Nuclear decommissioning and clean up

Shaping the future of decommissioning
Welcome to Wood

Wood is a global leader in engineering, project and technical services to industrial, energy, process and utility customers.

Playing a critical role in nuclear projects across the world
We have been at the forefront of the nuclear industry for over 60 years. We are passionate about nuclear energy, its role in the world today and in the future. Our reputation is founded on the very best technical expertise and the reach to deliver this knowledge locally to projects across the world. Our approach is highly collaborative and based on long-term relationships. We are a trusted partner for customers on five continents.

Our people write the world’s standards
At the very heart of our business are our people: nuclear specialists including international technical leaders in their field. We choose to be technology independent so that we can bring our partners the very best-in-class experience from different technologies and vendors.

We also own and operate the UK’s largest independent nuclear research and testing facilities with 12,000m² of labs and test rigs plus remote handling and inspection technology.

As part of Wood, we can call on the skills and resources of more than 55,000 multi-disciplinary professionals across engineering, design, project and programme management disciplines.

Technical excellence breeds innovation and assurance
By combining engineering and technical excellence with innovation, research and development, we have the ability to solve the world’s most complex nuclear problems safely and cost effectively.

As a Tier 1 contractor, we have global experience of applying results-driven programme management to some of the world’s most challenging nuclear sites. Wood has demonstrated that it can solve some of the world’s biggest nuclear problems thanks to our broad engineering capability and large scale project experience, combined with specific technical understanding of nuclear sites, processes and waste.

This includes helping operating partners to manage the change of mindset and culture required to move from operations to decommissioning. Underpinned by our research and development base and an unrelenting safety ethos, we bring practical, cost-effective solutions that are both technically and commercially innovative.

We are working on site at the world’s most challenging decommissioning sites including Sellafield, Chernobyl and Fukushima.

We have played a key role in every UK new nuclear build project.

We are strategic lifetime partners for fleet critical projects and life extension support to EDF Energy.
Nuclear decommissioning and clean up

We deliver innovative, safe and cost-effective solutions for decontamination, dismantling, deactivation and demolition of high-hazard plants and sites. We combine safety case management, environmental and radiological consultancy, and health physics support with our core engineering capabilities and expert knowledge of nuclear regulatory and licensing frameworks.

Our global expertise includes:

Decommissioning and dismantling
We are active at every stage in this process from research and development, design, manufacturing, testing and installation. Currently, we are working on primary circuit decommissioning in Europe, including decontamination, dismantling and waste management of pressure vessels, reactor internal components and systems.

Waste management
Our comprehensive services cover every step from waste characterisation, through minimisation and treatment to transportation and safe final disposal. We can deploy remotely operated equipment and provide radiological monitoring to ensure safety.

Labs and testing
Wood operates the UK’s largest independent nuclear research and testing facilities. Using the extensive facilities in 10,000m² of laboratories and test rigs, we carry out bespoke programmes for customers such as EDF Energy and the Ministry of Defence. The complex includes the UK’s High Temperature Facility, a government-funded laboratory which supports research into Generation IV reactors.

Our gamma irradiation service provides world class consultancy on the effects of radiation on safety critical components and materials, together with the operation of a flexible Co-60 facility; we can offer technical solutions for radiation testing to help improve asset design, ensure reliability and extend service lifetime.

Site restoration and remediation
We provide customers with consultancy and analysis on all aspects of environmental management in the nuclear sector. We carry out the work either on site or in our laboratories, backed up by proprietary technology and an extensive and experienced in-house environmental resource with expertise in all relevant disciplines.

Geological disposition
We assess the safety of the geological disposal of nuclear materials and assess ground contamination and environmental impacts. Our proprietary ConnectFlow software provides a flexible modelling environment for integrated assessment of structural geology, engineering, hydrogeology, hydrogeochemistry and contaminant transport processes.

Oil and gas decommissioning
Decommissioning is a core Wood capability founded on the global strength and expertise from our offshore and onshore engineering, operations, maintenance, and duty holder services. We help customers to plan and manage decommissioning projects from the small to the highly complex. We focus on providing safe, fit-for-purpose and environmentally responsible solutions to ensure cost certainty and efficiency.
International experience

Our breadth of technical knowledge and practical experience of working in different countries means that we bring innovation and pragmatic approaches to solve decommissioning challenges across the world.

I g n a l i n a ,L i t h u a n i a

The two RBMK reactors at Ignalina Nuclear Power Plant once supplied more than 88% of Lithuania’s electricity. Since the closure of the second reactor in 2009, the focus of the site has been on waste management and decommissioning. Wood runs the customer-side Project Management Unit (PMU) for key decommissioning infrastructure at Ignalina, including the Interim Spent Fuel Storage Facility (ISFSF), which covers almost six hectares and can hold up to 16,000 heat-producing fuel assemblies in about 190 containers. The ISFSF opened in October 2016 and the final container is due to be moved in by the end of 2022. The quality of international cooperation at Ignalina has been praised by the European Bank for Reconstruction and Development, the project’s main funder.

C E A M a r c o u l e , F r a n c e

Wood and Orano are working together to retrieve 50 tonnes of waste, including discarded magnesium sheaths, which are stored at CEA Marcoule, 25km north-west of Avignon. The sheaths are from fuel elements used in three Uranium Naturel Graphite Gaz (UNGG) power reactors, the last of which was shut down in 1984. Wood will design a remotely operated robotic arm to remove the waste sheaths from a storage silo and also design a manufacturing unit to produce a geopolymer that will be used to immobilise them. Once treated with the geopolymer, the waste can then be made ready for long-term storage in a geological disposal facility.

N u c l e a r D a m a g e C o m p e n s a t i o n a n d D e c o m m i t t i o n f a c i l i t a t i o n c o r p o r a t i o n , J a p a n

Wood has carried out a major study into managing radioactive waste at Fukushima Daiichi to assist Japan’s Nuclear Damage Compensation and Decommissioning Facilitation Corporation (NDF) to develop a long-term waste management strategy for the site. The work was done by an expert project team with experience of providing similar services to the Nuclear Decommissioning Authority in the UK, as well as relevant projects in continental Europe and the USA. The team identified practical planning tools to support the development of a waste management strategy at Fukushima, which included strategic planning, logistical modelling and assessment methods, combined with efficient approaches to waste sampling and analysis.
Helping to transform Sellafield

Wood can trace its history back more than 50 years at Sellafield. We have been a key player in the development of Thoirp, the vitrification and encapsulation plants and the stores, and we are active on many major projects including BEP and the SIXEP Contingency Plant. Wood’s laboratories also play a key role at Sellafield under a 10-year contract for the analysis and characterisation of waste.

Delivering savings to Sellafield
As a member of the AXIOM joint venture, Wood has contributed to the success of the Design Services Alliance framework, which has cut more than £90m from the cost of projects over the past six years by finding more cost-efficient, fit-for-purpose solutions, redefining scope and introducing more “commercial off-the-shelf” equipment rather than bespoke designs. Under the DSA, staff from Wood and Sellafield work together in integrated teams and 80% of work is done on a target-cost basis.

Tackling major decommissioning challenges
Wood is playing a key role in waste retrievals from the Magnox Swarf Storage Silo, one of Sellafield’s high hazard legacy facilities. We helped to install the first silos emptying plant (SEP) machine, a major milestone in the decommissioning process.

Remote operations: lowering water levels in highly active storage ponds
Wood successfully delivered a technically complex project which gave Sellafield better control over the water level in the First Generation Magnox Storage Pond (FGMSP), one of the site’s most hazardous legacy facilities.

We designed a bespoke package to drill double the number of purge inlets at a lower position in the pond’s vessels. Because of the radioactive hazard, this had to be done using remotely operated equipment. Greater control over the water level in the pond has made it easier to retrieve waste from the pond for treatment and storage, which is one of Sellafield’s key hazard reduction objectives.

Wider site management
For eight years until 2015, Wood was part of Nuclear Management Partners, a consortium of global nuclear industry leaders that ran the Sellafield site and delivered enhanced capability. Achievements included the site’s best ever overall safety performance for two consecutive years and the first retrieval in 50 years of spent fuel and radioactive sludge from one of the legacy storage ponds.

Delivering site services
OneAIM, a joint venture between Wood and Interserve, carries out engineering support services for asset care and maintenance in support of reprocessing plants and facilities at Sellafield under the Operations Site Works (OSW) framework, which is worth up to £160m over four years. OneAIM is the largest provider of site services at Sellafield.
Applying innovation to deliver practical solutions

Wood’s approach to innovation is based on the practical application of new technology and ideas to deliver cost effective, practical solutions to decommissioning.

Innovation Integrator

Wood is leading a project funded by the UK government’s Department for Business, Energy and Industrial Strategy, the Nuclear Decommissioning Authority (NDA) and Innovate UK after winning a prestigious competition to design a demonstrator system for cleaning and dismantling highly radioactive rooms or ‘cells’ at Sellafield.

New navigation and materials handling solutions developed in space exploration, car production and medicine will be combined with new data and control systems and state-of-the-art robotics, so that the new system can reduce the risks of working at height, optimise the performance of robots and use autonomous mapping where human access is impossible.

In this project and others, Wood acts as an innovation integrator, bringing together ingenious ideas from industry and academia to define a new approach to the nuclear decommissioning challenge.

SIAL®

Liquid and quasi-liquid radioactive sludge is dangerous to transport so Wood developed SIAL®, a geopolymer solidification technology that converts it into a safe form. Importantly the service is applied directly on site without the need for significant capital expenditure, major new facilities or complex waste transport logistics.

The SIAL® matrix is a blend of inorganic compounds – mainly an alkaline solution and aluminosilicates – which are mixed with waste to create a solid waste package. Our method allows this to be done quickly at the point of retrieval, so it is a very convenient way to treat hazardous, liquid waste before transportation, storage and final disposal.

SIAL® has many advantages over conventional methods:

- Incorporates up to four times as much sludge or resin waste;
- Greater mechanical strength;
- Lower leachability (the release of radionuclides through contact with water);
- Cost effective to deploy on site;
- Low volatility and fire risk;
- Excellent physical stability.

Scabbling

To remove radioactive material embedded in the surface of concrete structures, Wood has developed a range of scabbling techniques. Our systems, which are deployed remotely, will remove several centimetres from the contaminated concrete surface with the waste vacuum-extracted from the scabbling head into hoppers and disposed of via approved waste transportation routes.

ScanSort™ and ScanPlot™

ScanSort™, Wood’s proprietary technology for real-time radioactive material segregation, uses conveyor systems along with nuclear isotope spectroscopy to segregate radioactive material on a bespoke basis. Once the radioactive material is removed, large quantities of inert soil, rubble or vegetation can be reused. This vastly reduces the amount that needs to be sent, at great expense, to specialist disposal sites.

The system has been deployed around the globe, saving nuclear and governmental customers millions of dollars through rapid and accurate segregation and reduced radioactive waste disposal fees. For instance at the NASA Plum Brook facility in Ohio, cost savings of $30m were achieved.

It offers significant benefits over traditional sorting methods including:

- Rapid segregation (up to 200 tonnes/hr);
- Accuracy of segregation (regularly exceeding 95%) and associated significant reduction in radioactive waste volumes);
- Improved certainty for customers and regulators;
- Ability to sort all types of material (soil, crushed concrete and vegetation).

ScanPlot™ is a mobile system that performs surface and shallow-depth radiological examination and characterisation of open land. It provides instant output in a customisable GIS report format and delivers spatially precise maps with plotted locations of detected radioactivity, including concentrations of each radioactive isotope detected and measured. Depending upon its configuration and the detection criteria, ScanPlot™ can examine up to 20 acres of open land per day.
Wood has developed innovative equipment and techniques for cleaning and visual observation of the interior of VVER reactors. Together with SIAL, our proprietary geopolymer encapsulation technique, we can offer a unique suite of cleaning and waste management services which are tried and tested on VVER units.

Our customer, Slovenske Elektrarne, operates a total of four VVER-440 V-213 reactors at Bohunice and Mochovce Nuclear Power Plants in Slovakia. Complex reactor cleaning was required, including pumping out the sludge from the reactor pressure vessel with concentrated boric acid. This had to be done immediately after fuel removal but before coolant was removed from the reactor.

Impurities and sludge had to be pumped out from all the safety and control rod assembly channels. Coolant in the reactor pressure vessel had to be filtered. Larger particles had to be removed from the bottom of the reactor.

Reactor cleaning was carried out during outages, with a focus on decreasing the outage time. Wood’s innovatively-designed equipment was used to pump sludge out of the reactor bottom. Visual examination of the reactors’ internal structures, carried out during the cleaning process, provided further valuable information for the customer about the overall condition of the reactor pressure vessel.
Innovation in radiation monitoring

Wood has made radiation monitoring of storage ponds safer and more timely by using specially adapted remotely operated vehicles (ROVs).

Conventionally, samples of pond water are collected manually and sent away for laboratory analysis. This approach exposes workers to increased radiation doses, carries the risk of contamination spread due to dropped samples and never gives a current reading because it takes several days to obtain the analysis results. In an innovative project for a UK nuclear site, Wood found a way to speed up the process and minimise human intervention while still obtaining the highest quality results.

A submersible ROV collects samples of water before docking at a custom-built monitoring station floating at the side of the pond, where the sample is analysed by a gamma radiation spectrometer.

With the new system, the reading is obtained in real time and there is no risk of contamination spread because the sample remains underwater. Sampling and monitoring is performed remotely meaning that the operator is not exposed to elevated radiation levels. The successful project is a great example of Wood’s ability to apply a mix of appropriate technologies to solve a difficult technical problem for customers in a cost-effective way.

LLWR
LLW Repository Ltd (LLWR), the company responsible for overseeing the management of the UK’s lower activity radioactive waste, has been a valued customer since it was created in 2009.

Wood provides LLWR with a range of services, including environmental safety case and waste characterisation and assurance support.

LLWR operates the UK’s Low Level Waste Repository in West Cumbria on behalf of the Nuclear Decommissioning Authority and also oversees the management of lower activity waste throughout the country.

Wood is LLWR’s single supplier for hydrogeological and geological support, and as one of four suppliers for general technical support.
Dounreay

Dounreay, the former centre of fast reactor research and development in Caithness, Scotland, is the UK’s most complex nuclear site after Sellafield.

As part of the decommissioning process, three different reactor types must be dismantled to slab level and 15,000 cubic metres of higher activity waste has to be managed, some of it stored in a 65-metre deep shaft. The UK government’s Nuclear Decommissioning Authority (NDA) has tasked Dounreay Site Restoration Limited (DSRL) with closing down the site and leaving it in a safe condition for future generations.

Wood’s role as a supplier to DSRL ranges from design and build of key facilities to providing civil and structural surveys:

- Engineering, procurement and construction of a new effluent treatment plant - concept and detailed design; production of the safety case and supporting environmental documentation; manufacture of the modular process plant, offshore testing, on-site installation and commissioning;
- Detailed design, safety case and environmental assessment for a new intermediate level waste store;
- Design and manufacturing of new fuel containers;
- Professional services framework, covering engineering support, civil/structural reviews, building inspections, electronic control and instrumentation, mechanical handling, mechanical services, heating ventilation and air conditioning, vessels and pipework;
- A framework contract for up to four years, covering electrical installation, control and instrumentation, testing, commissioning and maintenance support.
Under a contract from ITER Organisation, Wood led a concept-level study of the duration, sequencing and cost for deactivating the ITER nuclear fusion reactor once it comes to the end of its life in the 2040s.

The work performed included:

- Preparation of an exhaustive database in line with the current design of the ITER fusion reactor and its auxiliary buildings; the database includes all relevant information of the contained systems and equipment in regard to their later deactivation/decommissioning, e.g. volume, mass, radiological data including tritium contamination.

- Assessment of deactivation scenarios for:
  - Neutron Beam Cells;
  - Tokamak cooling Water system;
  - Tritium Plant;
  - Hot Cell Complex;
  - Other Tokamak building items;
  - Development and scheduling of an optimised global deactivation scenario;
  - Identification of the main cost drivers for later decommissioning of the ITER fusion reactor and its auxiliary buildings and preparation of a detailed cost breakdown;
  - Consideration of French regulatory and nuclear safety constraints.
Oil and Gas decommissioning

Wood built its decommissioning capability in the Oil and Gas sector, founded on the global strength and expertise of our offshore and onshore engineering, operations, maintenance, and duty holder services. Our experience stretches over three decades with involvement in many significant projects, including preparing the Shell Brent Delta Platform for the world’s heaviest offshore lift (24,200 tonnes).

**Strategic planning**

Ageing assets bring challenges and uncertainties which have impacts on cost, safety, liability and regulatory compliance. We provide stakeholders with the quality of detail needed to identify the optimal concept and timing for abandonment and removal, so that they can achieve maximum economic recovery and efficient decommissioning. Through our strategic planning process, we provide customers with the most cost-effective solutions while complying with legislation.

We also provide the initial plan for all elements of the decommissioning process. Typically, this includes development of the integrated cost and schedule models, removal method selection options, temporary utility requirements, and strategies for major accident hazard and safety critical equipment, maintenance and isolation, and project contracting. Careful planning ensures that resources are efficiently used and people and the environment remain safe and protected.

**Late life asset management**

As an asset progresses through the lifecycle, changing priorities make it necessary to adapt the mode of operation. Wood’s asset lifecycle experience is focused not only on delivery but more importantly the management of change at these transition points.

Wood’s provision of late life management services can encompass individual or bundled assets including:

- OPEX budgetary decisions analysed on a life of field basis;
- Maintenance – including post cessation of production reliability;
- Logistics services;
- Platform operations and life support services;
- Early preparation scopes for post cessation of production activities;
- Legislative and regulatory compliance (including safety case).

Our strategic planning for late life concentrates on:

- Maximising economic recovery;
- Optimising the transition between final production and abandonment and removal;
- Minimising total OPEX and ABEX (abandonment expenditure) across this time horizon;
- Managed regulatory compliance;
- Delivering integrity assurance.

**Decommissioning services**

Wood’s execution services can be deployed as part of a holistic decommissioning strategy or in support of an existing decommissioning plan. These services can be delivered individually or as part of an integrated campaign. Our approach is to optimise scope execution, reduce platform footprint and the environment and as a result provide cost-effective solutions that protect reputations.

Wood’s extended range of capabilities deliver full solutions or facilitate services for the following stages including:

- Make Safe
- Well Plug & Abandonment
- Topsides Preparation
- Topsides Removal
- Substructure Removal
- Subsea Infrastructure Removal
- Onshore Recycling
- Site Remediation
- Post remediation Monitoring

**Case Study - Brent Bravo decommissioning**

In 2017 we were awarded a contract to support Shell in the decommissioning of their Brent Bravo platform in the North Sea. Wood was responsible for preparing the platform for removal via a single lift methodology including structural strengthening and installation of under deck lift points.

The contract followed on from our work on the Brent Delta which culminated in the topsides removal earlier in 2017, which at 24,200 tonnes was the heaviest marine lift ever undertaken at sea. While the removal methodology was the same, Wood undertook the delivery of the Brent Bravo scope, which used an innovative approach and new technical solutions. These reduced costs (75% reduction in lift preparation cost from the first project), improved the schedule (completed in one season rather than three) and maximised offshore work.
About us

We are a global leader in engineering, project and technical services to industrial, energy, process and utility markets.

160+ Year history

$10bn Revenue

55,000 Employees

60+ Countries

400+ Offices

We have a global network of skilled professionals, delivering on our reputation for operational integrity and assurance.

Sector and markets we operate in:

- Alternative Energy
- Chemicals
- Petrochemicals
- Environment and Infrastructure
- Manufacturing
- Marine and Defence
- Mining and Minerals
- Power and Utilities
- Oil and Gas
Wood is a global leader in the delivery of project, engineering and technical services to energy and industrial markets. We operate in more than 60 countries, employing around 55,000 people, with revenues of around $10 billion. We provide performance-driven solutions throughout the asset life-cycle, from concept to decommissioning across a broad range of industrial markets including the upstream, midstream and downstream oil and gas, chemicals, environment and infrastructure, power and process, clean energy, mining and general industrial sectors.