



HELCZA complex
Plzeň, Czech Republic



NUVIA

A new era in the nuclear sector

With several Nuvia entities taking part in the major ITER project in Cadarache, France, the ITER Organization has selected Nuvia teams in the Czech Republic to carry out cyclical resistance testing for ITER EU primary first wall components. A unique experimental complex was created to perform the tests. Called HELCZA (High Energy Load Czech Assembly), the technology can test components subjected to high temperature flux and in direct contact with the plasma. From cameras to vacuum units and sensors, the machine was comprehensively designed and built by Nuvia CZ as a contribution to the construction of the world's largest-ever tokamak. Over the next several years, about 30 panel variants will be tested.



BRUNO LANCIA
Chief Executive Officer,
Nuvia

A major nuclear New Build player

How did your markets shape up in 2016?

The year was fairly stable overall, with significant differences from one country to the other. In France, we experienced strong growth driven primarily by the design-build Epure project in which we are helping to put up a new nuclear radiography facility. In the United Kingdom, the diversification of our activities in EPC and turnkey projects involving the construction and maintenance of waste treatment facilities has compensated for the decline in the decommissioning market. In the rest of Europe, business remains brisk in the Czech Republic following a record year in 2015, while in Sweden, the announcement that a number of reactors are to be shut down has curtailed development.

The nuclear industry, in which time is measured in decades, is less sensitive than other sectors to the impact of economic crises...

That is true, but there is another side to that coin: in a more buoyant economy, without leverage effects, the sector does not experience very strong growth. And in this market, which is by nature quite stable, investment strategies are closely predicated on political decisions. Against that

A good success in 2016?

Recognition of our capabilities and experience in EPC (Engineering, Procurement and Construction), notably at Hinkley Point.

An iconic project?

HELCZA for the complexity of the device and the passion of the teams involved (see page 64).

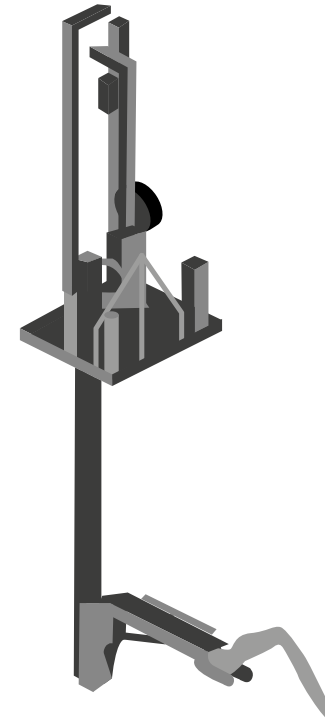
A watchword for 2016?

Convergence: the variety of our complementary expertise, activities and locations in 12 countries is an asset for our employees and a one-of-a-kind advantage for our clients.

backdrop, EDF's decision to build two new EPR reactors at Hinkley Point near Bristol has given the sector a new lease on life in Europe and sent a clear message of support for the carbon-free energy source to the international community. Nuvia's participation in this important project confirms its status as a major nuclear New Build player.

One of Nuvia's strengths is that it works across the entire life cycle of a nuclear facility. Its scope of work in France illustrates this perfectly.

We are indeed involved in the "Grand Carénage" overhaul programme designed to make EDF's fleet of power plants even safer. We are handling heavy maintenance operations such as condenser retubing works in Cattenom and turnkey construction at power plant sites. Nuvia is also involved in a novel programme in France: the start of decommissioning of the reactor vessel at Chooz A in the Ardennes, together with Westinghouse Electric France. Over a number of years, the project will call for broad capabilities ranging from civil engineering to mechanical engineering and radiation protection. →



Nuclear specialist

The Nuvia Group works throughout the life cycle of nuclear facilities, from construction to operation, maintenance and decommissioning. The Group's expertise covers three major areas of nuclear activity: engineering, services and works, and products. It includes safety and security in all its activities, which cover civil engineering, mechanical engineering, waste management and radiation protection, including nuclear measurement, and fire and flood protection.

2,535
EMPLOYEES

€345 m
REVENUE

NEW ORDERS

- Five-year renewal of the operating contract for nuclear facilities at the CEA's site in Valduc, France
- Supply of NUVIA Tech Protection biological protection systems at the EPR in Taishan, China
- Renewal of the project management contract for decommissioning the Kozloduy nuclear power plant, Bulgaria
- General contract covering the European Spallation Source (ESS), a proton accelerator used to create neutrons, Sweden
- Project engineering for equipment at the new hospital centre in Condrieu, France

→ Outside the nuclear power plant fleet, the Epure project launched at the CEA (French Alternative Energies and Atomic Energy Commission) site in Valduc and the international ITER project in Cadarache are demonstrating our teams' ability to carry out major design-build projects.

What other activities are you developing in 2016?

Safety and security of the facilities are ongoing challenges that require excellence on the part of all industry participants. In this spirit, we are expanding our facility protection and nuclear measurement product lines around the world under the NUVIA Tech brand. In parallel with our longstanding activities in the nuclear sector, we are continuing to broaden our capabilities in other sectors. For example, Nuvia is increasingly involved in the healthcare sector in Europe through its design and production of radiation measuring equipment.

Have you made any noteworthy progress in innovation?

At the Sellafield site in the United Kingdom, our teams developed an innovative system for decommissioning a chimney at a nuclear facility (see page 73). The latest dismantling work got under way in January 2017. In 2016, we signed two strategic R&D partnerships with CEA Tech to design and develop new nuclear measurement equipment.

Is international expansion still on the Nuvia brand's agenda?

As a major source of carbon-free power, the nuclear industry can expect a promising future. More and more countries are including nuclear power in their energy mix or are preparing to do so. There have never been as many new power plant projects. But the centre of gravity is shifting from North America and Europe to Asia and the Middle East. We will consolidate our business in our current areas of operation, but we are also going to accompany this historic evolution by giving ourselves the ways and means of operating in key countries.



Highly
trained and
solid
technical
experts



John "Jack" O'Neil - The JGW Group
Vice-president

"SIRIS is an innovative detection system that is particularly well suited to the safety needs of homeland security groups such as customs and border patrol, local and national law enforcement agencies, first-responders to CBRNE (chemical, bacteriological, radioactive, nuclear and explosive) attacks, the military, special research departments, teams in charge of special events and personnel responsible for protecting high-value buildings, assets and iconic sites. As a special partner of Pico Envirotec, we worked together to accelerate the launch of SIRIS on the U.S. defence and security markets. The technical experts at the Nuvia subsidiary in Canada are highly trained and solid. Not only do they help to improve the product by offering increasingly sophisticated and cutting-edge innovations, but they also facilitate marketing. Building on longstanding expertise in customised, mobile (airborne and land-based) radiation detection systems, they are responsive to clients seeking simple, user-friendly solutions."

SIRIS AT THE SERVICE OF SAFETY



In Canada, Pico Envirotec built on its geolocation and nuclear measurement expertise to develop SIRIS (Stand-off Integrated Radiation Information System), which detects and identifies radiation at a distance. It is suited to the detection of illicit radioactive materials and meets key requirements of the civil defence and military authorities.



An innovative remote radiation detection system

At a time when the threat of nuclear terrorism is taken very seriously, SIRIS can detect neutrons, identify isotopes (from both artificial and natural sources) and detect high doses. It uses sensors and the new isotope identification algorithms developed by Pico Envirotec experts in 2016 to locate radioactive sources in complex environments. "The system consists of a detection module and a laptop computer for data acquisition and system setup," says Ian Newkirk, Production and Client Service manager at Pico Envirotec. The detection unit is a reinforced case containing two scintillation detectors, a Geiger-Mueller tube, a solid neutron detector, a multi-channel analyser (MCA) and an uninterruptable power supply (UPS)." As such, SIRIS is an integrated tool that can be used to dynamically or statically collect data as well as to display it in real time via customisable audio and visual alarms, and to control processing and analysis.

Accurate evaluation and swift localisation

Rapidly searching for and locating chemical, bacteriological, radioactive, nuclear and explosive (CBRNE) substances is a key civil and military defence issue. In 2016, the Canadian teams at Pico Envirotec continued to develop SIRIS in close cooperation with the United States Department of Defense and came up with new solutions meeting needs on the ground, for example to track illegal trafficking in radioactive materials. The system can not only locate the sources of radiation but establish a reliable distinction between potential threats and radioactive materials that normally occur in nature. So SIRIS is an ideal tool for use in security patrols.



Nuvia Structure

In 2016, three years of advanced calculations and testing of the bearings designed to support the cryostat in Cadarache were completed. The cryostat is the heaviest component of the future ITER nuclear fusion reactor and the largest - at 16,000 cu. metres - stainless steel high-vacuum pressure chamber ever built. The bearings, which must withstand sharp dilation and rotation under load as well as very low temperatures, were tested on an outsized test bench in Italy. Nuvia Structure and Nuvia Process worked

in a joint venture with Westinghouse Electric France for EDF to build the waste processing unit at the Chooz A reactor in the Ardennes region. A crucial step in this major event in France in 2017: the underwater decommissioning of a pressurised water reactor (PWR) vessel. This year, teams from Nuvia Structure also helped build the first two Emergency Diesel Generators (EDG), with one goal: to reinforce the safety of the facilities in the post-Fukushima era. In parallel, they carried out major maintenance operations such as **condenser retubing works at Cattenom** and the replacement of steel-core reinforced concrete pipes at several nuclear power plant pumping stations.



Nuvia Access

The new Nuvia France subsidiary specialising in equipment to provide secure access to work areas operates upstream from the other Group entities. Its expertise in such things as scaffolding, coatings, logistics, containments and protection helps with bids on turnkey projects. 2016 projects included the **design and installation of access equipment to partly replace the CBAT (steel core reinforced concrete piping) equipment at EDF's Paluel power plant**; the containment of infrastructure prior to asbestos removal at the French Alternative Energies and Atomic Energy Commission's (CEA) Gramat centre and rail borne tarpaulins placed on facilities in the military port of Cherbourg.

Millennium

In 2016, the Millennium teams rounded out their range of scientific modelling and calculation and statutory analysis and inspection solutions by adding high value-added solutions covering fire, multi-physical calculation, as well as human and organisational factors (HOF) in risk assessment, in the nuclear industry. They also broadened their design range to include expertise in nuclear facility and component design projects, and undertook active participation in the Franco-British Epure project in Valduc. The company reinforced its partnerships with CEA, EDF, and AREVA and extended the scope of its work with the National Radioactive Waste Management Agency (ANDRA). Millennium also carried out extensive nuclear physics studies to optimise **the facilities of the future ARCADE** (Advanced Resource Centre for HADrontherapy in Europe) cancer treatment centre in Caen (see page 79), other medical facilities using particle accelerators and the accelerator system called AGLAE (for *Accélérateur Grand Louvre d'Analyses Élémentaires*) which remains the world's only facility dedicated to the study of heritage objects to be located in a museum laboratory.



Nuvia Process

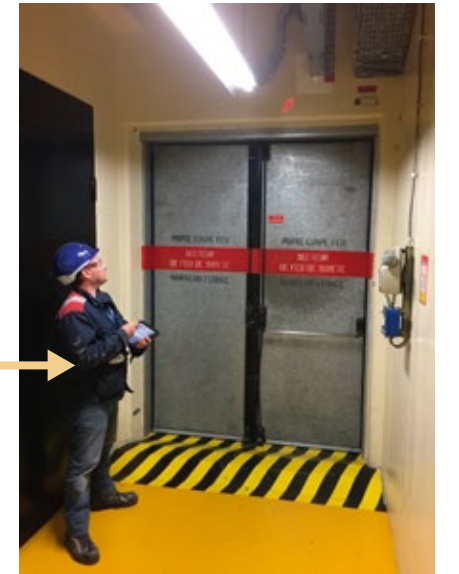
At the CEA site in Marcoule, France, remote operators at Nuvia Process implemented the MAESTRO slave arm manipulator to dismantle highly radioactive equipment and in-cell pipework in a highly radioactive environment. This is the **first "active" pilot project using the MAESTRO arm**. The innovation more broadly illustrates the expertise of the teams that resulted in the renewal of several multi-year contracts in 2016, including plant operation of the Marcoule tritium workshop (ATM). Nuvia Process began laser cutting operations on the R7 evaporator in La Hague, completed dismantling and decontamination of Room 60 at Marcoule and took samples in highly radioactive tanks at the two sites. Lastly, the dismantling of the plutonium technology workshop (ATPu) and the chemical purification laboratory (LPC) in Cadarache, which were commissioned in the 1960s, was completed in December 2016. Overall, this amounted to 400,000 hours of work since the decree authorising shutdown was issued in March 2009, making this one of France's most extensive dismantling projects involving plutonium.

Nuvia Protection

Nuvia Protection, market leader in protection of sensitive industrial sites, consolidated its order backlog in passive fire protection by securing a major contract to seal penetrations at EDF's fleet in operation. A digital solution was proposed for this project: the **introduction, at eight sites, of digital tablets to monitor operations**. The subsidiary continued its technical development work, which led to qualification of new products for ITER, and signed new contracts in Belgium, South Korea, China, India and Japan.

Nuvia Support

Nuvia Support coordinates and manages activities such as logistics, radiation protection and facility operation services. In 2016 it continued to deliver solutions in line with the objectives of nuclear operators. In addition to multiannual **global site work assistance at the Cruas, Dampierre and Penly power plants**, the teams worked on EDF's nuclear fleet to carry out decontamination work, using equipment specially designed and developed by Nuvia.





Nuvia CZ

In addition to the successful HELCZA project (see page 64), Nuvia CZ conducted brisk business in 2016. Many software development projects are under way for data acquisition and radiation monitoring systems, including continuous improvement of the DAQIS, MonRaS and RaMon measuring, management and inspection tools. Tests carried out on the SuperNEMO demonstrator at the Modane underground laboratory (*Laboratoire Souterrain de Modane*, where research is carried out on the neutrino, the dark matter in the universe) were successfully completed. In other developments, the solutions devised by Nuvia CZ to improve monitoring and minimisation of tritium and ¹⁴C radionuclide discharges and to optimise material clearance were implemented at the operational Ukrainian nuclear power plants.

In 2016, the Czech NBC Defence Institute (University of Defence), Air Force and Air Defence Military Technical Institute called on the systems used to monitor radiation in emergency situations, which were developed by Nuvia CZ. A new piece of mobile and stationary on-board equipment used to monitor radiation drew the attention of various security stakeholders. Representatives of the police, the fire brigades, the armed forces and the emergency services as well as universities, research units and government agencies discovered the device at a special presentation meeting held in June 2016, where the installation of **helicopter-borne radiation monitoring equipment was a particular attraction.**

Lastly, Nuvia CZ boosted its solutions and services in all business areas. For example, the company offered new neutron scintillation detectors (NuDET) and a metrology device that can be used to characterise radioactive waste (NuMUM), developed in partnership with the European Commission's science and knowledge service, the Joint Research Centre (JRC) in Ispra, Italy. In 2016 a device was also designed with the Nuvia Process teams and developed to monitor laundry and clothing contamination for the CEA in Marcoule, and a monitoring and sorting portal gate was developed for a Saudi partner to combat illicit traffic in nuclear materials.

SEA and MED

SEA, which specialises in radiation protection equipment and nuclear measurement, is continuing to promote its flagship product around the world: the portable NuCoMo contamination meter. The two Nuvia subsidiaries in Germany, SEA and MED, offer to adapt **the range of hand, foot and clothing (HFC) contamination monitors** to clients' needs.



Nuvia UK

In a difficult nuclear business environment in the United Kingdom, Nuvia UK has shown strong resilience and held up particularly well in its historically strong legacy waste management and decommissioning markets. In Cumbria, at the Sellafield site, the final phase of the Sellafield Export Facility project was successfully completed, including on-site installation and inactive commissioning.

Nuvia Group has begun work on dismantling a 120-metre-high chimney

that rose 60 metres above the United Kingdom's main nuclear fuel processing facility. To carry out this operation, a self-climbing platform (SCP) was attached to the outside of the chimney. In November 2016 it began its vertical sliding operation that enabled teams to gain access to the structure to begin cutting. The teams had received special training in this crucial stage of the works. In addition, Nuvia's operations staff assigned to the site is continuing demolition work under the comprehensive dismantling plan, supporting progress on the Sellafield decommissioning mission.

The year's successes included delivery of a design project at Aldermaston in Berkshire, for the Atomic Weapons Establishment (AWE) and the extension of a 24 hours a day, 7 days a week on-call assistance service contract between the UK Border Force and the Nuvia health physics team.



In New Build, following the investment decision taken by EDF, the Nuvia Group will take part in building the two EPR type reactors in **Hinkley Point**. It will work with Rolls Royce to supply **turnkey subassemblies for the power plant's coolant treatment system: the primary circuit boron recycling and the liquid waste systems.** The Group is also well positioned to take on further major EPC projects at the site, and with other New Build developers.