Summary

- SNGC companies and CNPRI intensify their collaboration
- ENUSA will supply a new automatic pellet visual inspection equipment to China
- ENUSA installs the “Espiga” device
- Tecnatom enhances Emergency Preparedness Capabilities in China
- Tecnatom participates in the NOMAD Project to increase nuclear power plant safety
- The European Commission approves ENSA MEACTOS project
- ENSA collaborates in an international project to study the behavior during transportation of spent fuel assemblies in its cask ENUN 32P
- ENSA will carry out the tests of the robot within the COROMA European program
- ENSA receives the Certificate of Compliance of the ENUN 24P cask in Spain
- Ringo supplies more than 500 valves to Baltic Shipyard for construction of a nuclear icebreaker
- Ringo supplies valves for the Alternate Coolant Injection System of Olkiluoto NPP
- Additional information contacts
SNGC companies and CNPRI intensify their collaboration

China Nuclear Power Technology Research Institute (CNPRI), a company of the China General Nuclear Power Group (CGN) and the Spanish Nuclear Group for Cooperation (SNGC) have signed recently a Memorandum Of Understanding during meetings held in Madrid to intensify the collaboration started in 2008 between the different companies of the Group. The collaboration will cover different activities, and in particular:

- Design, development, manufacturing, modification, testing and training of tooling, devices, robots and equipment in NPPs in operation.
- Structural integrity testing and in-service inspection of equipment and components
- Materials and spare parts engineering and manufacturing
- Fuel Transport containers and associated logistic
- Spent fuel storage, transportation and associated technology
- Mechanical Failure Analysis support

Additionally, both parties will analyse the establishment of joint R&D initiatives, especially in researching and developing robot applications to be used in Nuclear Power Plants to increase safety, reduce doses and improve cost effectiveness of different manually performed tasks. Combined research teams and technologies of the parties could support the pursuit of potential opportunities in the world nuclear power robot market.

ENUSA will supply a new automatic pellet visual inspection equipment to China

ENUSA and its Chinese customers CJNF and CNEIC, both belonging to the CNNC group, signed last October 24 a contract for the supply of a new automatic nuclear fuel pellet visual inspection equipment for the Yibin Fuel Factory, operated by CJNF and located in Sichuan province. This contract is the most important order for ENUSA in the Asian country to date and it puts an end to a negotiation process that lasted for several years. It is also the first ever export of this inspection equipment developed by ENUSA in the Juzbado fuel factory.
CJNF and ENUSA began their successful relationship in 2008 with the signature of a Memorandum of Understanding. In 2013 the companies sealed and agreement for the supply of an ultrasonic inspection equipment, followed in 2015 by another inspection equipment based on eddy current technique. The new equipment represents the third order placed by the operator of the Yibin fuel factory to ENUSA, an indication of the confidence that the biggest nuclear fuel manufacturer in China has placed on the Spanish company.

The system will be installed at Yibin new production workshop and will contribute to sustain the continuous growth of nuclear fuel demand in China, driven by the 37 reactors in operation and the 18 under construction in the giant Asian country, as well as to reinforce the quality and reliability of the nuclear fuel produced in Yibin.

ENUSA installs the “Espiga” device

In September 2017, after more than five years of engineering development, manufacturing qualification and licensing, ENUSA has carried out the first installation campaign in spent nuclear fuel in one Spanish nuclear power plant. Fifty irradiated fuel assemblies have been repaired during this first campaign.

This first campaign has demonstrated a very good performance of the equipment. During this first campaign, some different sequences are being used in order to establish the shortest procedure to optimize the entire process. A second campaign is planned in a different Spanish NPP in October 2017.

The ESPIGA device is a structural component designed to carry the weight of the fuel assembly complying with the design criteria for 17x17 12-ft assemblies. ENUSA provided the description of ESPIGA device, as well as the process and tools to carry out its installation into the fuel assembly in a previous number of this Newsletter. ENUSA has performed several functional tests both in air and under water, demonstrating the excellent performance of the different in-house developed equipment during the installation/uninstallation of the ESPIGA.

During the first semester of 2017, ENUSA has successfully tested in dummies fuel assemblies, in two different nuclear plants, the tools and the electrical discharge machine (EDM) equipment developed for the setting up of ESPIGA device. Both campaigns have shown the compatibility of the tools with both plants layout and the suitability of the process developed to guarantee the correct set up of the ESPIGA device in a fuel assembly. EDM machine is designed to drill the top nozzle instrument tube plug. ENUSA has also led the development and manufacturing of other tools, such as the short and long tool for ESPIGA installation and the specific tooling required for the adequate on-site process performance.

During blank tests ENUSA also conducted a specific risk analysis based on Failure Modes and Effects Analysis (FMEA) to establish improvement actions and control activities during the process in order to reduce the risks levels in the actual campaigns.
Based on the risk analysis conclusions as well as the feedback from both blank tests, taken the following actions prior to the first campaign to assure the correct performance of the total process:

- Final process definition with specific control steps
- Some tools duplication as a contingency measure to minimize any delays in case of any event during the process, such as second EDM machine, short tool, support for camera
- Spare parts availability
- Specific training for technicians

After these tests, the manufacturing of the devices for the first campaign began according to the corresponding Manufacturing and Quality Plan, which was previously approved by ENUSA. The manufacturing process was qualified during the manufacturing of the prototypes used in the different tests described above. Industrias Maxi is ENUSA partner in charge of the manufacturing of the various parts of the ESPIGA device, as well as some of the tools developed by ENUSA. During the development phase, ENUSA has deeply analysed all aspects related to the different potential raw materials, the process flow, the welding procedures, the inspection requirements and the cleaning and handling operations. Processes such as stamping, machining as turning, grinding, milling, drilling, threading, manual and automatic robotic welding have been used. ENUSA has also required an extensive dimensional characteristic control of the different parts and components, and paid a lot of attention to the welding process and inspections and to all different functional tests.

As a conclusion, this has been a long journey of more than five years of a very deep work of conceptual ideas, engineering development, “Espiga” device and different tool prototypes manufacturing, testing, with thousands of man hours from many different organizations at ENUSA devoted to the project. Followed by the blank tests in air and under water and with the exhaustive manufacturing surveillance of the actual devices and tools, which have concluded in a very successful campaign with the installation of the first fifty devices, that will be continued with some other campaigns in the different Spanish NPPs that are affected.

Tecnatom enhances Emergency Preparedness Capabilities in China

The closing meeting of the European Project “Enhancing the capabilities of China in the field of Nuclear Safety in the areas of emergency management and the management of severe accidents” (CH3.02/11A) was held in Beijing on October 10th and 11th.

The project was funded by the European Commission, with the People’s Republic of China as beneficiary, the final users being the Chinese Atomic Energy Authority (CAEA) and the National Nuclear Emergency Response Technical Assistance Centre (NNERTAC), among others.
Tecnatom participated in the project undertaking leadership of Task 2 “Regulations, rules for emergency preparedness and response”, among other activities. Throughout the project, a number of activities were carried out, with the collaboration and support of Trillo nuclear power plant and the Nuclear Safety Council.

Both the Chinese Ministry of Foreign Affairs (MOFCOM) and the Chinese nuclear authority and NNERTAC, on the one hand, and the European Commission, on the other, have underlined the quality, the particularly high technical level and the applicability of the work performed, expressing their intention to continue to work with Tecnatom.

**Tecnatom participates in the NOMAD Project to increase nuclear power plant safety**

Tecnatom participates in the recently started European research project NOMAD (“Non-destructive Evaluation System for the Inspection of Operation-Induced Material Degradation in Nuclear Power Plants”). The project aims to develop a non-destructive evaluation system for nuclear power plants with the final goal of responsibly extending their period of operation.

In the European Union, about 200 nuclear power plants are currently feeding electricity into the grids with more than half of them exceeding a lifetime of 40 years by 2020. In order to ensure the needed electricity supply for the next decades, the EU is targeting lifetime extensions of existing plants to up to 60 or 80 years.

Tecnatom participates in the project with the role of end user, and will try to guide the project with its experience and knowledge, in order to contribute to the inspection techniques and technologies developed to suit the real conditions of nuclear plants.

Launched in June 2017, the new research project NOMAD will make a significant contribution to ensuring long-term safety for the environment and European citizens by developing a novel and reliable evaluation tool giving insight into the actual state of material degradation in the individual power plant.

This project has received funding from the European Atomic Energy Community (EURATOM) research and training program 2014-2018 under grant agreement No 755330 in the context of the Horizon 2020 Program.
The European Commission approves ENSA MEACTOS project

The European Commission has approved ENSA MEACTOS project (Mitigating Environmental Assisted Cracking Through Optimisation of Surface Condition).

This project, which lasts four years, aims to improve the reduction of residual stresses and the stress effect of cracking corrosion in steels from the perspective of micro-tensions and surface cracks induced by machining and treatments that can be given superficially to the pieces to alleviate them or to avoid their appearance.

In addition to the general objectives of the project, ENSA expects to obtain information on the possible replacement of cutting fluids and oils by refrigeration with cryogenic technology (CO₂), and to acquire the necessary qualifications to carry out processes that have to do with this surface induction tension effect in machining. In its “passion for improvement”, it is important for ENSA to work with the most advanced technologies, such as cryogenics or CO₂ cooling and introduce the latest technological advances in its manufacturing processes.

Led by CIEMAT (Energetic, Environmental and Technological Research Centre) and within the framework of Research and Innovation Program of the European Union Horizon 2020, the Company is participating with AREVA, EDF and Nuclear AMRC.

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 755151.
ENSA collaborates in an international project to study the behavior during transportation of spent fuel assemblies in its cask ENUN 32P

The tests performed aim to validate that the spent fuel maintains its integrity during normal conditions of transport.

Equipos Nucleares (ENSA) participates in an international and pioneer project to study the behavior during different transportation modes of the nuclear fuel assemblies in its ENUN 32P cask, licensed for both storage and transportation purposes. This is the first time that a test of this nature is performed to verify the integrity of spent fuel in real transport conditions.

The company has collaborated with the Spanish companies ENRESA and ENUSA, the US laboratories: Sandia National Laboratories (SNL) and Pacific Northwest National Laboratory (PNNL) and with several organizations in South Korea (KORAD, KAERI, KEPCO and KINS).

This collaborative project has used the ENUN 32P cask, loaded with 3 surrogate fuel assemblies supplied by ENUSA, Sandia and Kepco, which were instrumented with gauges and accelerometers to measure the stresses during cask loading movements in the nuclear power plants, as well as during the different transportations carried out: by road, by sea along the coast and across the Atlantic Ocean and by railroad.

Railway transportation tests

The rail transportation tests carried out on the ENUN 32P ENSA cask aims to validate the initial hypothesis that spent fuel maintains its integrity during normal transportation conditions.

The tests have been carried out by Sandia National Laboratories and Pacific Northwest National Laboratories at the Transportation Technology Centre (TTCI) in Colorado where the data was collected, obtaining around 8 terabytes of information. The ENUN 32P has been subjected to various railway tests such as twist and roll, pitch and bound, dynamic curving, coupling impact, among others.

Preliminary analyses of the data suggest that the real stresses fuel due to vibrations and shock during normal transportation are far below the yield and fatigue limits of the fuel cladding.

ENSA will supply ENRESA with 10 ENUN32P casks for Trillo and Almaraz, two Spanish nuclear power plants.
ENSAS will carry out the tests of the robot within the COROMA European program

COROMA European project (Cognitively Enhanced Robot for Flexible Manufacturing of Metal and Composite Parts) seeks to develop a new concept of intelligent, modular and flexible industrial robots, capable of executing multiple processes and manufacturing metallic and composite parts for demanding sectors as aeronautics, shipbuilding or power generation. The Advanced Technological Centre (CTA) of ENSA will carry out the tests of the robot for this latter case.

The initiative, which started in late 2016 and will conclude in October 2019, has the participation of a total of 16 companies, research centers and universities from seven different countries. COROMA has a budget of more than 7 million euros, 6 of them have been funded by the European Commission through the program to boost research and innovation Factories of the Future, within the frame of the multi annual program Horizon 2020.

The technical team will work to ensure that the design of the human-robot interface will fast programming. The modularity of the COROMA robotic system will allow it to adapt to the specific requirements of different manufacturing companies.

This Project has received funding from the European Union Horizon 2020 research and innovation program under grant agreement No. 723853.

ENSAS receives the Certificate of Compliance of the ENUN 24P cask in Spain

Equipos Nucleares (ENSAS) has received the approval of the Spanish Ministry of Energy, Tourism and Digital Agenda for the design of its ENUN 24P cask for the transportation of spent nuclear fuel. With this approval, the licensing process in Spain of the cask is concluded. The design of the ENUN 24P allows the storage and transportation of up to 24 non-damaged used PWR fuel by road, rail and sea. ENSA has already manufactured a unit of this model, which has already been delivered to the Daya Bay plant in Shenzhen, China.

This license approval is a milestone for the Spanish nuclear industry, since the ENUN 24P is the first cask licensed in Spain that allows the transportation of high burnup fuel (> 45 GWD / MtU). Additionally, the ENUN 24P increases the list of self-designed casks already licensed by ENSA, adding to ENUN 32P...
and ENUN 52B. The Energy Policy and Mines General Directorate of MINETAD, in accordance with the favourable report issued by the CSN (Spanish nuclear regulator) and, as a result of the evaluations carried out, agreed to approve this design for "complying with the requirements for type B (U) packages as per the regulations of the International Atomic Energy Agency and the Spanish regulations on the transport of dangerous materials ".

ENSA is currently providing support to its customer URC (Uranium Resources Company Ltd.) for the design validation process by the Chinese Nuclear Regulatory Authority (NNSA). This validation will presumably enable URC to carry out the first commercial high burnup fuel transportation in China.

**Ringo supplies more than 500 valves to Baltic Shipyard for construction of a nuclear icebreaker**

Ringo Válvulas has finalized the manufacturing of more than 500 valves to be supplied to Baltic Shipyard for the construction of a nuclear icebreaker. The scope of the contract includes manual, motor operated and pneumatic valves:

- Bellow sealed globe valves up to 12” (DN300) – 258 pieces
- Bellow sealed globe control valves up to 6” (DN150) – 16 pieces
- Stop check valves up to 12” (DN300) – 254 pieces
- Angle type globe valve 3/8” (DN10) – 4 pieces

The contract includes valves for atmospheric steam discharge, which involves a challenge due to the pressure drop and temperature (300ºC). Ringo solution has consisted in the design and production of 6” 600# stainless steel control valves, bellow sealed and PILOT LDB trim, including an outlet diffuser with multi drilled plates.
Ringo supplies valves for the Alternate Coolant Injection System of Olkiluoto NPP

Ringo completed the manufacturing and inspection of a package of nuclear valves up to class 1 related to an order for TVO (Olkiluoto NPP Units 1 & 2). Scope of the order is detailed below.

As part of the scope of the job, Ringo performed the specific tests to the Motor Operated and Pneumatic valves:

Base line tests using a VIPER Diagnostic System to get the torque and thrust values by means of the strain gauges. In the case of the MOV Valves, diagnosis to get the motor power was performed at the same time using a SIPLUG diagnostic system in order to establish a relation between the actuator power and the valve torque and thrust values.

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</table>

The valves have been already shipped to the plant.
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