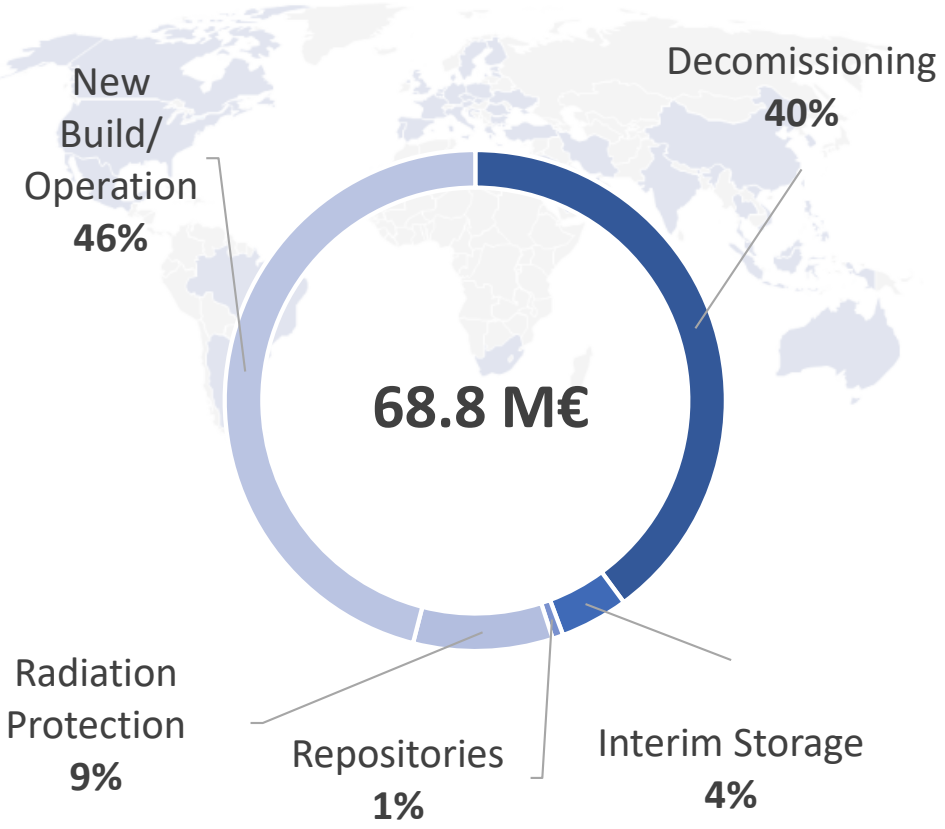
Our general nuclear scope

Adapted to the respective ***stages of the life cycle*** of nuclear facilities: new build and refitting, operation, decommissioning ***for all kinds of nuclear facilities***, e.g.

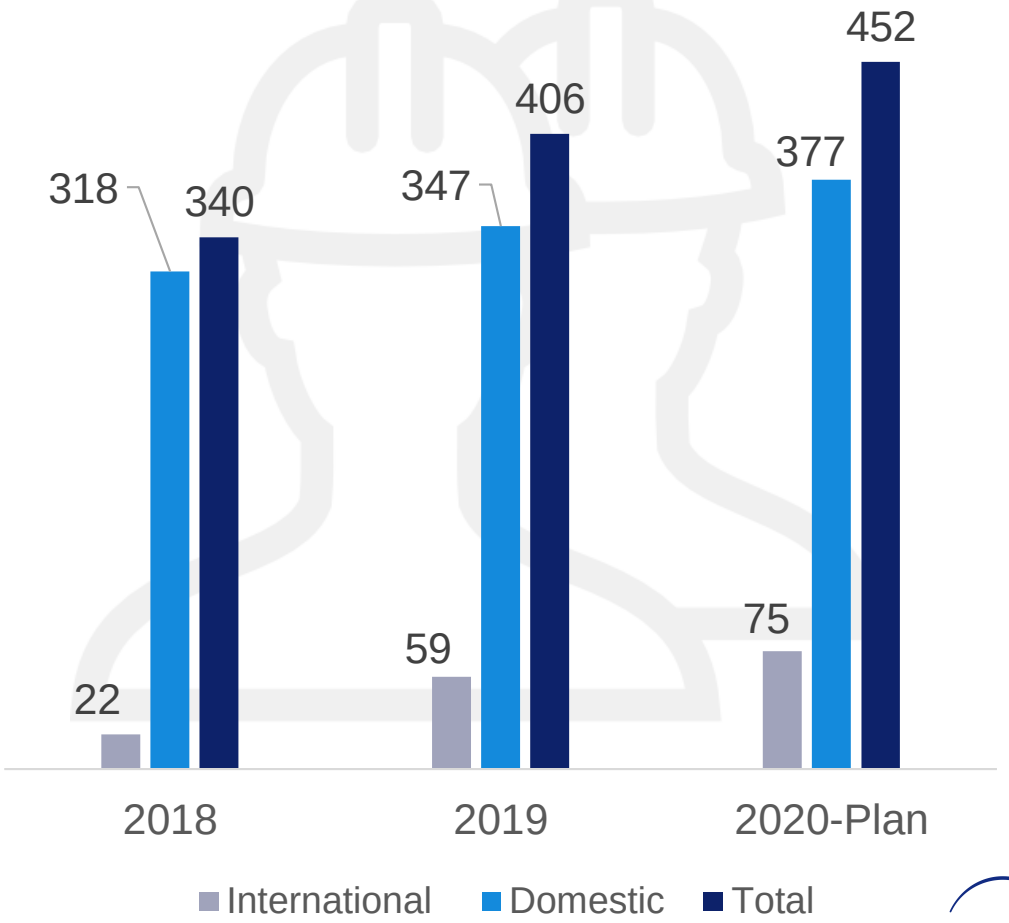
- nuclear power plants
- research reactors
- fuel supply facilities
- treatment and interim storage facilities for spent fuel and radioactive waste
- repositories for final disposal

TÜV NORD NUCLEAR –
FACTS AND FIGURES

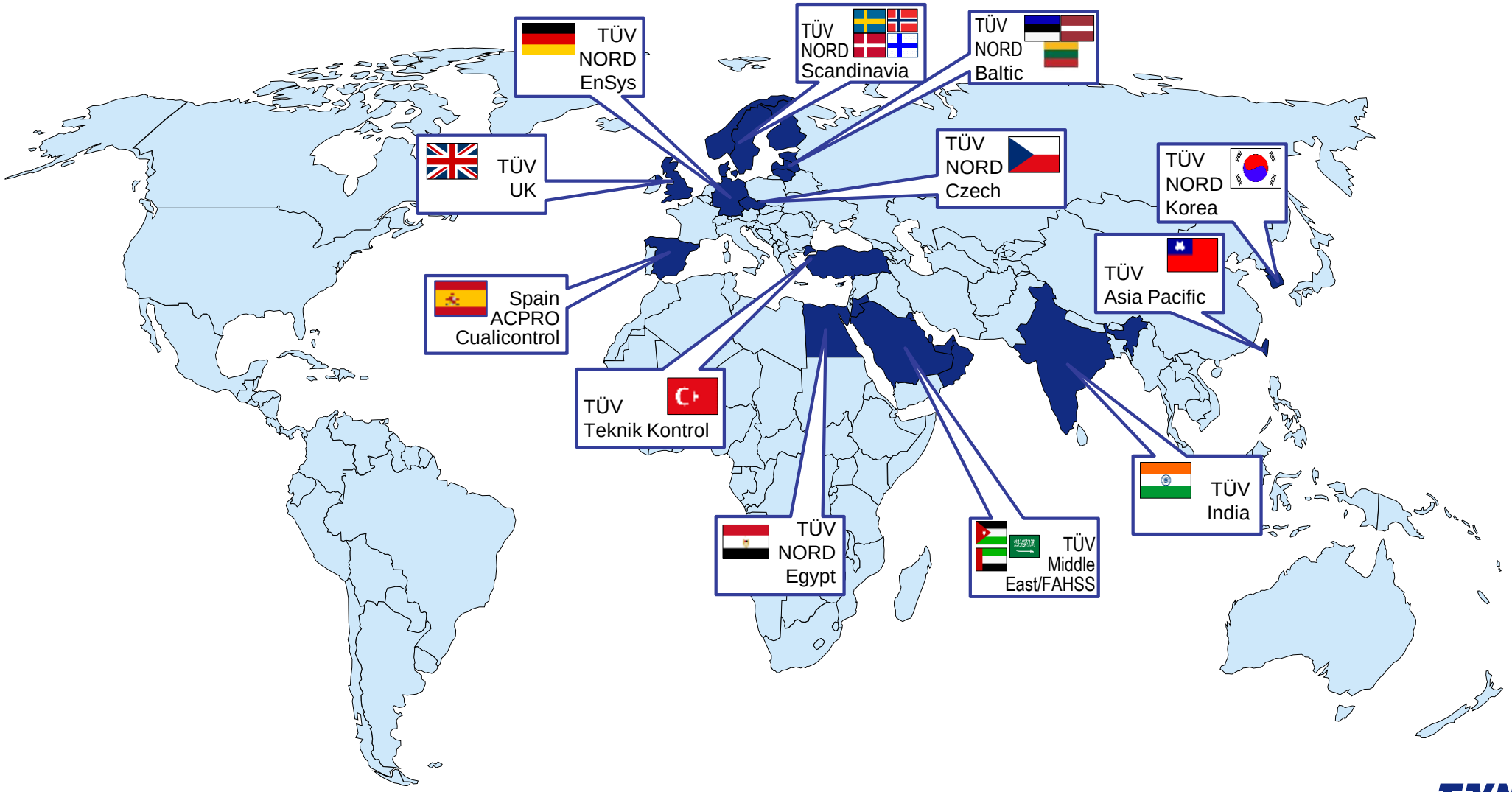
REVENUE DISTRIBUTION



NUMBER OF EMPLOYEES



TÜV NORD NUCLEAR INTERNATIONAL ENTITIES…



TÜV NORD NUCLEAR:
COVERING THE ENTIRE LIFE CYCLE

New Build
- Concept & Planning
- Licensing Support
- Construction & Erection
- Manufacturing
- Commissioning

Operation
- Start-up
- Power Operation
- Outage Support
- Life Time Extension

Decommissioning & Dismantling
- Planning & Licensing
- Post Operation Clean Out
- Decontamination & Dismantling
- Site Remediation, Release & Store

Waste Management
- Waste Concepts
- Properties, Handling and Conditioning
- Interim Storage & Disposal

TÜV NORD NUCLEAR:
COVERING THE ENTIRE LIFE CYCLE

New Build

- Concept & Planning
- Licensing Support
- Construction & Erection
- Manufacturing
- Commissioning

Concept & Planning

- Safety assessment of concepts and designs
- Safety related co-engineering of structures, systems and components
- Assessment of Safety Case and supporting documentation
- All siting issues like Environmental Impact Assessment

Construction & Erection

- Reviews and inspections of design and manufacturing documents
- Inspections during manufacture and erection on site
- Work and safety aspects

Commissioning

- Testing, qualification and commissioning
  - systems & components; cold tests
  - nuclear commissioning

TÜV NORD NUCLEAR:
COVERING THE ENTIRE LIFE CYCLE

Operation

- Start-up
- Power Operation
- Outage Support
- Life Time Extension

Operational Supervision

- Periodic in-service inspections
- Operation (conduct and occurrences)
- Plant and document modifications
- Assessment of events and occurrences in nuclear installations

Lifetime Extension

- Reviews and inspections of design and manufacturing documents
- Inspections during manufacture and erection on site
- Work and safety aspects

Revision and Outage

- Safety re-assessments
- Safety evaluations during maintenance, repair and outages

TÜV NORD NUCLEAR:
COVERING THE ENTIRE LIFE CYCLE

Decommissioning & Dismantling

- Planning & Licensing
- Post Operation Clean Out
- Decontamination & Dismantling
- Site Remediation, Release & Store

D&D

- Safety assessment of decommissioning concepts and review of safety cases
- On site inspection and surveillance
- Radiation protection

Clearance & Release

- Clearance concept
- Measurement strategies
- Application of clearance and exposure scenarios
- Clearance-driven D&D-concept
- Economics of clearance vs. radwaste

Site Remediation

- Decommissioning goal (green or brown field, reuse as nuclear site)
- Decontamination concepts
- Measurement strategies
- Renaturalisation concepts

TÜV NORD NUCLEAR:
COVERING THE ENTIRE LIFE CYCLE

Waste Management

- Waste Concept
- Properties, Handling and Conditioning
- Interim Storage & Disposal

Waste Concept

- Definition of waste-streams
- Evolution of waste composition during the course of decommissioning
- Concepts for problematic waste
- Storage space, logistics, etc.

Properties, Handling and Conditioning

- Assessment of properties of radioactive waste
- Assessment and qualification of waste treatment and storage concepts
- Assessment of conditioning facilities
- Inspection during waste processing
- Evaluation of documentation

Interim Storage and Disposal

- Assessment of interim storage and disposal concepts and facilities
- Verification of compliance with regulatory requirements and acceptance criteria
- Evaluation of documentation

ABOUT TÜV NORD NUCLEAR IN THE UK

TÜV UK
KEY DATA

- **A Notified Inspection & Certification Body**

- **Head Office:** Croydon

- **Employees:** 45 Full Time Employees, 8 Based in Croydon
  & Contract 50+ Approved Assessors - Inspectors &
  16 Consulting Associates

- **Foundation:** TÜV UK Ltd was established in 1979

- **Turnover:** 2020 - £4.4M 2019 - £4.1M 2018 - £3.8M

- **Sectors:** Energy / Nuclear, Food, Inspection, Welding, Buildings & Certification

TÜV UK

NUCLEAR SERVICES

- **OFFERING:** **All TÜV UK Standard Core Skill Non-Nuclear services** as a Notified Inspection & Certification Body, transferable to meet nuclear requirements
  RccM qualified & accredited by UKAS Type A Body to 17020
  ASME III Nuclear Equipment, non-accredited
  Extensive Build-Op-Decom Regulator support from Germany & internationally
  Specialist Nuclear Consultancy Services

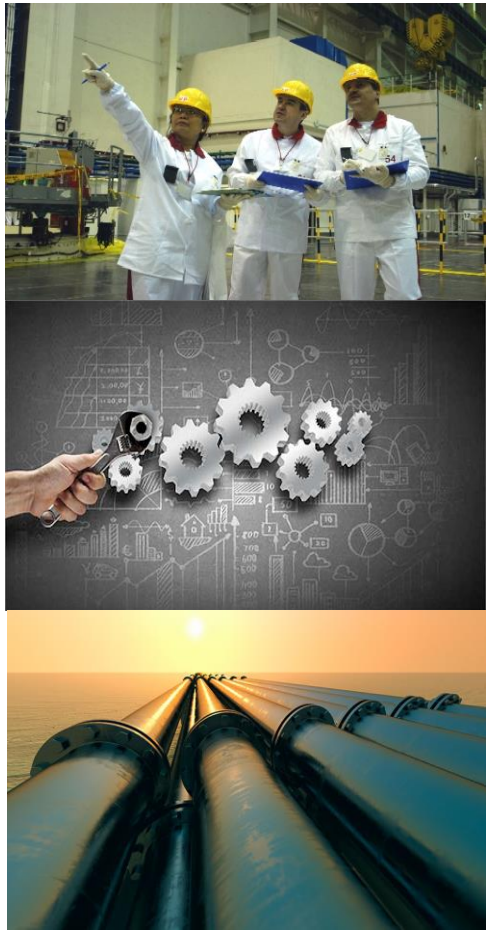
- **SECTORS:** New Build & Advanced Nuclear Technologies (ANTs): SMRs/AMRs/Fusion
  Current Operations & Fuel Cycle
  Decommissioning & Waste Management

- **STAFF:** 16 expert Associate consultants in a variety of Specialist Nuclear fields
  UK core skills staff: 45 FTE & 50 contractors
  Reach back to >400 Nuclear technical staff in Germany & other international regions

TÜV UK

PRODUCTS: CORE SKILL SERVICES FOR NUCLEAR

- **FIELDS:** Certification Inspection Consulting Training Qualification Validation
- **KEY SKILLS:** Rcc-M: system, welding & pressure equipment training & CAB + ISO19443 potential
- **MAIN TRANSFERABLE AREAS:** UKAS accreditations, Type A Conformities & Certifications Body
  - ***Conformity Assessments*** - ISO17020:2012
    2014/68/EU Pressure Equipment Directives (PED) - Notified Body
    PSSR2000 – In-service Inspection and written scheme
    2014/29/E Simple Pressure vessels
    LOLER 1998 Lifting equipment
  - ***Product Conformity Certification*** - ISO17065:2012
    CPR EU No 305/2011: Construction Products Regulations
    98/214/EC: Conformity of Construction Products + ISO1090 CE structural Steel & Aluminium
    ISO 14064-1 (GHG) (UKAS Verification body)
  - ***Quality Management*** System Certification Welding: Certification – ISO17021-1:2015
    ISO 9001:2015 General QMS
    ISO 3834:2005 Certification to all levels Certification parts 2, 3 & 4
    ISO14001:2015 Environment management System (EMS)
    BS OHSAS18001:2007 and ISO45001:2018 Health and Safety Management System (HSMS)
  - ***Data security:***
    ISO 27001 (DAKKS accredited) & BS 10012:2017 Data protection

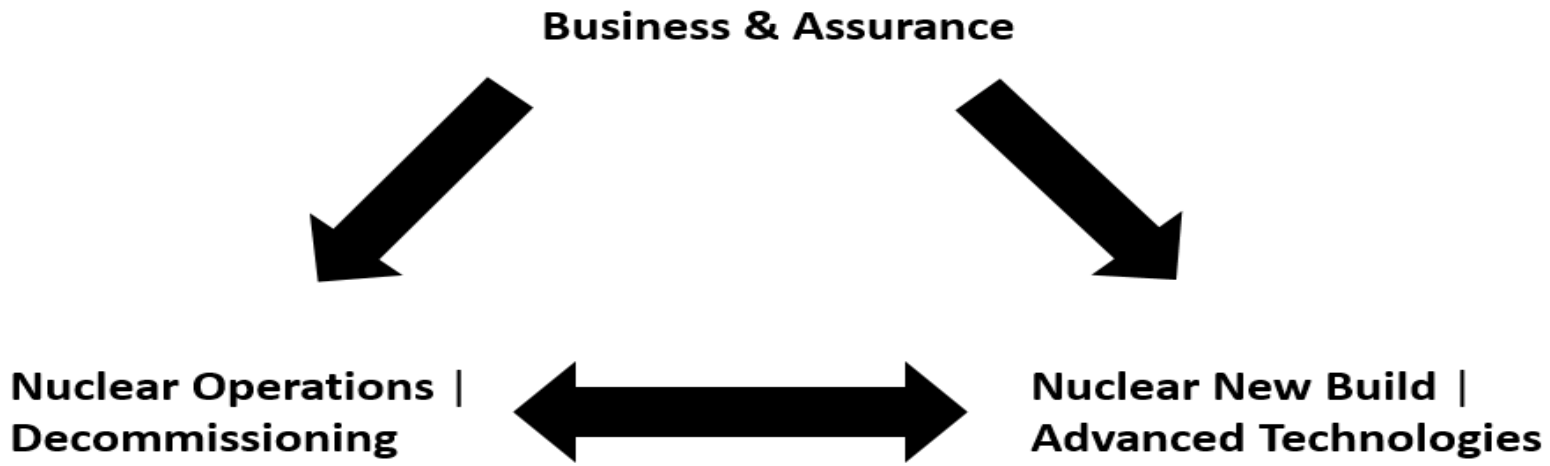


TÜV UK

SPECIALIST NUCLEAR CONSULTANCY SERVICES AREAS

>500 years collective experience from an elite team of Nuclear expert consultants, some of whom have held the most senior positions in the:
UK Regulatory system, Government & Nuclear industry

Our services are cross cutting over three key areas:



TÜV UK

BUSINESS & ASSURANCE CONSULTANCY SERVICES

Business & Assurance

- Bespoke Training & Knowledge Transfer
- Business Advisory Services
- Business Case Development
- Cost & Risk Analysis
- Independent Assurance
- Independent Peer Review
- Investment Appraisal (IA) & Value for Money (VfM)
- Operational Research & Analysis (OR/OA)
- Procurement & Supply Chain Strategy Development
- Regulatory Advice
- Stakeholder Engagement & Communication
- Strategy Development
- Systems Engineering
- Technical Authoring
- UK Policy & Gov't Advisory Services

TÜV UK

NUCLEAR OPERATIONS & DECOMMISSIONING CONSULTANCY SERVICES

NPP Operations | Decommissioning

- Assessment of radiological hazard
- Chemistry & chemical processes
- Decontamination for Decommissioning (DFD)
- Decommissioning Projects Management
- Decommissioning Strategy Development & Planning
- Decommissioning Technology Assessment & Optioneering
- Graphite Expertise
- Nuclear Education & Bespoke Specialist Training
- Nuclear Safety & Safety Case Development
- Process Engineering Design – from concept to commissioning
- Radioactive & Conventional Waste Management
- Research & Development
- Spent Fuel Management
- Technical Peer Review

TÜV UK

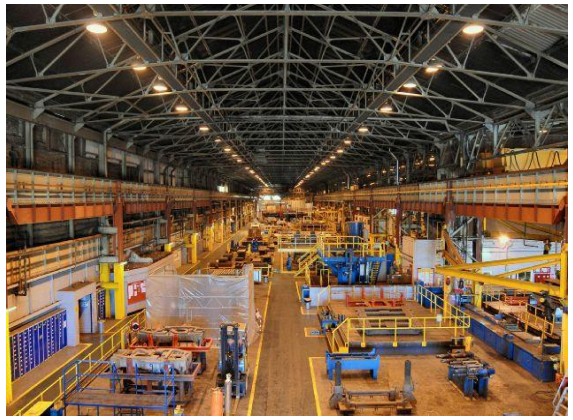
NEW BUILD & ADVANCED TECHNOLOGIES CONSULTANCY SERVICES

Nuclear New Build | Advanced Nuclear Technologies (ANTs): AMRs/SMRs/Fusion

- Alignment of Digitalisation & Safety Case
- Collaborative Working to Link Engineering-Manufacturing-Construction-Operations
- Design of Support Structures for Nuclear Plant
- Digitalisation (including BIM)
- Full Structural Design of Nuclear Manufacturing Facilities
- Funded Decommissioning Planning
- Independent Assessment of Structural Compliance & Buildability
- Regulatory Expertise – Safety & Licensing
- Radioactive Waste Management
- Spent Fuel Management & Reprocessing
- Technology Assessment & Optioneering

TÜV UK

NUCLEAR CONSULTANCY CASE STUDY EXAMPLES:



TSP Engineering:
Sellafield Fuel Flasks

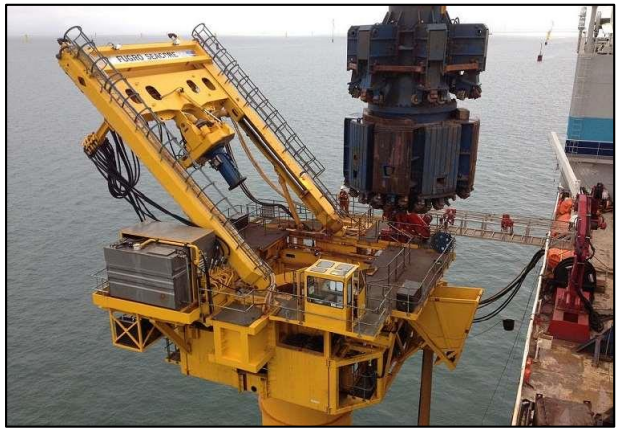
ONR: Technical Services Framework

Moltex Energy: UK AMR Business Advisory & Regulatory Support

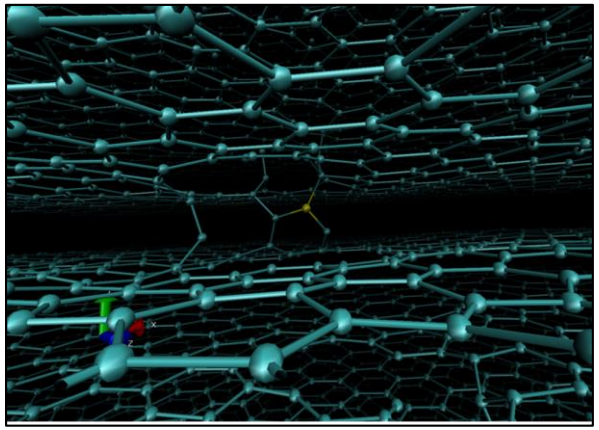
NDA: Independent Assurance Reviews Framework

TÜV UK

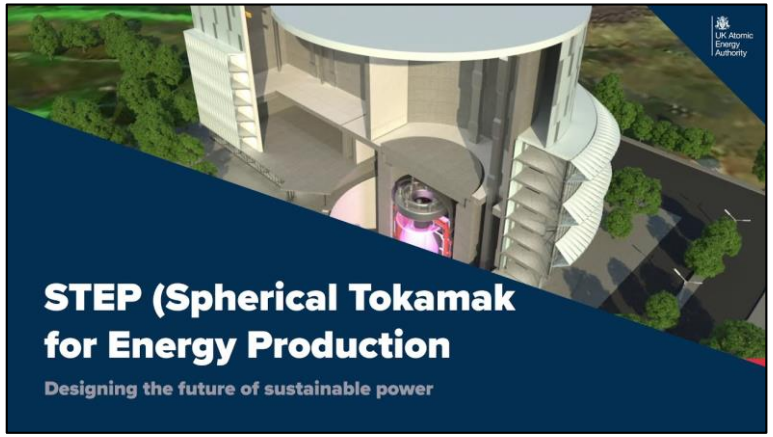
NUCLEAR CONSULTANCY CASE STUDY EXAMPLES:



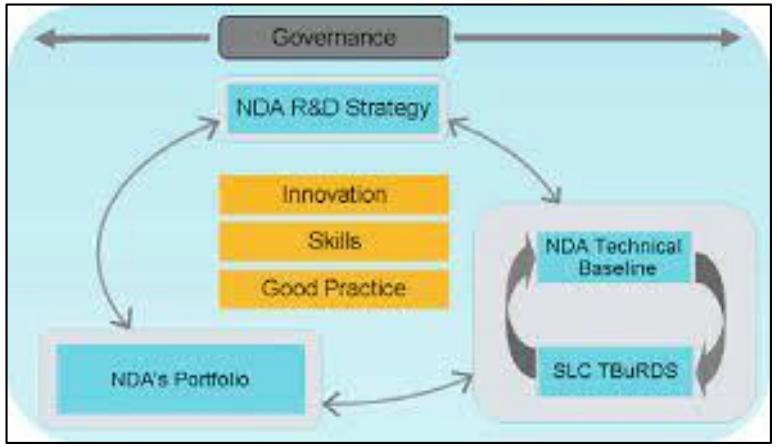
Balfour Beatty: HPC
Off-shore Grout Verification



RWM: Graphite Wigner Energy
Potential Impact for GDF



UKAEA: Engineering Design Services Framework



NDA: Direct Research Portfolio Framework

TÜV UK

NUCLEAR CREDENTIALS:

CYBER ESSENTIALS PLUS

Supply Chain Charter for Nuclear Decommissioning Sites Signatory

Nuclear Industry Association

Member NSAN

the nuclear institute

SAFed

NORTHERN NUCLEAR ALLIANCE

TÜV NORD

TÜV NORD NUCLEAR REFERENCES & EXPERIENCE

Germany

Europe

Worldwide

International Standards

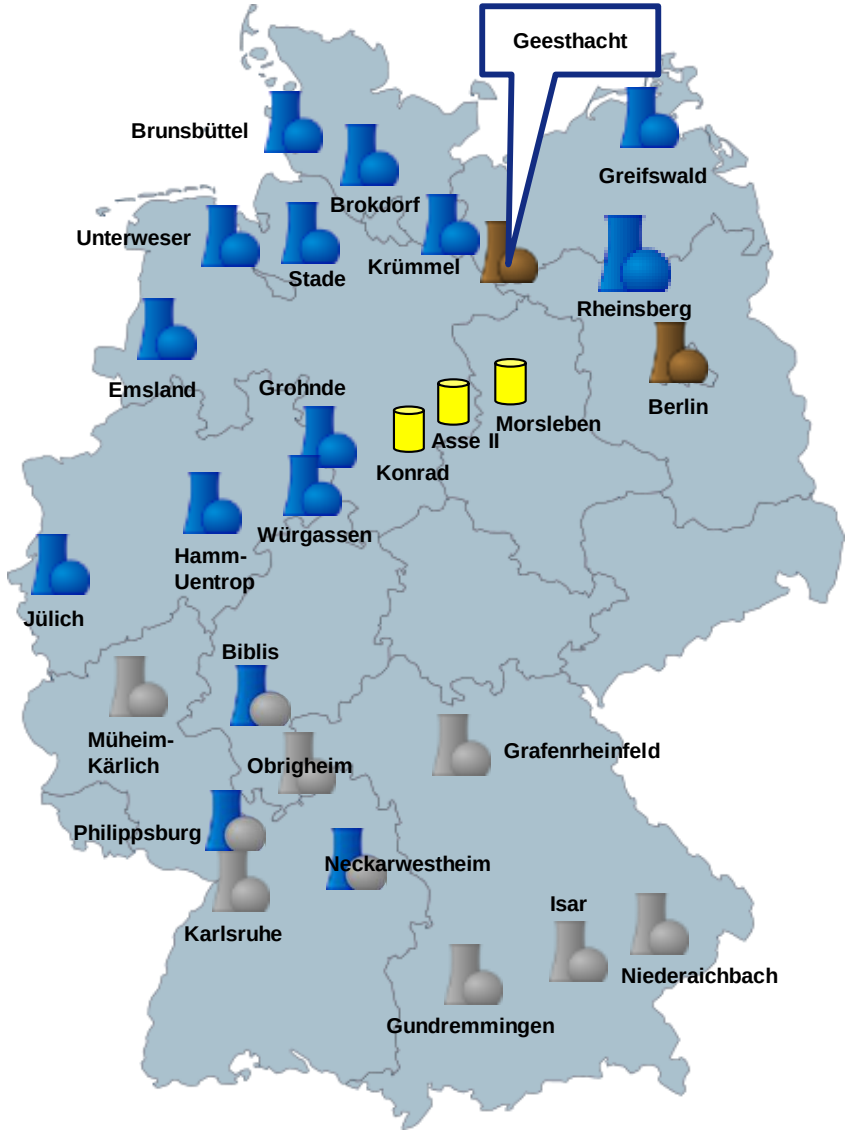
REFERENCES IN GERMANY

TÜV NORD Nuclear is appointed technical support organisation for German regulators and as such involved in the majority of German nuclear power plants, including:

- Operation of 5 power reactors.
- D&D of 13 power reactors.
- D&D of 2 research reactors.
- Three waste repositories.
- Waste package evaluation.
- Conventional hazards of waste.

TÜV NORD Nuclear's work comprises of:

- Licensing.
- Concept evaluation.
- Radiological measurements.
- On site inspections.
- Training & consulting.



Power reactor, TNN main contractor

Research reactor, TNN main contractor

Power reactor, TNN involved

Power reactor, TNN not involved

Repository for LLW/ILW with TNN involvement

EXPERIENCES IN GERMANY WITH DIFFERENT REACTOR TYPES

NS Otto Hahn
Small PWR,
dismantled in 1978.

NPP Rheinsberg (PWR)
Dismantling of the activated parts from 1999 to 2011, early VVER.

NPP Greifswald (PWR)
Europe's major D&D project:
5 reactors (VVER 440).
Ongoing since 1995, large components removed.

NPP Stade (PWR)
In D&D since 2005, dismantling completed, buildings left.

NPP Würgassen (BWR)
D&D 1996 - 2014,
components removed,
buildings left.

NPP Lingen (BWR)
Safe enclosure 1988 to 2013, entering D&D,
Oil fired super heater.

TÜV NORD

SELECTED REFERENCES IN EUROPE

Finland NPP Olkiluoto 3 (EPR)

- Design reviews and inspections

Sweden NPP Barsebaeck, Forsmark, Ringhals

- Third party review of operation and plant modifications

Belgium FBFC Dessel MOX Fuel Fabrication

- Safety evaluation of decommissioning project

Switzerland

- Assessment of the clamping device of the core shroud NPP Mühleberg
- Heat removal from interim storage facility at Beznau NPP

Spain NPP Trillo

- Assessment of neutron noise measurements

SELECTED REFERENCES: WORLDWIDE

Argentina NPP Atucha 2

- Review of safety-related documents
- On-site inspections during erection
- Support in Commissioning Preparation

Argentina NPP Embalse (CANDU)

- Review of documentation of PLEX

Brazil NPP Angra 2 & 3

- Review of specifications and pre-approval of manufacturing documents
- Supplier qualification

Korea NPP Hanbit 2 & 3

- Safety assessment of Embedded Flaw repair technique for CEDM nozzles in the Reactor Pressure Vessel Head
- Independent witnessing and evaluation of in-service inspection by automated ultrasonic testing of RPV welds

South Africa NPP Koeberg

- Assessment and inspection of RPV head replacement
- Developing classification system for SSC
- Risk Based Maintenance concept

UAE NPP Barakah

- Safety Assessment in licensing as TSO to FANR (UAE regulator)

OUR REFERENCES: INTERNATIONAL STANDARDS

- IAEA Safety Guides and Standards
- NEA Publications
- German KTA codes,
  DIN standards, RSK Guidelines
- European PED
- French RCC-M, RCC-E
- US NRC Reg. Guides, SRP 10 CFR ASME Codes III,VIII
- Korean KEPIC codes
- Russian GOST, TGL
- Swedish SSMFS
- Finnish YVL codes
- Argentinean Regulatory Standards