

# Orano DS

## Dismantling and Services

Expertise and technologies of the future



orano

The Orano logo consists of a stylized yellow "O" shape composed of three concentric arcs, positioned above the word "orano" in a lowercase, sans-serif font.

# Orano DS



**Alain VANDERCRUYSEN**  
Senior Executive Vice President,  
Orano Dismantling and Services

## “ OUR KNOW-HOW AND OUR DETERMINATION ARE OUR STRENGTH

Part of Orano, a leader in the nuclear fuel cycle, Dismantling and Services offers its customers a unique solution that is founded on 50 years of experience and covers the entire value chain in three areas of activity:

- **Dismantling of nuclear facilities and equipment**, from the design of projects to their eventual completion on the ground
- **Management of radioactive waste**, of all types and levels of radiological intensity, whether originating from production activities, the operation of facilities, their dismantling or major maintenance operations
- **Services to nuclear operators**, including expertise in site support logistics, specialized maintenance, radiological safety and nuclear training

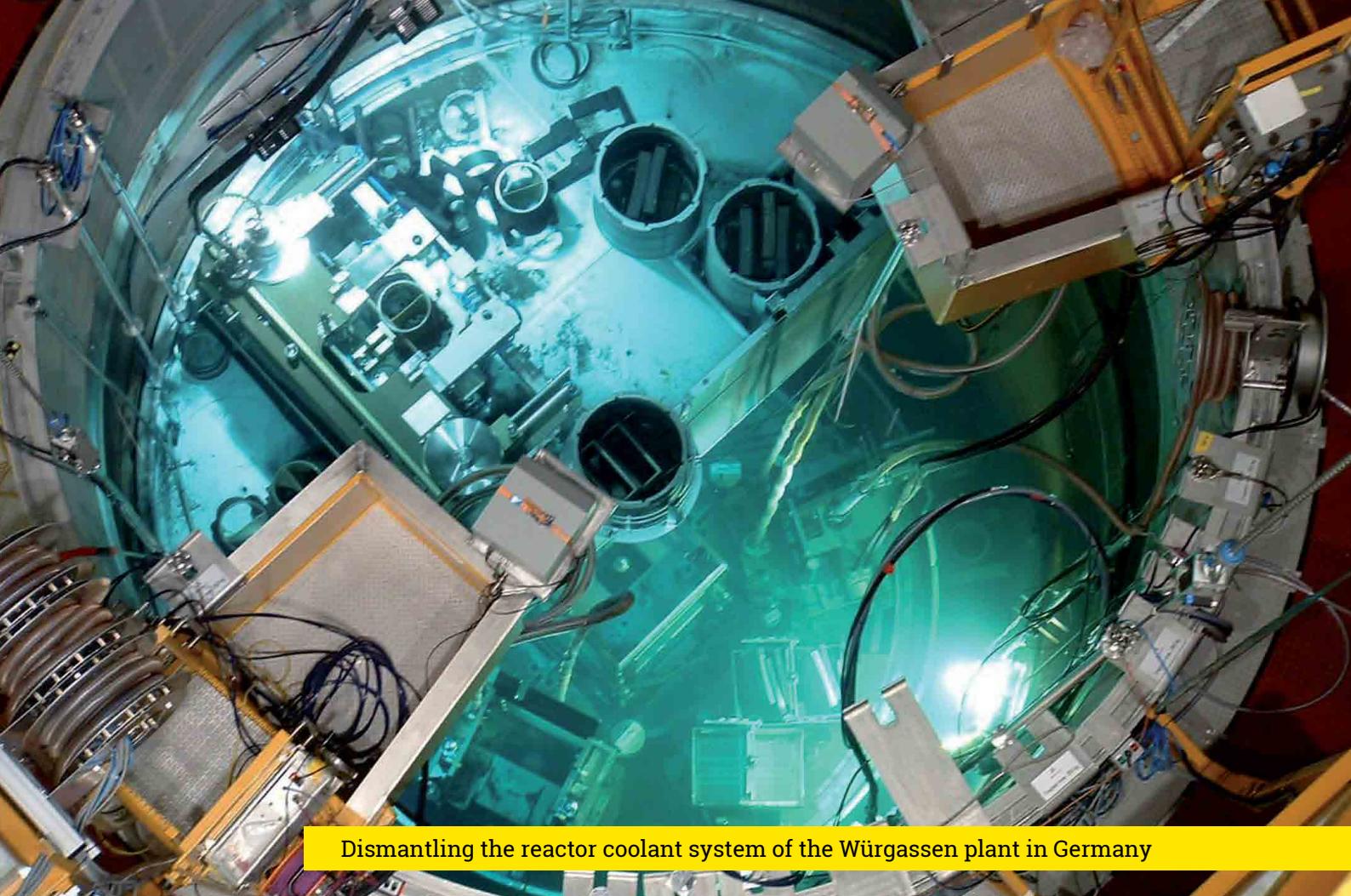
On markets which are growing worldwide, the know-how, experience and capacity for innovation of our 4500 employees are what make the difference and give us our strength.

For nearly half a century, we have been working alongside our customers, operators of nuclear installations either in operation or at the end of their lifecycle, to help them meet their commitments in terms of nuclear safety, occupational safety and control over costs and delivery times.

A leader in dismantling and a key player in the management of radioactive waste and nuclear services, we provide our customers with technical know-how and rigorous project management built on the successful completion of a variety of complex worksites.

On an international scale, Orano DS harnesses two drivers of growth. On the one hand, the expertise of its German and American teams, which have unique know-how regarding the dismantling of nuclear reactors. On the other, targeted partnerships to combine the talents of Orano DS with those of local businesses, thereby creating a strong, competitive offer.

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Dismantling the reactor coolant system of the Würgassen plant in Germany



**More than 4 500**  
employees in France,  
Germany and the USA



**50 years**  
of experience



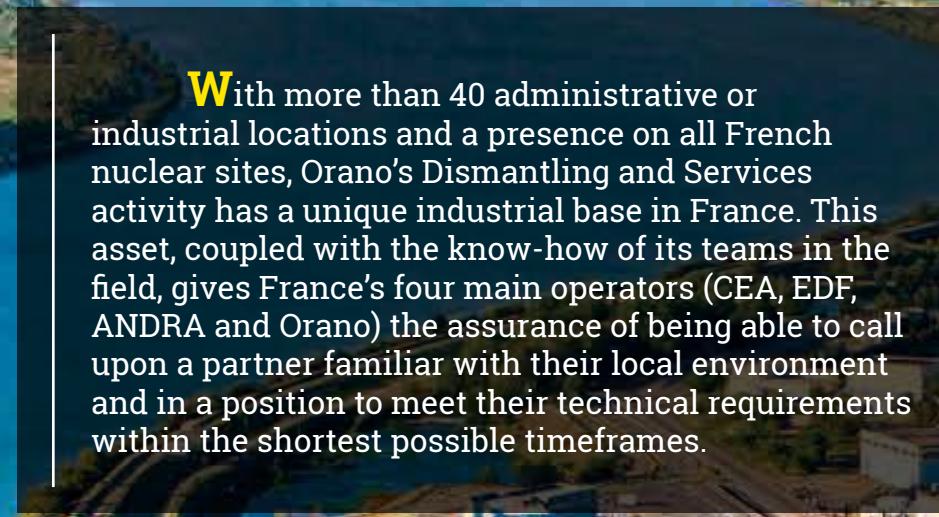
**€600m**  
2/3 revenue  
1/3 Orano's end-of-  
cycle provisions



Watch the Orano DS  
presentation video

# Orano DS worldwide

With more than 40 administrative or industrial locations and a presence on all French nuclear sites, Orano's Dismantling and Services activity has a unique industrial base in France. This asset, coupled with the know-how of its teams in the field, gives France's four main operators (CEA, EDF, ANDRA and Orano) the assurance of being able to call upon a partner familiar with their local environment and in a position to meet their technical requirements within the shortest possible timeframes.



# A national presence through four legal entities

Orano DS, Orano Cycle, Orano DA, Trihom



Nuclear power plant in operation

Nuclear power station shut down

Installation of the nuclear fuel cycle

Trihom training center

Administrative headquarters

# Orano DS worldwide



In the field of nuclear reactor dismantling, whether for research or power reactors, Orano DS harnesses the expertise of the German teams in its Orano GmbH subsidiary. This skills center has long-standing know-how in the cutting and conditioning of the most radioactive parts of nuclear reactors: the reactor vessel and internal equipment, and large components such as the steam generators, among others.

Its service offer covers all market segments – from radiological characterization and preliminary studies to the execution of dismantling projects, including the custom design of operating tools, project management and operation planning.

The German teams also offer services such as the creation of 3D models and specialist engineering, notably in the field of robotics, through the DSR entity.

**30 years' experience in the global dismantling markets**



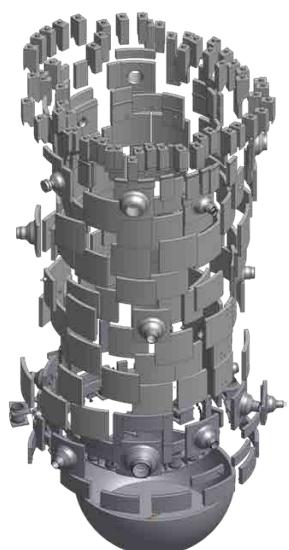
Dismantling of large reactor coolant system components  
(vessel, pressurizer, steam generators)



Dismantling of internal reactor vessel equipment (control rod guide assemblies, control rods, etc.)

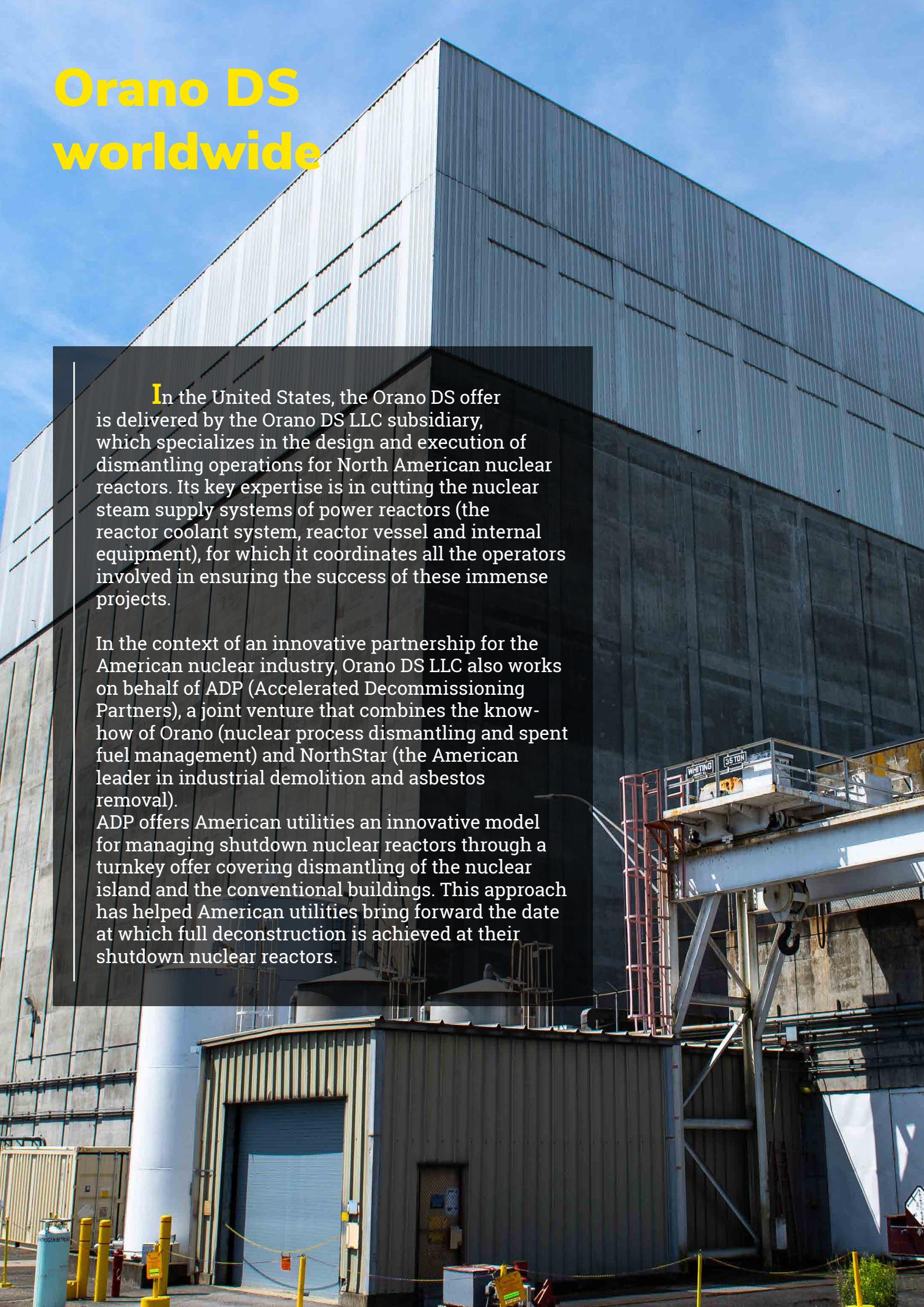


Head office



3D projection of reactor vessel segmentation

# Orano DS worldwide

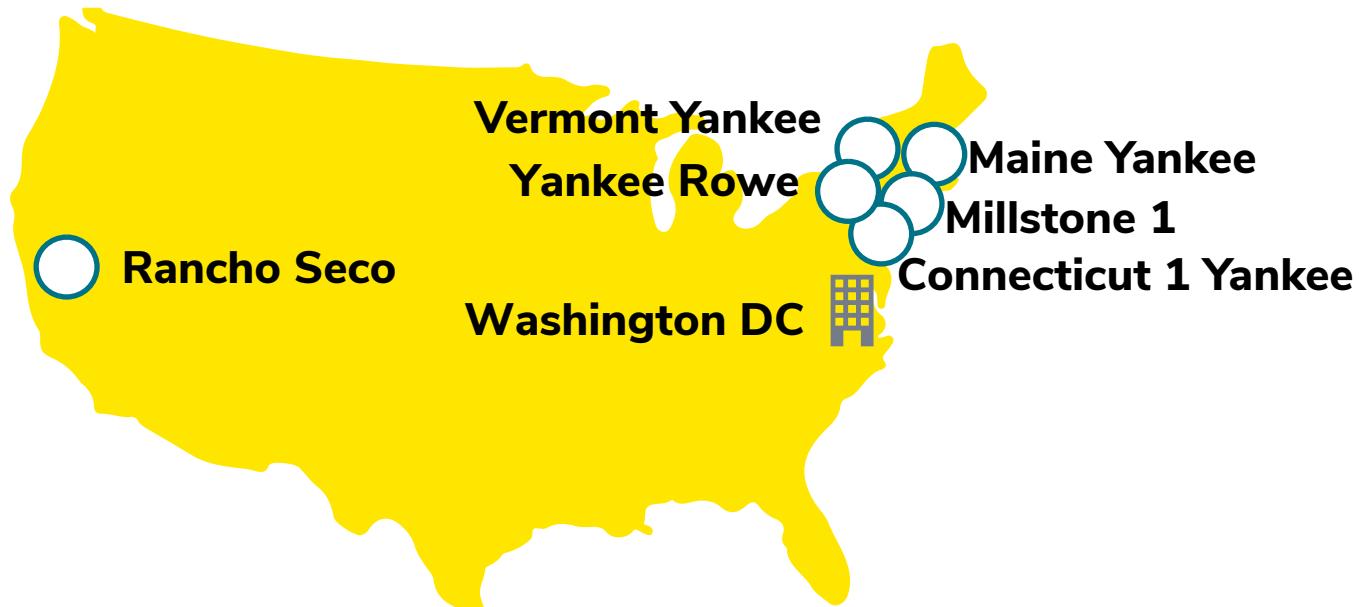


In the United States, the Orano DS offer is delivered by the Orano DS LLC subsidiary, which specializes in the design and execution of dismantling operations for North American nuclear reactors. Its key expertise is in cutting the nuclear steam supply systems of power reactors (the reactor coolant system, reactor vessel and internal equipment), for which it coordinates all the operators involved in ensuring the success of these immense projects.

In the context of an innovative partnership for the American nuclear industry, Orano DS LLC also works on behalf of ADP (Accelerated Decommissioning Partners), a joint venture that combines the know-how of Orano (nuclear process dismantling and spent fuel management) and NorthStar (the American leader in industrial demolition and asbestos removal).

ADP offers American utilities an innovative model for managing shutdown nuclear reactors through a turnkey offer covering dismantling of the nuclear island and the conventional buildings. This approach has helped American utilities bring forward the date at which full deconstruction is achieved at their shutdown nuclear reactors.

# A key partner of American industry in nuclear dismantling



Dismantled reactor, or reactor undergoing dismantling



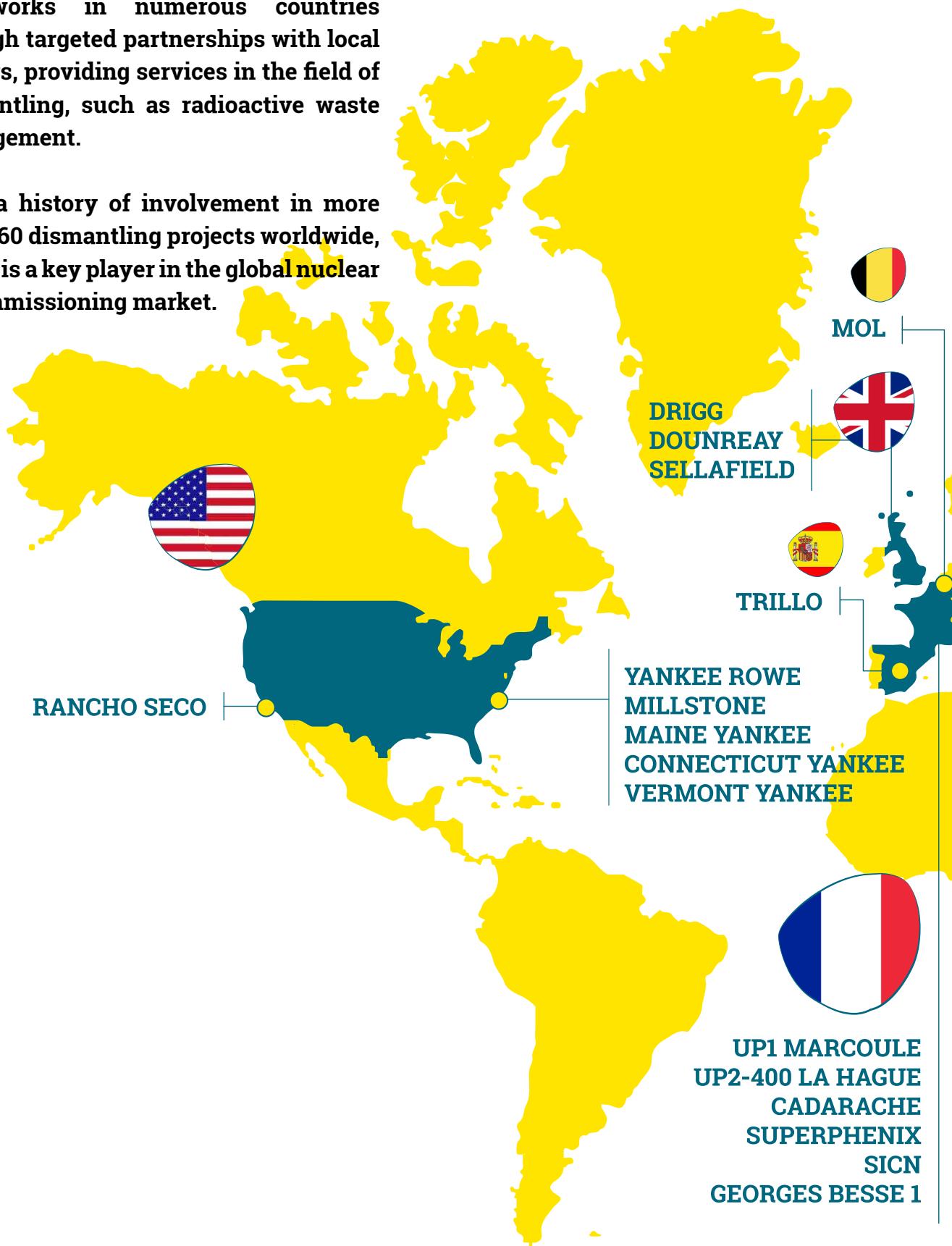
Head office



Dismantling operations at the Vermont Yankee nuclear power plant, United States

Beyond its industrial bases in France, Germany and the United States, Orano DS works in numerous countries through targeted partnerships with local players, providing services in the field of dismantling, such as radioactive waste management.

With a history of involvement in more than 160 dismantling projects worldwide, Orano is a key player in the global nuclear decommissioning market.





# OUR EXPERTISE

## DISMANTLING OF NUCLEAR FACILITIES AND EQUIPMENT

Estimated to be worth more than 200 billion euros worldwide over the decades to come, with three-quarters of this revenue to come from Europe, the nuclear dismantling market draws upon a wide range of complex skills and expertise. In France, Germany and the United States, Orano DS is at the forefront of the sector.



Cutting of radioactive parts by a remote operator behind a shielded window

**Nuclear dismantling is a complex market that presents a set of considerable industrial, technical and financial challenges.**

## Industrial

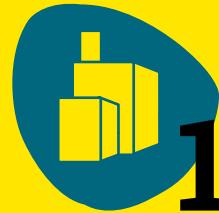
Nuclear dismantling is an activity that has evolved more recently than is often thought: the first worksites in Europe only commenced in the 1990s, with the closure of the first generation of nuclear facilities after around forty years in operation. As in any developing sector, work is under way in nuclear dismantling to standardize processes and make them more reliable and robust.

## Technical

The construction of nuclear facilities in the 1950s, in both Europe and the United States, did not take account of their dismantling in the future, unlike new nuclear facilities today. Factors including the reinforcement of the structures and the confined nature of the premises present a set of challenges which make it difficult to perform interventions and remove materials. This initial complexity is further compounded by the unique nature of the first facilities to be dismantled – research reactors and laboratories, experimental fuel fabrication plants, and so on. The uniqueness and age of such facilities means it is necessary to precisely establish the initial conditions under which teams will have to perform interventions, before developing the optimum procedure to dismantle the nuclear equipment, whilst keeping the exposure of personnel to radiation to a minimum.

## Financial

In an economic environment subject to tight constraints, it is essential to maintain control over the costs of dismantling worksites. To achieve this, intervening contractors and operators employ new technologies and methods of optimization to ensure that worksites are completed in line with cost and delivery time targets. A considerable challenge at a time when the regulatory framework is becoming ever more demanding.



**19**

**facilities (laboratories, plants and reactors) have been dismantled in France and around thirty more are currently undergoing or awaiting dismantling and decommissioning**

## DID YOU KNOW?

### **It is not only nuclear power plants that have to be dismantled**

Contrary to what is often thought, out of around 30 facilities currently undergoing or awaiting dismantling in France, only nine are nuclear reactors. The majority of the dismantling projects involve workshops and plants belonging to nuclear fuel fabrication cycle and research facilities.

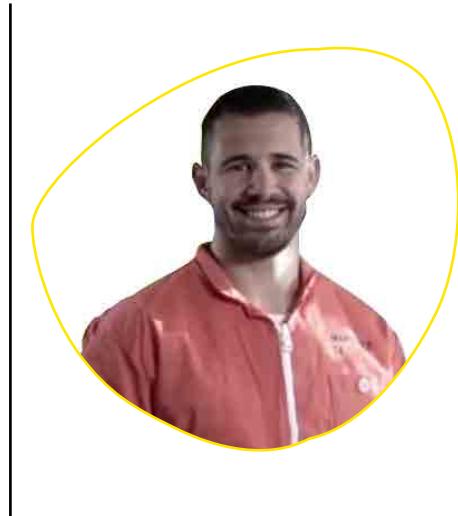
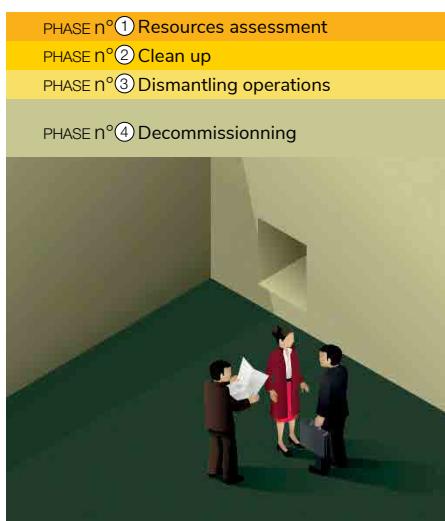
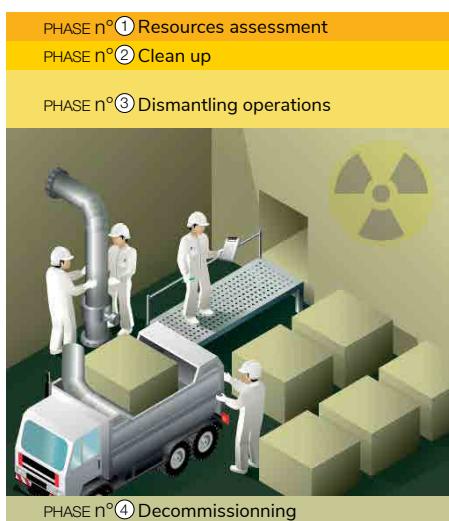
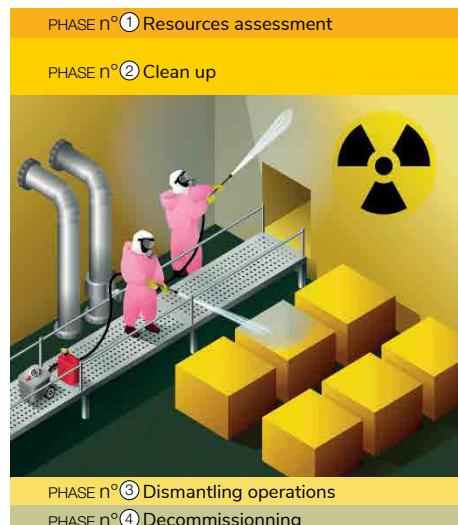
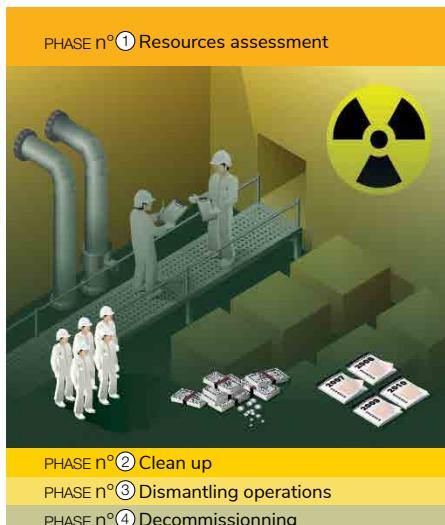
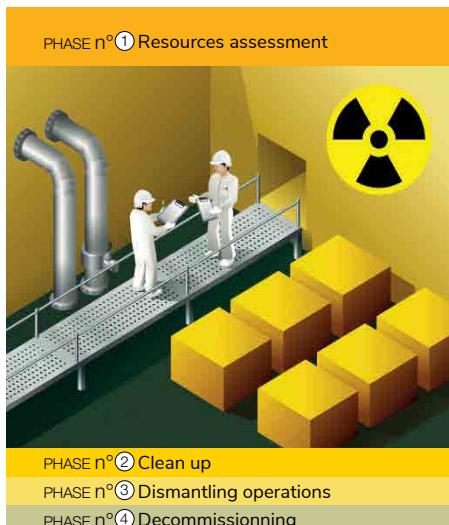
### **«Dismantling» does not mean «demolishing a building»**

Most of the facilities being dismantled at the moment are located on sites that have other facilities still in operation. Buildings decontaminated as a result of a decommissioning project could certainly accommodate a new industrial activity in the future, rather than being demolished.

# Process of dismantling of a nuclear facility

The dismantling of a nuclear facility consists of the set of operations leading to its official decommissioning. The operations carried out in the field include all the activities to dismantle nuclear equipment and clean up the premises in order to reduce the level of radiological contamination and be able to guarantee that they can be dismantled or re-used without any risk to health.

Find out more : <http://www.orano.group/>



Find out about the work done by cleanup and dismantling operators

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*Our teams have access to the tried-and-tested solutions they need to successfully carry out dismantling projects*

"

Thomas Eichhorn, Managing Director of Orano GmbH



Preparation for an operation in a contaminated zone in ventilated suits

# The expertise of the leader in nuclear dismantling

Orano's Dismantling and Services activity is present across the entire value chain in the sector, from design through to the execution of dismantling projects.

Its teams thus carry out not only operations involved in the dismantling and cleanup of nuclear equipment (cutting, conditioning, construction of protective airlocks, etc.) but also work on the project design phase or project management.

DS's know-how is founded on the experience acquired by its teams on a variety of complex worksites, both within the Orano group, as well as for its customers in France or abroad.

## A sector of permanent innovation

Whether to solve a technical problem, improve the productivity of operations or reduce their cost and risks, innovation has an important place in dismantling activities.

As projects have been completed, the Orano DS experts have developed innovative solutions based on the latest technologies: robotics, virtual and augmented reality, and 3D scanning, to name but a few.

These technical developments support the work of field operators to dismantle complex facilities in the best conditions and within an optimal timeframe



### ROBOTICS OPERATION PACK

Orano DS's robotics operation pack comprises the RIANA™ all-terrain motorized platform and the DORICA™ investigation drone. Whether these devices are used together or separately, their onboard probes and sensors allow the acquisition of physical or radiological data in hard-to-reach areas. These innovations won first prize in the «Nuclear safety» category of the World Nuclear Exhibition (WNE) Awards in 2016.

### 3D SCANNER

The 3D scanner uses contactless laser technology to obtain, after processing, a high-precision virtual 3D reconstruction of complex environments and environments with large dimensions.

## Cadarache: the first successful dismantling of a MOX plant in France

At Cadarache, from 2009 to 2016, Orano dismantled the equipment of the former MOX fuel fabrication plant. The unprecedented scale of the project makes it one of the largest dismantling projects in the world. At the peak of activity, as many as 300 employees were mobilized by Orano and its partner companies. In total, more than 460 «glove boxes» (sealed enclosures for the handling of radioactive materials), 30 tanks and 4 km of pipework were disassembled, cut and then packaged and evacuated safely.



Video of  
dismantling of  
the Cadarache  
plants

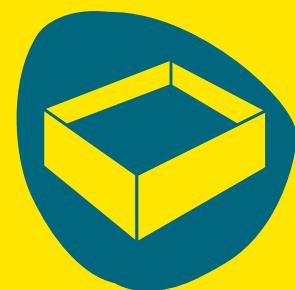


**30 000**

DRUMS OF WASTE  
COMPATIBLE WITH  
DISPOSAL AT ANDRA'S  
AUBE DISPOSAL FACILITY



**462** GLOVE  
BOXES



**30** TANKS, 5 COATED  
WITH BITUMEN



A NETWORK OF  
**4000 m**  
OF PIPING

## MANAGEMENT OF RADIOACTIVE WASTE

In France, the long-term management of radioactive waste is the responsibility of the French national radioactive waste management agency (ANDRA). Before final disposal, the waste is first processed and conditioned depending on its state (liquid, solid, etc.) and radiological intensity (low-level/high-level radioactive, long-lived or short-lived, etc.). Orano has cutting-edge expertise in the characterization, conditioning and evacuation of radioactive waste, whether originating from the operation of nuclear facilities, their dismantling or from major maintenance operations.



ANDRA's Aube disposal facility for radioactive waste

**Radioactive waste means any substance for which there is no envisaged use, and the level of radioactivity of which is such that it cannot be released in an uncontrolled manner into the environment.**

Around 85% of the volume of radioactive waste produced every year in France originates from the production of electricity. The other 15% comes from non-nuclear industries (hospitals, universities, research centers or military activity).

The classification of nuclear waste has traditionally been based on its radiological intensity (from very low-level to a high level of radioactivity) and its lifetime (from short-lived to long-lived). In addition to this first level of distinction, consideration is given to the physical state of the waste, which may be liquid or solid, and whether it is conventional or not.

All these parameters lead to industrial companies positioning themselves on different segments of the market, requiring a diverse range of technical skills (from logistics for large volumes of very low-level radioactive waste to cutting-edge chemistry for the management of long-lived highly radioactive waste).

Even though the skills to manage different types of radioactive waste already exist, the market in France and worldwide is still in a phase where it is structuring its needs. It still remains a market of major importance, however – according to the estimates of certain industrial players, the market for the decontamination of low-level radioactive waste alone will be worth around 210 billion euros between now and 2030.



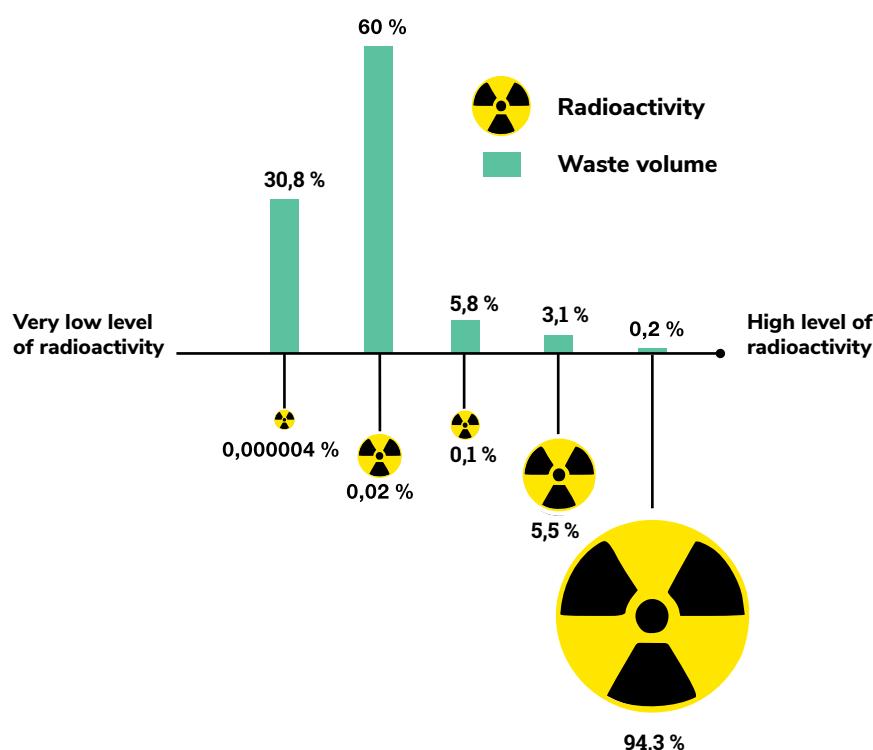
**2kg**

of radioactive waste produced on average in France per inhabitant per year, compared to 360 kg of household waste and 2500 kg of industrial waste



**91%**

of French nuclear waste already has a long-term disposal solution



## Quantity is not the same as intensity

The main part of the volume of radioactive waste does not account for the majority of the radioactivity: 94% of the radioactivity is concentrated in just 0.2% of the waste, which is classified as «high-level waste». The management of this type of waste requires expertise only possessed by a dozen or so companies worldwide, one of which is Orano.

## The expertise required to manage all types of radioactive waste

Orano DS has cutting-edge expertise in the management of radioactive waste of all types – from very low-level to medium- and high-activity, solid and liquid, conventional or non-conventional. This know-how gives its customers the guarantee of turnkey management of their issues and the development of technical and technological solutions that are adapted to meet their constraints.



#Recovery of existing waste



#Automated sorting



#Conditioning

### Operations integrated with different industrial activities

Orano DS's radioactive waste management offer is designed to address several types of issue: waste generated on a daily basis within a nuclear facility (gloves, work suits, etc.), as well as waste originating from major maintenance operations or from the dismantling of a site (cut-up pieces of equipment, vinyl airlocks, tools, etc.). Its expertise also means it is able to take care of the recovery of existing radioactive waste for which interim storage is no longer compliant or which has deteriorated over time, to enable it to be reconditioned and put safely back into interim storage once again.

All these operations involve a process of sorting waste according to its radiological characteristics (from low-level to high-level radioactive waste), then its conditioning in an appropriate form factor (bag, metal drum, concrete, etc.) before sending it for disposal via the proper channel. Thus, a pair of plastic gloves used to perform a maintenance operation will be put into a bin bag to be destroyed at an appropriate waste disposal facility while radioactive sections of piping will be cut up, reduced in size and then stored in a drum that will be sent to one of ANDRA's final disposal facilities.

**“ We have everything we need to become France’s leader on the radioactive waste management market ”**

Alain Vandercruyssen, Senior Executive Vice President, Orano Dismantling and Services



Find out about the work done by waste controllers



## TRIADE, the flagship nuclear facility for outsourced waste processing

The expertise of Orano DS in waste management notably comes from almost 30 years of running its own decontamination facility, TRIADE, in south-east France.

Thanks to adjustable, specially equipped workspaces, TRIADE offers complete, integrated solutions for the management of radioactive waste. Originating in nuclear facilities in operation or undergoing dismantling, the waste is brought to the site, where the teams are responsible for every aspect of its management – from studies all the way to shipping to approved facilities after processing. The teams use tried-and-tested cutting, sorting and conditioning technologies to process several hundred cubic meters of radioactive waste each year, reducing its volume, partially decontaminating it and then reconditioning it for final disposal.

## SERVICES TO NUCLEAR OPERATORS

Driven by the need to maintain EDF's nuclear fleet and its large-scale modernization program, a major scheme to overhaul France's nuclear power plants, the nuclear services market involves a wide range of expertise. Orano DS is a key player on this market, in particular in the fields of worksite logistics, specialized maintenance, radiological safety and nuclear training.



A scaffolder prepares equipment

The market for services to nuclear sites in operation in France alone accounts for several hundred million euros in investment per year. It is driven by the need to carry out regular maintenance work on facilities, and on nuclear power plants in particular, and by EDF's large-scale modernization program to make France's nuclear power plants safer and extend their lifetime. To this end, the utility plans to invest several tens of billions of euros between 2015 and 2025.

The investments are linked to the need to raise the safety standards of facilities subsequent to the events at Fukushima and to maintain their industrial capability. This investment will largely go toward operations to replace or modernize heavy components such as the steam generators or alternators, as well as heavy maintenance operations on certain components requiring the support of companies with expertise in worksite logistics.

In recent years, more than 20,000 employees of contractor companies have in this way been mobilized on a regular basis to work on EDF's nuclear sites, not to mention the thousands of other people called upon to intervene on the nuclear sites of other nuclear operators (Orano, CEA, ANDRA).



employees of Orano DS are specialized in nuclear services



Find out about the work done by scaffolders in nuclear plants

## Logistical support for power generation

For a nuclear power plant to operate smoothly, it is necessary to carry out regular maintenance of its industrial facilities, and to ensure the site is managed efficiently on a daily basis. The broad range of expertise at Orano DS's disposal notably includes «global site support services», a comprehensive service offer enabling the nuclear operator to delegate responsibility for site logistics in order to concentrate on its core business: generating electricity.



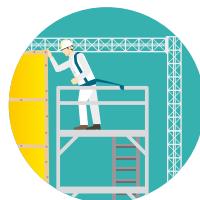
Radiation protection



Cleanliness of facilities



Laundry system



Scaffolding and industrial insulation



Handling Site support



Management and inspection



Coordination of activities



Equipment store



Waste management

# A diverse yet complementary nuclear services offer

Orano DS offers operators of nuclear facilities a wide range of support services. A key player in the area of «global site support services», DS provides, for example, the industrial logistics for several of France's nuclear power plants. In the maintenance sector, Orano DS has teams which intervene on all nuclear power plants nationwide throughout France to carry out servicing of sensitive items of equipment (lifting equipment, overhead cranes, etc.). The service offer also includes a set of services specialized in ensuring the radiological safety of persons working in nuclear environments, ranging from radiation protection to environmental analyses. Lastly, through its subsidiary TRIHOM, Orano is also a leader in the nuclear training sector, with more than 35 000 trainees attending its 17 training centers in France every year.



#Nuclear  
training



#Worksite  
logistics



#Specialized  
maintenance



#Radiological  
safety

## Four areas of service activity



### MANUELA™

(Mobile Apparatus for NUclear Expertise and Localization Assistance)

MANUELA™ is a portable real-time radiological and topographical mapping device. Measurements are spatially positioned and instantaneously retranscribed in 3D on a monitoring screen. The data can be used in post-processing to prepare intervention scenarios for operators.



### POLAR CRANE DRIVING SIMULATOR

With a cabin fully equipped with screens, a sound system which reproduces the atmosphere of a reactor, plus semi-artificial intelligence, the simulator allows both young and more experienced polar crane\* drivers to maintain their technical skills at the highest level.

\*A removable and rotating beam located beneath the dome of the main reactor building enabling heavy loads to be moved around within the reactor containment



Check out the Orano YouTube channel to find out more

## Logistical expertise in providing support for nuclear power generation

In 2016, and again in 2019, Orano DS was awarded several significant contracts with EDF for support activities associated with electricity production at nuclear power plants. These services include handling of casks, low-level radioactive waste management, radiation protection and assembly of scaffolding and insulating protection. In total, the contracts won represent several tens of millions of euros worth of business and are mobilizing dozens of employees from Orano DS.



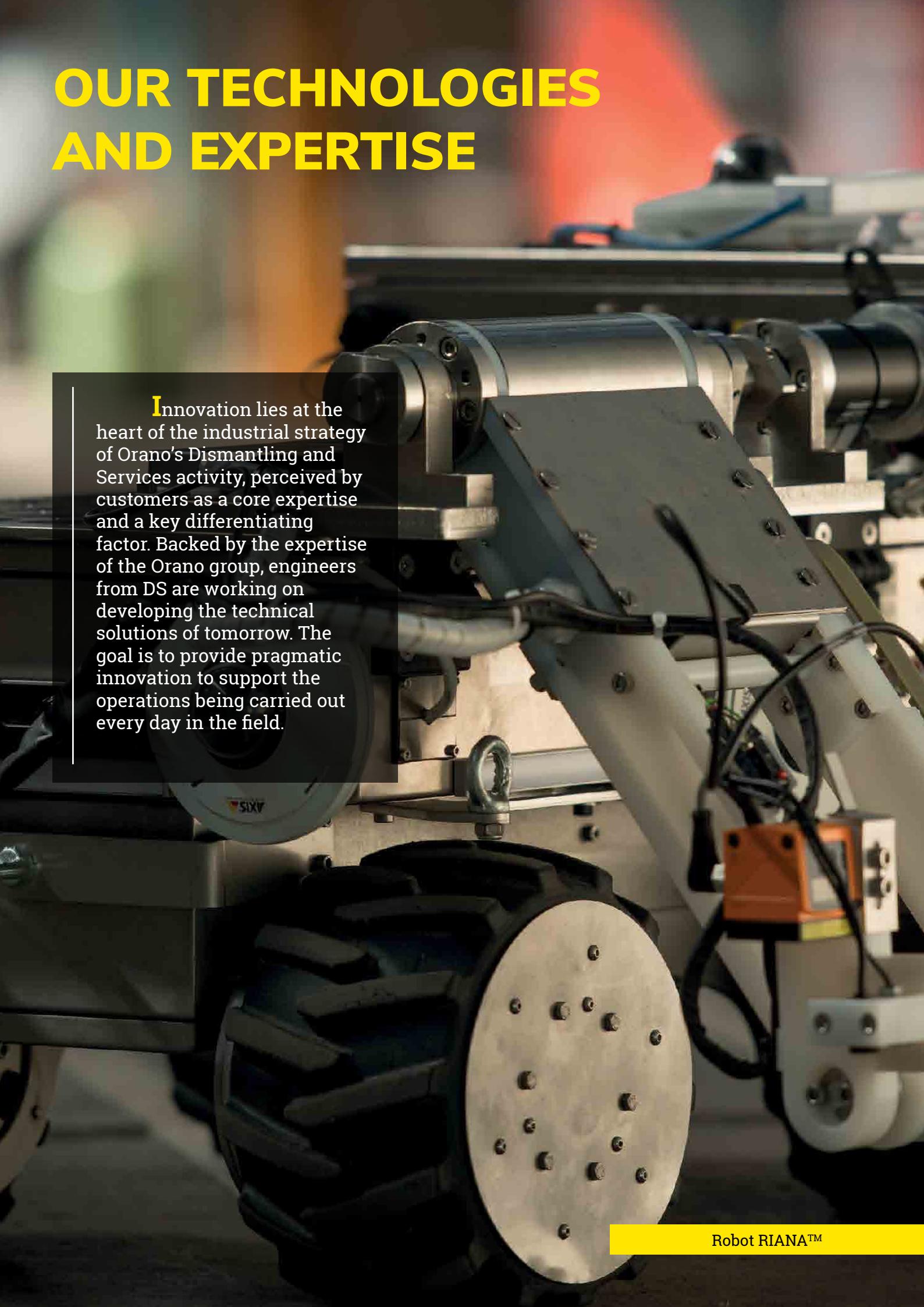
Find out about the work done by nuclear maintenance technicians

*“Our strength: complementary professional skills and recognized technical expertise”*

François Lurin, Vice President, Service Activities for Nuclear Fleet, Orano DS



# OUR TECHNOLOGIES AND EXPERTISE



Innovation lies at the heart of the industrial strategy of Orano's Dismantling and Services activity, perceived by customers as a core expertise and a key differentiating factor. Backed by the expertise of the Orano group, engineers from DS are working on developing the technical solutions of tomorrow. The goal is to provide pragmatic innovation to support the operations being carried out every day in the field.

**Orano DS offers its customers a wide range of technological solutions, with four objectives:**

- Strengthen the safety/security of operations (reduce the exposure of operators to radiation, improve their working conditions, gain better knowledge of facilities for more effective intervention preparation, etc.)
- Improve worksite productivity
- Propose new services that represent a breakthrough with regard to more traditional approaches
- Perform completely new operations for which the technical solutions are not yet available

### **A dense catalog of technological innovations**

Dismantling and Services has a technological catalog consisting of dozens of technologies that have been developed, tested and implemented in nuclear zones. These innovations draw on the science of robotics, virtual reality and information technology, as well as chemistry, nuclear measurement, mechanics and much more. Numerous technical developments refined in the Dismantling and Services laboratories have been patented to protect the know-how that makes our business stand out.

### **Engineering teams providing reliable, competitive solutions**

To help customers make their projects a success, Dismantling and Services draws on a management structure built around the engineering disciplines, in four key fields of expertise: cleanup/dismantling, waste, equipment production and associated studies, and nuclear safety. This means that more than 200 specialist technicians and engineers actively contribute to the success of projects both in France and further afield, often in extremely complex environments.



Find out about the work done by safety engineers



**More than  
40  
patents held by  
Orano DS**

**4 fields of expertise and  
more than  
30 skills areas**



**More than  
200  
engineers and  
technicians**

Orano transforms nuclear materials so that they can be used to support the development of society, first and foremost in the field of energy.

The group offers products, technologies and services with high added value throughout the entire nuclear fuel cycle, from the raw materials right through to the treatment of waste. Its activities encompass mining, uranium chemistry, enrichment, used fuel recycling, logistics, dismantling and engineering.

Orano and its 16 000 employees bring to bear their expertise, their mastery of cutting-edge technology, their permanent search for innovation, and their unwavering dedication to safety, to serve their customers in France and abroad.

## Orano DS is hiring

Check out our offers at  
<https://recrutement.orano.group>  
Keyword: "Orano DS"



**orano**

Giving nuclear energy its full value