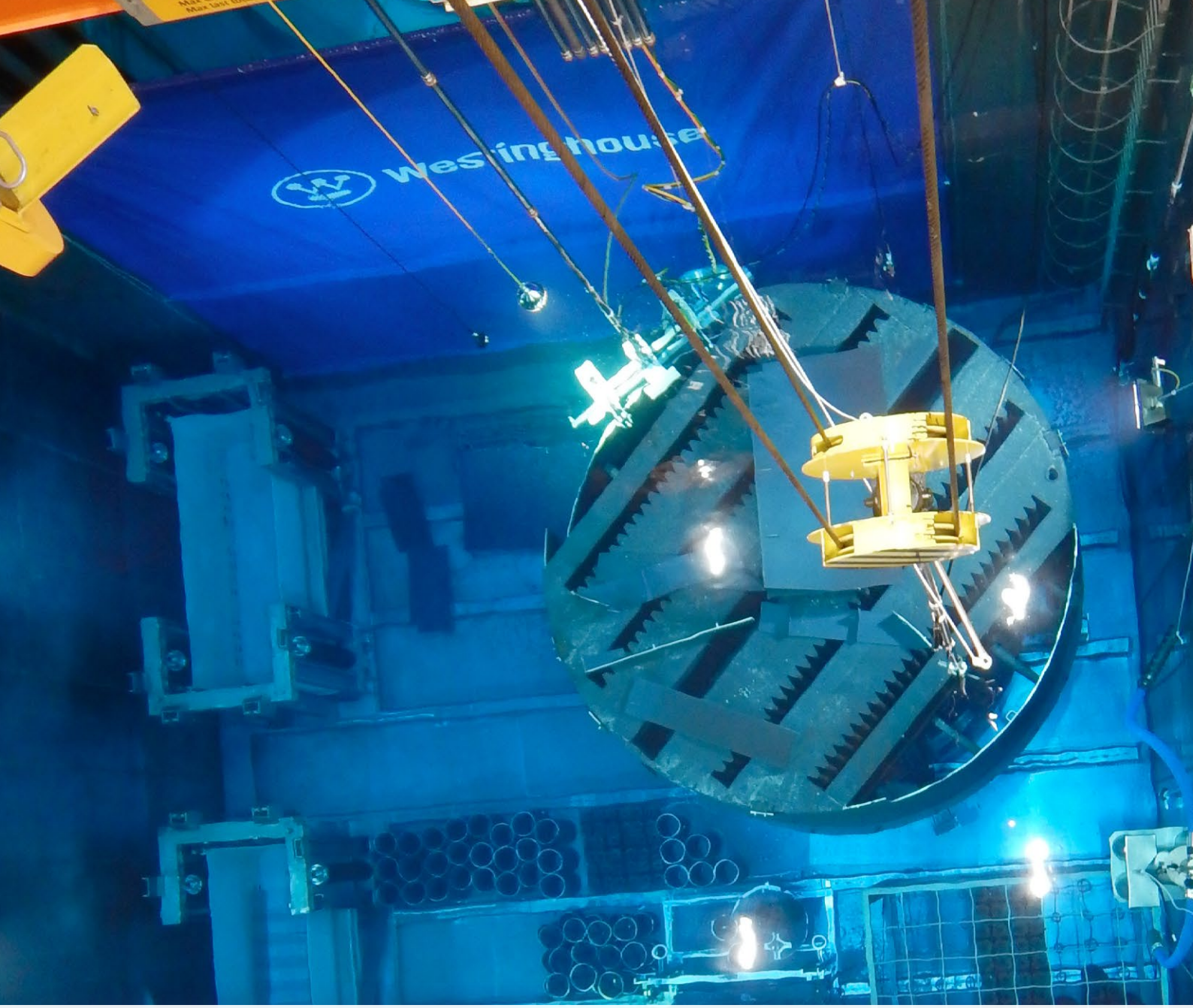
Nuclear España
JOURNAL OF SPANISH NUCLEAR PROFESSIONALS
sne
SPANISH NUCLEAR SOCIETY
www.revistanuclear.es

# VIRTUAL MEETING 2020

Las centrales nucleares no emiten $CO_2$




## MÁS DE 30 AÑOS DE EXPERIENCIA EN PROYECTOS DE DESMANTELAMIENTO, DESCONTAMINACIÓN Y GESTIÓN DE RESIDUOS

Con más de una docena de proyectos en curso de desmantelamiento en reactores comerciales, y sumando, Westinghouse es líder en planificación, gestión e implementación de proyectos de desmantelamiento, descontaminación y gestión de residuos en la industria nuclear.

Combinamos nuestra experiencia en diseño de herramientas, metodologías de corte, tecnologías de desmantelamiento y conocimiento en gestión de residuos con nuestra experiencia demostrada a la hora de completar con éxito un desmantelamiento seguro, consiguiendo ahorro de costes y ajustándonos al programa establecido.

www.westinghouse**nuclear**.com/D-D

Westinghouse

Westinghouse Electric Company

@WECNuclear

Westinghouse Electric Company

wecchinanuclear

Nuclear España
JOURNAL OF SPANISH NUCLEAR PROFESSIONALS
2020

# VIRTUAL MEETING 2020




PUBLIC UTILITY COMPANY
SNE
SPANISH NUCLEAR SOCIETY
Campoamor, 17, 1.° - 28004 MADRID
Tels.: 91 308 63 18/62 89
Fax: 91 308 63 44
sne.1974@sne.es
www.sne.es

## SOCIOS COLECTIVOS DE LA SNE

AHLBERG CAMERAS AB
AMARA, S.A.
APPLUS NORCONTROL, S.L.U.
ASOCIACIÓN NUCLEAR ASCÓ - VANDELLÓS II
CENTRALES NUCLEARES ALMARAZ - TRILLO AIE
CEGELEC, S.A.
CEN SOLUTIONS
CIC CONSULTING INFORMÁTICO DE CANTABRIA S.L.
CIEMAT
COAPSA CONTROL, S.L.
COLEGIO DE INGENIEROS DEL ICAI
EDP ESPAÑA, S.A.U.
ELECOR, S.A.U.
EMPRESARIOS AGRUPADOS INTERNACIONAL, S.A.
ENDESA GENERACION, S.A.
ENUSA INDUSTRIAS AVANZADAS S.A. S.M.E.
ENWESA OPERACIONES, S.A., S.M.E.
ELECTRIC POWER RESEARCH INSTITUTE
EQUIPOS NUCLEARES, S.A.
EULEN, S.A.
EXPRESS TRUCK S.A.U.
FRAMATOME
GAMESA ELECTRIC S.A.U.
GD ENERGY SERVICES, S.A.U.
GE - HITACHI NUCLEAR ENERGY INTERNACIONAL
GENERAL ELECTRIC STEAM POWER
GEOCISA
IBERDROLA GENERACION NUCLEAR S.A.U.
IDOM CONSULTING, ENGINEERING ARCHITECTURE, S.A.U.
INGECID S.L.
MAESSA
MANSERVA, S.L.
MARSEIN, S.A.
MEDIDAS AMBIENTALES S.L.
MOMPRESA
MONCOBRA
NATURGY GENERACIÓN S.L.U.
NATURGY INGENIERÍA NUCLEAR, S.L.U.
NUCLENOR, S.A.
NUCLEONOVA S.L.
ORANO CYCLE
ORANO TN
PROINSA
PROSEGUR
PRYSMIAN GROUP
RINGO VÁLVULAS S.L.
SGS, S.A.U.
SIEMSA, S.A.
TECNASA
TECNATOM, S.A.
TÜV SÜD ATISAE S.A.U.
WESTINGHOUSE ELECTRIC SPAIN S.A.
WESTINGHOUSE TECHNOLOGY SERVICES, S.A.

**Edit by** SENDA EDITORIAL, S.A.

**Directress:** Matilde PELEGRÍ
**Editorial Advisor:** Editorial Staff Commission of the SNE - **English translations:** IPT Translations
**Desing & Model:** José RIBERA MORENO y Clara TRIGO - **Administration and suscriptions:** Lola PATIÑO

C/ Poeta Joan Maragall, 56. 7° D. 28020 MADRID - Tel: (34) 91 373 47 50 • email: nuclear@gruposenda.es

Depósito legal: M-22.829/1982 - ISSN: 1137-2885

This publication is associated with AEEPP (which in turn is a member of CEOE, CEPYME, EMMA and FIPP) & with CEDRO.

AEEPP
CEDRO CENTRO ESPAÑOL DE DERECHOS REPROGRÁFICOS

ALL OUR PUBLICATIONS HAS BEEN PRINTED ON ON ECOLOGICAL CHLORINE FREE PAPER

The SNE allows reproduction in other media of the abstracts of articles published in NUCLEAR ESPAÑA, provided that the source is cited at the beginning of the text of the reproduced abstract and a link to the SNE website (www.sne.es) is provided, as well as the author's name and date of publication. It is forbidden to reproduce, copy, distribute or publish any kind of content of the information published in the magazine without the prior express written consent of the SNE.
The reproduction, copying, distribution, transformation, making available to the public and any other activity that may be undertaken with the information contained in the magazine, as well as its design and the selection and form of presentation of the materials contained therein, whatever the purpose and whatever the medium used therefor, are forbidden without the express consent of the SNE.
NUCLEAR ESPAÑA does not hold itself responsible for the opinions expressed by the authors.

# PRESENTATION

**JAVIER GUERRA**
President
of the Spanish Nuclear Society

The year we have left behind, 2020, will be remembered as the beginning of a global pandemic, the end of which we are still unable to predict and with consequences that are yet to be seen, making uncertainty one of the characteristics that has accompanied us, and will continue to accompany us in the decisions we have made, both professionally and personally.

Mentioning COVID-19 brings to negative aspects mind, many negative aspects, especially those that have affected people's health and that undoubtedly constitute the most important aspect of the times we are experiencing. But I would like to look a little further and give a vision of the positive from this year, which has also been positive. I want to talk to you about how we have all adapted and faced adversity and, especially, as the people who are close to the Nuclear Society, we have been able to innovate, adapt, and face new situations, in a very changing and adverse environment.

As an industrial sector, we have continued to fulfill our professional commitment with companies and institutions and with the supply of an essential asset for people, which is electricity. Nuclear plants have completed their shutdowns for refueling, complied with their procedures, and maintained the highest standards of safety and efficiency, without the difficulties imposed by mobility limitations and other impediments managing to change anything essential in their operation of these facilities. This is undoubtedly a success that will continue for many years, with or without a pandemic, and that values the work of our magnificent professionals, at a time of great difficulty, which is when the consistency and resilience of the Spanish nuclear industry are truly demonstrated.

Likewise, the management and activities of the Nuclear Society have adapted to the new environment with great agility, maintaining strategic objectives and fulfilling our mission. One of the keys to making this possible is the incorporation of digital technologies that were already beginning to be used in previous years, but which in 2020 had a boost and reached a very significant level of maturity. Our magazine, *Nuclear España*, was launched in digital format at the beginning of 2020 and has established itself as one of the references in our sector, open to society, with more and more content, with higher quality, and with a growing number of readers from our country and increasingly attracting a wider audience without borders. We have also adapted other activities to the digital format, such as Nuclear Thursdays, which have continued to be held in a virtual format, which have been well received, and initiatives, also virtual, organized by our Program Committee which has maintained a level of programming level even greater than other years thanks to the opportunities offered by digital tools. A new website has also been launched, which updates the Society's image, in addition to facilitating access to the information and the different services provided through our portal, and which, I hope, is useful to all our members and to all people, more and more so, who are interested in learning more about nuclear science and technology. Similarly, in digital format, two books promoted by the Terminology Commission have been published and various seminars organized by the Em-


## BOARD OF DIRECTORS

*President:* Javier GUERRA SÁIZ
*Vice-president:* Héctor DOMINGUIS PÉREZ
*Secretary General:* Rafael VARGAS TRAID
*Treasurer:* Francisco GARCÍA ACOSTA
*Vocals:* Lourdes BORONDO ARRIBAS, Laurent BROCHET, Miguel Ángel CORTÉS CABAÑERO, Eduardo GALLEGO DÍAZ, José GARCÍA AYCART, Enrique M. GONZÁLEZ ROMERO, Pablo T. LEÓN LÓPEZ & Francisco TARÍN GARCÍA.

## COMMUNICATION COMMISSION

*President:* Montse GODALL VIUDEZ
*Vice-president:* Manuel FERNÁNDEZ ORDOÑEZ
*Vocals:* Alfonso BARBAS ESPA, Laura ESCRIBANO UCAR, Daniel GALLEGO ZAMORANO, Lucía GÓMEZ SÁNCHEZ, Laura ORTEGA PASTOR, Teresa PALACIOS ALLER, Carmelo PALACIOS ESTEBAN, Miguel SÁNCHEZ LÓPEZ & Amparo SOLER MARTÍNEZ.

## PROGRAMS COMMISSION

*President:* Amparo SOLER MARTÍNEZ
*Vocals:* Jesús FORNIELES REYES, Carlos Alfonso GÓMEZ RODRÍGUEZ, Antonio GONZÁLEZ JIMÉNEZ, Santiago LUCAS SORIANO, José Luis MANSILLA LÓPEZ-SAMANIEGO, Nicolás OLMO JUAN, José ORDOÑEZ RÓDENAS & Santiago SAN ANTONIO GUERRERO .

## TECHNICAL COMMISSION

*President:* Rafael SÁNCHEZ FERNÁNDEZ
*Vocales:* Jorge ALDAMA SECADES, Marta BALADÍA OLMEDO, Francisco José BENÍTEZ, José Antonio CARRETERO FERNANDINO, Mª Soledad CORISCO CARMONA, Juan de la Cruz MARTÍNEZ ROBUSTILLO, José María FIGUERAS CLAVIJO, Marisa GONZÁLEZ GONZÁLEZ, Francesc GONZÁLEZ TARDIU, José GUERRERO SANZ, Jorge JIMÉNEZ RODRÍGUEZ, Fernando LEGARDA IBÁÑEZ, Juan Antonio MUÑOZ SÁNCHEZ, Raquel OCHOA VALERO, Silvia ORTEGA LES & Gabriel PIÑA LUCAS.

## EDITORIAL STAFF COMMISSION

*President:* Miguel SÁNCHEZ LÓPEZ
*Vicepresident:* Ángela CORTÉS MARTÍN
*Vocals:* Miguel BARREIRO BUGALLO, Javier GIL JORDÁN, Eugenio GIL LÓPEZ, Beatriz LAMELA PASCUA, Andrés FELIPE MARTÍNEZ, Matilde PELEGRÍ TORRES, José César QUERAL SALAZAR, Raquel OCHOA VALERO, Miguel Ángel RODRÍGUEZ GÓMEZ, Carmen VALLEJO DESVIAT, Carlos VÁZQUEZ RODRÍGUEZ & Stella ZAMUDIO DE LA VARGA.


spanish nuclear society

ployment and Professional Development Commission have been given.

The activity of the various committees has been carried out virtually, and it can be stated that the essential part of the mission for each committee has been carried out quite normally, despite the "exceptional" means that we have used. Tools such as Zoom, Teams, etc., previously not well known or used, are now something that are part of our day to day and that have made it possible for our activity to develop relatively normally and that we have dared to advance along little-explored paths until now.

External communication work has continued, reinforcing our presence on social networks, Twitter, Facebook, Instagram, and LinkedIn, with the encouragement from the Communication Commission, Nuclear Young People, and the Win Commission to keep the flame of our presence and positioning alive in this increasingly relevant communicative space.

The survey conducted with our members last year, with the subsequent analysis and preparation of a plan for improvement proposals in different areas of the Society's action confirms the SNE's commitment to continuous improvement and adaptation in this difficult environment.

The Annual Meeting deserves a separate chapter, inexorably converted into a Virtual Meeting. In the month of April, in full confinement, in view of the foreseeable impossibility of holding a classic face-to-face meeting, the Board of Directors made the decision to launch a meeting in a virtual format that would allow us to maintain this well-established professional meeting in these times of physical distancing. Now we all know what a virtual meeting consists of, but in April 2020, none of us who participated in the decision were clear about how our annual meeting could be transformed into something purely virtual, and our experience in these types of formats was truly limited. Despite this, we understood that it was important in this difficult time to keep the spirit of improvement and the cohesion of the nuclear industry alive, organizing an event that would be a meeting point and would serve to promote knowledge and dissemination of our technology in addition to showing the pulse, vitality, and adaptability of the great professionals in this sector. As a kind of rehearsal, the traditional Technical Conference was developed in a totally virtual way, which allowed us to draw on lessons learned and make the necessary changes so that for the SNE Virtual Meeting everything worked in the best possible way.

We must congratulate all the people who worked hard to make what in April were nothing more than scattered ideas come true. Our Organizing and Technical Committees for the Virtual Meeting, the Communication Commission, WIN, Nuclear Young People, and our collaborator SENDA achieved what we all already know, a convention where about 500 professionals participated, with more than 20 exhibiting companies, and more than 200 presentations, highly technical and current, maintaining the essence of our Annual Meeting and turning the challenge into an opportunity.

It is also worth highlighting the important and necessary adjustment of the Society's budget to the circumstances of the year, significantly reducing the costs of our activities, managing to do more with less. A common effort by all the Commissions that have implemented imaginative solutions and enthusiasm to achieve the objectives with the means at their disposal. The outsourcing of the administrative activity for the headquarters has also contributed to this adjustment, which, in addition, has allowed us to focus our work on the essential purposes of our Society: members and the dissemination of knowledge of nuclear science and technology for its better development.

We are extremely fortunate to work in a sector such as the nuclear sector, which has professionals who demonstrate day after day, year after year, that the excellent functioning of our plants would not be possible without people, without a doubt the protagonists of the desire for improvement and of service that has allowed us to overcome a year as difficult as 2020 and assures us that we will be able to face what may come in the future. A future that I encourage you to look to with optimism and with the pride of being part of this group of great professionals and great people who have once again demonstrated that they can be counted on in any circumstance and that they know how to face adversity.

Undoubtedly, the Nuclear Society has managed to keep its pulse alive and to a large extent achieve the proposed objectives, although we cannot help but miss the contact and human warmth, that closeness that the pandemic has temporarily taken away from us and that no virtual media has yet managed to replace. We hope that, as soon as possible, we will recover those spaces, our face-to-face meetings, to see our friends and colleagues without forgetting everything we have learned this year and the tools that have kept us close in the distance, allowing us to reach further than what we expected to reach.

We are leaving behind a year that has definitely been difficult, and we look forward to the future, wanting to continue advancing, and knowing that, together, as we have already shown, we are capable of getting where we want to go.■

### TERMINOLOGY COMMISSION

*President:* Alfonso DE LA TORRE FERNÁNDEZ DEL POZO
*Viceresident:* Pedro Luis GONZÁLEZ ARJONA
*Vocals:* Agustín ALONSO SANTOS, Leopoldo ANTOLÍN ÁLVAREZ, José COBIÁN ROA, César DE LA CAL, Luis PALACIOS SÚNICO & Ramón REVUELTA LAPIQUE.

### EMPLOYMENT AND PROFESSIONAL DEVELOPMENT COMMISSION

*President:* Francisco José SÁNCHEZ ÁLVAREZ
*Vocals:* Alfonso BARBAS ESPA, Gonzalo CUEVAS EZQUERRA, Javier DIES LLOVERA, Inés GALLEGO CABEZÓN, Elisa GIL CRESPO, Mario GONZÁLEZ ÁLVAREZ, Alfonso GONZÁLEZ FERNÁNDEZ, Borja HERVÁS MARTÍN, Antonio JIMÉNEZ CARRASCOSA, Óscar LARROSA PERUGA, Rabel LEONARDO MAES, Clara MONTALVO OCEJA, Alejandro PALACIO ALONSO, Isaias RAMÍREZ RODRÍGUEZ, Rocío RODRÍGUEZ RUBIO, Lucía SEVILLA HORRILLO, Joaquín TOUBES TOVA & José María ZAMARRÓN CASINELLO.

### NUCLEAR YOUTH COMMISSION

*President*: Pablo GARCÍA GARCÍA
*Vice-president:* Francisco SUÁREZ ORTIZ
*Vocals:* Alejandro CARRASCO SÁNCHEZ, Luis Felipe DURÁN VINUESA, Daniel GALLEGO ZAMORANO, Elisa GIL CRESPO, Miguel Ángel GONZÁLEZ NAVARRO, Antonio JIMÉNEZ CARRASCOSA, Antonella LABARILE, Samantha LARRIBA DEL APIO, Sergio MORATÓ RAFET, Carlos MESADO MELIÁ, Aina NOVERQUES MEDINA, Irene RAMÍREZ MARTÍNEZ, Jaime REDONDO MORAIS & Carlos VÁZQUEZ RODRÍGUEZ.

### WIN COMMISSION

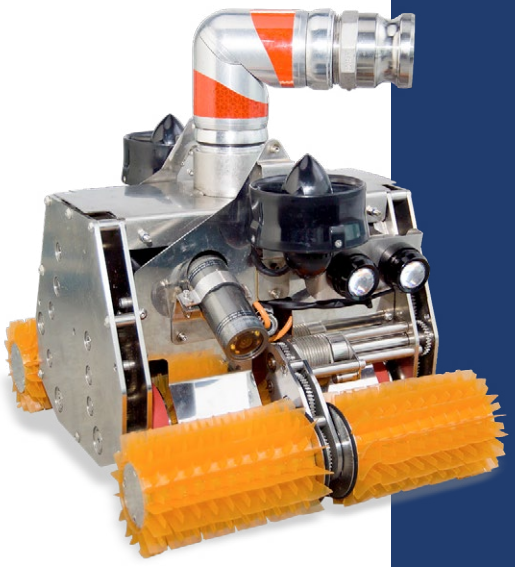
*President:* Susana FALCÓN CABRERA
*Vicepresident:* Mª Luz TEJEDA ARROYO
*Secretary General:* Patricia CUADRADO GARCÍA
*Speaker:* Amparo SOLER MARTÍNEZ
*Treasurer:* Rosa GONZÁLEZ GONDAL
*Vocals:* Adoración ARNALDOS GONZÁLVEZ, Ana CORTÉS & Matilde PELEGRÍ TORRES.
***Comittee of experts:***
Carolina AHNERT IGLESIAS, Inés GALLEGO CABEZÓN, Magdalena GÁLVEZ, Mª Isabel GÓMEZ BERNAL, Mª Teresa LÓPEZ-CARBONELL & Aurora MARTÍNEZ-ESPARZA VALIENTE.

### VIRTUAL MEETING ORGANIZING COMMITTEE

*President:* José GARCÍA LARUELO
*Secretary:* Germán DOMÍNGUEZ GONZÁLEZ
*Treasurer:* Adrián GONZALVO MANOVEL
*President of the Technical Committee:* Patricia CUADRADO GARCÍA
*Vocals:* Miguel BARREIRO BUGALLO, Cristina CALVO FREIJANES, Susana FALCÓN CABRERA, Laura GALA DELGADO, Pablo GARCÍA GARCÍA, Montse GODALL VIUDEZ, Francisco José GUTIÉRREZ GARCÍA, Paula MATEOS MANGAS, Teresa PALACIO ALLER, Enrique PASTOR CALVO, Matilde PELEGRÍ TORRES, Carmen VALLEJO DESVIAT, Rafael VARGAS TRAID & Francisco Javier VILLAR VERA.

### VIRTUAL MEETING TECHNICAL COMMITTEE

*President:* Patricia CUADRADO GARCÍA
*Vice-president:* José Enrique MARTÍN GARCÍA
*Technical Secretary:* Lola PATIÑO RAMOS
*Vocals:* Ana ALONSO ALONSO, Sofía CORINO DÍEZ, Daniel DE LORENZO MANZANO, Alberto ESCRIVÁ CASTELLS, Ángel GARCÍA BUENO, Domingo GARCÍA CÁRDENAS, Javier GARCÍA RODRÍGUEZ, Claudia LÓPEZ DEL PRÁ, Óscar MARTÍNEZ CABALEIRO, Álvaro ROJO BLAS, Eduardo SERRA SINTES, Francisco SUÁREZ ORTIZ & Isabel VINIEGRA CABELLO.



# NUCLEAR SERVICES


GDES

We add value
to provide ***energy*** to the world

ISO 9001 BUREAU VERITAS Certification · OHSAS 18001 BUREAU VERITAS Certification · ISO 14001 BUREAU VERITAS Certification · UNE 166002 BUREAU VERITAS Certification

O&M Support
•
Decommissioning
& Waste Management
•
Long-Term Operation
•
Thermal Protection
•
Radiological Protection
•
Surface Treatment
•
Logistics

## GDES BUSINESS UNITS

NUCLEAR SERVICES | DECOMMISSIONING
SURFACE TREATMENT | WIND | LOGISTICS | EMERGENCY RESPONSE


Ronda Auguste y Louis Lumière, 15
Parque Tecnológico
46980 Paterna, Valencia (Spain)
Tel. +34 963 540 300
www.gdes.com · Info@gdes.com

INTERVIEW

# JOSÉ GARCÍA LARUELO & PATRICIA CUADRADO


## CHAIRMAN OF THE ORGANIZING COMMITTEE & CHAIRWOMAN OF THE TECHNICAL COMMITTEE

Text: MATILDE PELEGRÍ Photo & video: INFORMAGEN

**The Annual Meeting of the Spanish Nuclear Society has a great tradition, not only in Spain, but in many countries where the nuclear industry is present, and it is recognized as a meeting point for companies and professionals.**

**As usual, at the closing of the 44th Annual Meeting, in Vigo, the Vice President of the SNE, Héctor Dominguis, announced the venue for the 45th: Granada. This was planned until COVID-19 changed all plans and forced rethinking a face-to-face convention to a virtual meeting.**

**José García Laruelo was at the head of the Organizing Committee that had to assume this important change, and Patricia Cuadrado led the Technical Committee.**

**We analyzed the most important aspects of the SNE Virtual Meeting 2020 with both of them.**

### FIRST IT WAS GRANADA

**The 46th Annual Meeting should have been held in Granada. How much had the organization of the Annual Meeting initially envisioned advanced?**

José García Laruelo. The organization of the SNE 46th Annual Meeting began in November 2019 and ended in April 2020, at which time the SNE Board of Directors decided to postpone the face-to-face event and start working on an online event. During those six months, progress in the different organizational activities was significant, mainly in all aspects related to institutional relations and the Granada Conference Center.

In this sense, I would like to take advantage of this interview to thank Endesa's General Manager for Andalusia and Extremadura for his support in obtaining a great institutional welcome in the city of Granada.

**Has any agreement been reached with Granada? How have those responsible for the Convention Center and the authorities responded?**

JGL. After decreeing the state of alarm in Spain due to the arrival of COVID-19, the Organizing Committee was forced to evaluate all possible alternatives for the face-to-face convention.

The first step was knowing the position of the Granada Conference & Exhibi-

> **The response of companies to the Virtual Meeting has been exemplary**

tion Center regarding a possible postponement. In this sense, there was no problem in moving the date of the event to 2021. Regarding the local administration, the initial assistance and support shown by both the City Council and the Government Delegation of the Regional Government of Andalusia in Granada and by the University of Granada exceeded our expectations. We hope to continue counting on these institutions for the next convention in 2021.

**What was the initial response of the companies in the sector?**

JGL. Logically, one of the first actions taken by the SNE was to consult the opinion of the member, sponsoring, and exhibiting partner companies, who agreed to postpone the event until the degree of uncertainty was reduced.

Immediately it was proposed to analyze the possibility of offering an alternative event in order to fulfill the commitments of the SNE to its individual and collective partners, as well as to the professionals in the nuclear sector.

With all this input, the SNE Board of Directors made the decision to postpone the 46th Annual Meeting in Granada to the year 2021 and launch the new Virtual Meeting 2020.

## THE TECHNOLOGICAL CHALLENGE

**The confinement situation caused all conventions to be suspended, which forced the companies of this sector to seek suitable technological solutions for the new situation. What were the priorities set by the Organizing Committee for the Virtual Meeting?**

JGL. Our first objective was to maintain the SNE's commitment to its members in terms of dissemination and as a meeting point for professionals in the sector. As a result, the second main objective was to create an event that maintained the content of the technical program, adapting it to the new normal. Finally, we had to be able to reduce the budget as much as possible, with the fundamental objective of minimizing the financial effort that companies would have to make to be present at the Virtual Meeting.

José García Laruelo is an Industrial Engineer from the Gijón Polytechnic School, specializing in Mechanics, having completed a master's degree in Nuclear Science and Technology from the Polytechnic University of Madrid.
In 2018, he joined Endesa's General Directorate for Nuclear Energy as Head of Nuclear Fuel.
His previous experience was developed at Idom, in the field of life management for the CNAT and ANAV nuclear power plants, as well as at ENUSA, first in the spent fuel area and later in the management of business and commercial development.
José was president of the Nuclear Young People Commission, from the SNE, between 2017 and 2018.

**How was the change in format from the face-to-face to the virtual edition managed?**

JGL. The experience acquired by the Annual Meeting over its 45 previous editions has made it possible to establish a stable and well-defined work methodology, which facilitates the work of the committees in terms of organization.

The change in format from a traditional convention to a virtual one, without any prior experience, was like looking off a cliff. To do this, and starting with a blank slate, we redefined each of the strands that make up the event, breaking the work methodology towards an agile model, prioritizing speed and flexibility to adapt to changing boundary conditions.

From my point of view, I believe that the experience gained and the organizational and work model developed this year can bring a lot of added value to future editions of the Annual Meeting.

**And from a technical point of view?**

JGL. The key has been the creation of a new website, which would integrate all the requirements of the Annual Meeting, but adapted to the Virtual

> **To change the format from a traditional convention to a virtual one, we redefined each of the strands that make up the event, breaking the work methodology towards an agile model, prioritizing speed and flexibility to adapt to changing boundary conditions**

## DATA

- 200 presentations distributed in 36 technical sessions classified in 16 subject areas, plus 1 poster session.
- 2 general sessions, 2 single subject sessions, and 1 workshop.
- Total number of registered attendees: 480.
- Average attendance at technical sessions: 32 attendees.
- Attendance at general sessions: 278.
- Maximum attendance in one session: 284 in the outreach workshop.

format, and to which we have integrated a new streaming tool.

Our venue has been the website, and there have been more than 400 participants attending the different events scheduled, constantly entering and leaving, without any technical issues.

Without a doubt, the result has been very satisfactory.

**What has been the response of the companies in the sector to this new approach?**

JGL. The response of companies to the Virtual Meeting was very positive, I would even say exemplary. From the creation of the idea for a virtual event to its achievement, we have always felt their support. This point is very important for the organization, even more so considering the difficult times that all companies have gone through throughout this year which, despite the uncertainties of the market in general, have maintained their support for the convention.

**What are the advantages and disadvantages of a virtual format versus a face-to-face format?**

JGL. For this point, I would like to differentiate between the technical program and the social program. Although the technical program clearly benefits from the use of streaming technologies, the social program and networking are at a disadvantage.

Patricia Cuadrado. Indeed, from the perspective of the Technical Committee, the use of the streaming format has allowed us to have foreign speakers of the highest level, and even representatives from different continents in the same session. In the case of General Session 2 on COVID-19, it allowed us to address the issue taking into account the experiences of different countries such as the United States, China, France, and Spain. Likewise, this format allows the attendance of foreign or national attendees residing in other countries, a fact that has been verified through the metrics obtained.

Another important aspect is that it is possible to have all the content for later, which allows congressmen to view all sessions at another time. This provides great added value.

JGL. As I mentioned earlier, one of the main attractions of the SNE convention is social contact, the space where professionals meet at least once a year with colleagues and friends in a relaxed atmosphere. Although the Organizing Committee has always had the possibility of holding a small face-to-face event, this event was canceled in accordance with the recommendations of the health authorities.

The initiative that we launched to promote networking was the creation of the attendee area on the Virtual Meeting website where the list of all those registered for the event was available, with tools that allowed them to establish contact with each other. This was something new that we consider as a positive, and we hope that it can be maintained in future editions.

### TECHNICAL CONTENT

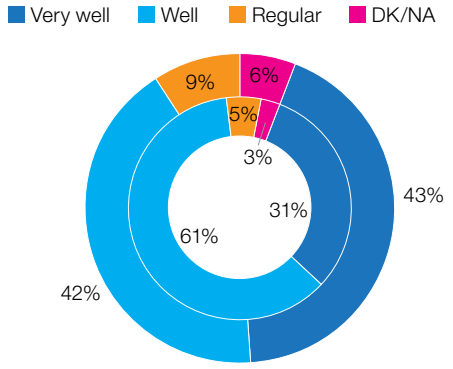
**The technical program is the basis of any convention, and especially for Annual Meetings. How was the program planned in this new setting?**

PC. This year, with the virtual format, we decided to keep the technical sessions and the poster session in their basic aspects, taking into account that the great novelty was the live transmission

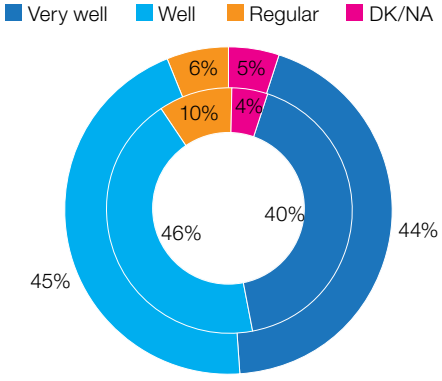
## SATISFACTION SURVEY

External Ring: Virtual Meeting 2020 Internal Ring: 45th Anual Meeting

**Overall assessment of the Technical Program**




**Overall assessment of the Website**



> **The streaming format has allowed us to have foreign speakers from different continents and of a very high level in the same session**

of all the presentations. In addition, we incorporated interviews from various locations, such as the Zorita Nuclear Power Plant in the Decommissioning session and the ENSA factory in the Fusion session.

**How was the participation of the attendees who presented papers coordinated, and how was the proper display of all the presentations guaranteed?**

PC. There was very good coordination with all the speakers since they were very used to virtual platforms due to the situation we are experiencing. In addition, connection tests were carried out prior to the Virtual Meeting with each of them to make sure that everything was working correctly. And for the special sessions (general sessions, single subject sessions, and workshops) a streaming platform was used. I want to emphasize that the role of the Coordinators of the Technical Committee and the collaboration of the speakers were fundamental.

**What role has the Virtual Meeting Technical Committee had for this convention?**

PC. The Technical Committee has played an essential role this year. In addition to the functions that the Coordinators of each session were already performing, classifying the presentations and coordinating each session, other responsibilities that the Presidents and Table Coordinators had in previous years have been added. They also moderated all sessions except the General Sessions, and all this in a new format for everyone and that, thanks to the great team we have, has been a success.

I want to thank the entire Technical Committee team and the Organizing Committee for their good work. It has been very easy for me to lead such a proactive and professional team.

**Looking at the technical field specifically, what are the subject areas that have had the most interest from the attendees?**

PC. For the technical sessions, the Training session, where training tools related to Virtual Reality were presented, was of great interest. Also, the sessions for Engineering and Innovation, Operations, Decommissioning, Nuclear Safety, and Thermohydraulics and Neutronics were well attended.

In general, attendance for all the sessions was very high compared to other years, since it was possible to attend different sessions that were being carried out in parallel. An average attendance of 32 per session and about 200 attendees in special sessions.

On the other hand, every year we try to innovate and offer attendees new formats, topics of interest, and top-level speakers. This year, for example, the Nuclear Power Outreach Workshop generated a lot of interest.

Patricia Cuadrado has a degree in Chemistry from the Autonomous University of Madrid, specializing in Analytical Chemistry.
She has more than twenty years of experience in the energy industry. She is the Commercial Director for the Nuclear Area of Advanced Projects and R&D at Empresarios Agrupados.
Since 2013, she has been part of the Technical Committee of the SNE Annual Meeting, first as a member, and since 2018, as President.
Patricia is an active member of WiN Spain and has been a member of the Board of Directors since 2017. She was President of the Technical Committee of the WiN Global World Congress, held in Madrid in 2019. She has been the general secretary of WiN Spain since December 2019.

## COMPANY PARTICIPATION

**The support of companies in the sector is key. What sponsorship options have companies had for this Virtual Meeting?**

JGL. The sponsorship model defined for the Virtual Meeting 2020 had to be adapted to the event since most of the activities sponsored with the face-to-face format were no longer available

**"The attendance of all sessions has been very high compared to other years"**

in the virtual format. Likewise, and in accordance with the situation in which we found ourselves, the SNE decided to strongly reduce the economic amounts, showing solidarity with the companies during this difficult period, thus facilitating their participation in the event.

For this, two ways of collaborating were created: the first consisted of sponsoring the event in general, and the second in sponsoring some of the individual activities listed by the Organizing Committee. This list included the sponsorship of the main activities for the technical program, as well as the networking tools, or the safety minute.

Additionally, this year, the so-called business round tables were held for the first time, which were also sponsored, and which have been very well received and have produced good results.

We believe that the sponsorship of the activities related to the technical program has had great visibility, not only during the days of the convention, but also during the delayed viewing period, and it may be advisable to keep it for future editions.

**And the exhibitors? What innovations have been offered to companies to optimize their presence at the commercial exhibition?**

JGL. From the Organizing Committee, we considered the possibility of moving the commercial exhibition to the virtual format. This point has been, without a doubt, the greatest challenge faced during the organization of the event.

Although we knew beforehand that the social component cannot be transferred to an online event, at no time did we want to abandon the possibility of networking through our website. For this, we created the virtual exhibition and a series of networking tools in order to facilitate communication between companies and attendees, as well as between attendees themselves.

Without a doubt, this point has been one of the most complicated and stressful, but the participation of companies has exceeded all our expectations. For all this, I would like to thank the support received from the sponsoring and exhibiting companies at the 2020 Virtual Meeting.

## THE VIRTUAL MEETING AND SOCIETY

**The participation of Nuclear Young People and WiN in the annual meetings allows the SNE to reach out to society. What have been the activities for these organizations in the Virtual Meeting framework?**

JGL. In addition to the activities included within the technical program, the WiN and Nuclear Young People commissions have organized two activities oriented to society in general, fulfilling the SNE's objective of disseminating nuclear energy and its applications.

WiN conducted a very interesting session entitled Application of Radiation in the Conservation of Cultural Heritage, which featured two experts in the conservation of Spanish cultural heritage.

For its part, Nuclear Young People held a session titled Back to the Future (of the Nuclear Industry), where several Nuclear Young People members discussed the fundamental advances in the nuclear industry in the next ten years.

## COMMITTEES

**Leading the organization of an Annual Meeting is a challenge and doing so when you have had to manage the transformation to a Virtual Meeting is even more challenging. How has the work of the Organizing and Technical committees developed?**


> **The heads of companies must be aware of the great work that the members of the Technical Committee have developed, especially this year**

JGL. As I mentioned before, an agile work model was established, which was characterized by coordination and decision-making in short periods of time, seeking constant adaptation to changing conditions. For this, good coordination and communication between the different working groups are essential.

At this point, I would like to thank the Technical Committee and, in particular, its president, Patricia Cuadrado, for the great work done. Not only have they known how to adapt to changes, but they have considerably increased their responsibilities. The effort carried out by the entire team has been key to the success of the technical program.

PC. For my part, I would like to convey to the heads of the companies the great work involved in actively participating in the committees, and especially this year, the role that the members of the Technical Committee have played. Executives are often not aware of this large volume of work, and just as the financial support of companies is necessary, it is essential to also recognize the work of the professionals who participate in the committees and who, therefore, make the meeting a success.

**How has the relationship with the Board of Directors been?**

JGL. The relationship with the Board of Directors has been excellent and we are very grateful in this regard. The Organizing and Technical Committees asked the Board of Directors to hold weekly meetings in order to speed up decisions since the time we had to organize the virtual meeting was minimal.

PC. With this idea in mind, a working group made up of the Permanent Commission and several members of the Board of Directors, presidents of other commissions, José, and me was set up to discuss issues and make decisions with greater agility, and that has helped us a lot in the organization of the Virtual Meeting.

## LESSONS LEARNED

**Every year, a survey is conducted among attendees. What are the most significant results of this meeting, so different from the previous ones but with the same spirit?**

JGL. Some of the results will be included in the issue dedicated to the Virtual Meeting, but I think the most significant refer to the good evaluation of the technical program, the business round tables, and the website.

PC. It is important to note that the overall assessment of the technical program has clearly improved compared to previous editions. It has been the first year of this virtual format. We have learned a lot, and we also know what aspects need to be improved, but clearly, the technical program has been very satisfactory, and this has been reflected in the survey.

**What are the lessons learned that you consider most important to pass on to the next Committee?**

JGL. Although the organization of the virtual event has been complicated and tedious, the experience of holding the event online opens the doors to new possibilities that can greatly enrich future face-to-face meetings and other SNE activities.

## ACKNOWLEDGMENTS

**Both José García Laruelo and Patricia Cuadrado insist on sending a final message of thanks.**

JGL/PC. We would like to thank the Board of Directors for their ongoing support. Likewise, we want to recognize all those people who have contributed their work and effort, which has allowed for the success of the 2020 Virtual Meeting, such as the members of the technical and organizing committees, the people who make up the SNE secretariat and collaborators, the Communication, Nuclear Young People, and WiN commissions, and the professionals from Grupo Senda.

And, of course, thanks to all the attendees, speakers, and sponsoring companies who have made the good result of this Virtual Meeting possible.

Thank you all very much for joining us on this exciting journey. ■


HOY EL SOL ILUMINA UN FUTURO MÁS SOSTENIBLE.
Porque hoy no solo cuentas con la energía del sol. También cuentas con la financiación de proyectos respetuosos con el medio ambiente en las zonas rurales donde esta se recoge. Porque el planeta no solo necesita una energía limpia, sino una más sostenible.
DESCUBRE MÁS EN ENDESA.COM
Open power for a brighter future.
endesa

# OPENING SESSION

The President of the Organizing Committee for the Virtual Meeting 2020, José García Laruelo, after explaining the main points to follow to make the most out of the Meeting, was in charge of presenting the President of the SNE, Javier Guerra, who opened the convention.

**JOSÉ GARCÍA LARUELO, President of the Organizing Committee**

I am fortunate to be the person in charge of presiding over the Organizing Committee for this particular edition of our convention.
The SNE Virtual Meeting is a 100% online convention, where all attendees and companies will participate through the www.reunionanualsne.es website.

Once we identify ourselves with our username and password, we will be able to access the new attendee area, personal and customizable. From our profile, in turn, we can access the main sections of the conventions: the Technical Program, the Commercial Exhibition, and the sponsors' area. Additionally, like a social network, all those attending the event can be viewed and contacted through the internal messaging tool, promoting networking among attendees.

The technical program maintains the format of the face-to-face edition, with two general sessions, two single subject sessions, and a workshop, as well as 9 technical sessions in parallel, one of them in poster session format.

By clicking on each of the activities, you will access the corresponding virtual room, where you can see the different speakers, either live or recorded. For each of the sessions, a tool for questions to the speakers will be enabled which will be managed by the coordinator of the session and conveyed to the moderator and/or speakers.

Regarding the exhibiting companies, the Organizing Committee has created a Virtual Exhibition where companies can locate their stand and convey their updates and products to the attendees. In the same way, the stand is a point of contact for attendees and companies. All virtual stands have a live chat system through which attendees can directly contact those responsible for the stand to answer their questions.

Additionally, the convention secretariat will also have a live chat to resolve any questions about the convention.

Once the more technical part of the opening is finished, I will give the floor to Javier Guerra, President of the SNE.

**JAVIER GUERRA, President of the Spanish Nuclear Society**

Welcome to the Spanish Nuclear Society Virtual Meeting which, as you well know, replaces our annual meeting that we were going to hold in Granada, and which has been postponed to 2021. In this meeting, we want to maintain the same spirit that has always guided our annual meeting: to be a meeting point for professionals, companies, and institutions in the sector, also taking advantage of this forum to share with society our vision of the contributions of nuclear energy to challenges as important as the fight against global warming.

On my own behalf and on behalf of the Board of Directors, I want to thank the Organizing and Technical Committees, the Society Committees, Senda, and all the people who have worked and will continue to do work during these days for their efforts to organize this meeting. We have had to reinvent ourselves and innovate, and I am convinced that the work has been worth it, and that despite the physical distance, we are going to share very interesting meetings with the panel of speakers that we have.

Initial proof of this success is an attendance that we can all be proud of: close to 500 attendees, more than 20 exhibiting and collaborating companies, and more than 200 presentations. Thanks to all of you for your involvement, support, and attendance.


I also want to take advantage of this welcome to highlight some aspects of our sector that have special relevance for our future.

First of all, it should be noted that, for the 9th consecutive year, in 2019, nuclear energy was the leading source for electricity generation with 22.6% of the total. This percentage represents 37% of electricity free of CO2 emissions. In addition, in 2020, and despite the extraordinary circumstances known to all, in the first half of the year, nuclear energy continues, likewise, to be the leading source of generation with 22% and also very important, providing employment to about 30,000 people.

Our plants, our industry, have demonstrated their ability to adapt and their resilience in the face of a serious crisis such as COVID-19. Everything we are experiencing is putting our society to the test on a global scale, and the foolproof safety provided by the nuclear industry reinforces our conviction that the excellent operation of this country's nuclear park is a strategic and necessary resource in an emission-free future with guaranteed supply and controlled costs.

Like all crises, COVID-19 comes with lessons and opportunities. One of those lessons, which I hope to find in society and especially among the political class, is the need to prioritize technical and scientific criteria for making the best decisions. It is time, in all areas, and also in ours, to give way to experts, technicians, to define the electrical mix for the future, a sum of technologies that achieves the optimal balance of the energy trilemma from Professor Mariano Marzo: security of supply, environmental sustainability, and economic efficiency, combining the achievement of environmental objectives with progress in the competitiveness of our economy and, consequently, in the prosperity of our country, something that undoubtedly happens through the long-term operation of our nuclear park.

But this year 2020 has also left us with other news, as relevant as it is positive, such as the granting of the new operating authorizations for the Almaraz and Vandellós II Nuclear Power Plants by the Ministry for the Ecological Transition and Demographic Challenge, which signifies clear recognition of the job well done in the operation of these facilities and a step forward in the continuity of our sector.

I would also like to mention the filing of the 7th General Nuclear Waste Plan (GRWP), prepared by ENRESA, sent to the Government in March of this year and awaiting approval that, we hope, will arrive as soon as possible, thus clearing up uncertainties about certain critical aspects, such as rates or the completion of a CTS, essential infrastructure for streamlining the management of spent fuel.

The unsustainable tax burden being borne by Spanish plants, (approximately €22/Mwh according to Foro Nuclear sources) deserves a special mention, which, in addition to being unfair, disproportionate, and discriminatory compared to other energy sources, penalizes the sector and makes it unsustainable. We demand immediate action to correct this situation, which should not be long in duration in order to guarantee the continuity of this sector that generates $CO_2$-free electricity for people, for industry, to continue moving this country.

If we broaden our perspective, a change in the direction of the tide is noteworthy, with more and more countries in the world re-considering nuclear energy as an important part of their electricity mix. In Europe, we have, as examples of this, the recent report from the Ministry of Economy and Climate of the Netherlands, in which the consideration of the construction of new nuclear reactors is recommended, in addition to the life-extension for Borssele, its only plant in operation, and the reconsideration of the closure of the Belgian plants, scheduled for 2025; the nuclear commitment in Poland, replacing uranium for coal; and plans already underway in the UK, France, Finland, Bulgaria, and Slovakia.

In the rest of the world, the great powers, the US, China, Russia, and India, continue with their nuclear development and innovation plans, like our motto, and consider nuclear energy essential in the fight against climate change.

In closing, I want to make a special mention to our professionals, who have maintained normality in the operation of our plants and our companies, who have known how to adapt and move forward in truly difficult circumstances on some occasions. My sincere congratulations to all of you. We are winning our future day by day. I am proud to be part of our sector, proud of you, proud to be nuclear.

I ask that we begin this meeting by feeling optimistic. While it is true that not all the keys to our future are in our hands, we do have many to use. We are going to talk about the safe operation of our facilities, the impact of COVID-19 on our industry, the future without $CO_2$ emissions, waste management, and generational change, but also about our role as generators of public opinion. No one knows our work, our facilities, and our capabilities better than we do. As I have done on many occasions, I encourage each and every one of you, in the same way that we are already doing as a Spanish Nuclear Society, to act as spokespersons for this message: Nuclear power is an option for the future. We believe in our future.

Thank you very much for your attention and have a good meeting!■

# PLENARY SESSION 1

## SUSTAINABILITY IN THE MANAGEMENT OF RADIOACTIVE WASTE


Sponsored by: IBERDROLA enresa

The safe, environmentally viable, and efficient management of spent fuel and radioactive waste is one of the main challenges currently facing the nuclear sector globally.

In Spain in March 2020, Empresa Nacional de Residuos Radiactivos (ENRESA) presented the draft of the 7th General Radioactive Waste Plan (GRWP) to the Ministry for the Ecological Transition and the Demographic Challenge in compliance with its obligations regarding nuclear safety. The 6th GRWP is currently in force, approved in 2006.

The two main lines of the GRWP have to do with the management of spent fuel and radioactive waste, and with the decommissioning of nuclear and radioactive facilities. The purpose of this session consisted of increasing the public's knowledge regarding these two areas by presenting successful international experiences and ENRESA's explanation of the general lines of the draft of the 7th GRWP regarding both aspects. To this end, expert speakers were available, two of them from abroad, which is why the session was held entirely in English.

The session was moderated by **Amparo González Espartero**, head of the Spent Fuel Management Unit in the Nuclear Fuel and Materials Section of the International Atomic Energy Agency. Amparo began by introducing the subject from the global point of view of the organization for which she works. She reviewed the figures for spent fuel, with the existing inventory in the world and how it increases every year, to frame the challenge of long-term storage. Regarding the decommissioning of nuclear power plants, the moderator recalled that most of the reactors in operation today are in the range between 30 and 40 years of life, therefore, regardless of whether it is decided to stop operating them due to business or political criteria, or if they continue to operate for up to 40 to 60 years, in the coming years, there will be numerous decommissioning projects that will have to be managed efficiently. And in the case of Spain, after many years without updating the Radioactive Waste Management Plan, in 2020 we have a new draft GRWP and an Integrated National Energy and Climate Plan that should bring clarity to the future of our sector.

The first presentation was given by **Päivi Mäenalanen**, Project Manager

for STUK, the Finnish regulatory body, for the supervision of the construction of the Deep Geological Storage in Posiva. This is the facility of this type that is closest to its full operation in the world, and therefore the entire sector is closely following its development.

The role of the Posiva organization, owned by the Finnish national nuclear power plant operators, has been that of the project developer: licensee, builder, and future operator of the facility. It consists not only of the underground storage itself but also of a surface fuel encapsulation plant and an underground rock characterization facility called Onkalo which was completed in 2016 and which will later be part of the storage facility.

The licensing process consists of four steps. Having already passed the second, obtaining the construction license, it is expected to move on to the third, the application for an operating license, in 2024. Final decisions are made in Finland by the Government, and all interested parties have the opportunity to participate throughout the process. The role of the regulatory body in this country is to review the licensing documentation and assess safety in each of the licensing steps. It is a prerequisite for the government to grant the license that the result of the safety assessment is positive.

The site selection process was carried out between 1983 and 1999. Initially, the sites were screened. By 1986, more than 100 candidate sites had been identified due to the favorable properties of their parent rock. Then, and until 1992, they proceeded to the preliminary characterization of the sites, selecting five to expound on their research. Finally, after proceeding to a detailed characterization of the preselected sites, the Eurajoki site was chosen, where the Olkiluoto nuclear power plant is located.

Regarding the participation of local industry in the project, Ms. Mäenalanen explained that, for jobs such as conventional construction, and generic specialties such as HVAC, electrical, or plumbing, Posiva mainly uses local or domestic contractors. However, the more specific the technology in question, the broader the spectrum of contractors considered. For example, European contractors were used for lifting equipment. For friction welding of copper capsules, an American company was used. For the bentonite used for sealing, probably a European supplier as there is no bentonite in Finland.

To conclude, the speaker wanted to highlight the early establishment of a complete national framework, the clarity of the licensing process, and the proactive work of the regulator as key elements to support the development of this type of project. As lessons learned from the pre-licensing phase, she noted the active participation of the regulator in the process, the previous application as a rehearsal for the current application, the fact that the regulator should not overstep when imposing conditions, and the need to develop the necessary competencies in the organization well in advance. And finally, she highlighted that the supervision of the Onkalo facility was a learning process, both for the regulator STUK and for Posiva.

The decommissioning issue was discussed by **Jochen Latz**, a partner at McKinsey & Company, who raised the question of how navigation and nuclear power plant decommissioning are alike. The answer would come at the end of his presentation.

According to his data, the average variance for current and past decommissioning projects has been 40%, or 4.1 years, in time, and 57%, or 270 million euros, in cost. The reasons

for these major variances are several: misaligned or unrealistic budgets and schedules, insufficient risk awareness, conflicting incentives and a lack of overview, lack of project mindset, unclear responsibilities and authority, and poor decision making.

However, from the consultancy, they see a potential for significant improvement in nuclear decommissioning. The presenter pointed to four success factors for efficient projects: a viable recruitment and incentive model, effective organizational and cultural change, optimized scheduling, and lean execution.

Regarding the hiring model, he distinguished between three models:

- Proprietary or state-owned decommissioning: characterized by a high capacity to manage the risk of nuclear decommissioning, to successfully transform to a project-driven culture, and by good contractor management skills. It is the model used, for example, by EnBW, E.ON, EDF, and the British NDA.
- Partnerships for decommissioning: they are the best way to integrate partner suppliers and to focus on managing the life cycle of contracts. They allow for establishing a solid project baseline, including the work breakdown structure. It is the alternative chosen by a medium-sized operator in northern Europe.
- License Transfer: also allows for focus on recruitment and contract

lifecycle management and is the best way to manage stakeholders. This model has been used in the United States, for example in the case of Zion.

The organizational and cultural shift from focusing on long-term stable nuclear operation, prioritizing reliability and availability to being a "dynamic demolition company" with a focus on speed and economy may require the development of new capabilities and an agile, project-oriented mindset. What must remain unchanged is the safety culture.

For example, one of the aforementioned German operators committed to bringing its former operating staff into the project, with an integrated ownership approach, facing the challenge of capacity building and mindset change.

The midsize operator in northern Europe, however, opted for another approach, reducing its own staff and drawing on outside expertise with a partnership or contractor mentality.

In the case of Zion, decommissioning experts from key positions were called in. Taking advantage of the knowledge of the plant from the former operating personnel was key, but their decision-making capacity was limited. The incorporation of the new personnel guaranteed the change of mentality that was sought.

To optimize the project schedule, it is essential to choose a suitable decommissioning strategy. The example case pointed out by the speaker has used a moderate sequencing of tasks in parallel, with no waiting period after the closure of the facility to begin decommissioning. In their opinion, this would be the preferred option because it has the lowest overall risk-adjusted cost and because it has a broad base of international experience.

Early planning is also key to optimizing the schedule and cost of the project, speeding up the emptying of the spent fuel pool as much as possible, and, in the decommissioning execution phase, incorporating PPM methodology, or Project Production Management. The traditional approach to project management focuses on the scope and the quality of supply, planning, and resources. Project production management considers scope and quality, but also process design, capabilities, inventory, and variability.

In summary, the improvement potential for a project that applies a proper recruitment model has an effective organization with the appropriate culture, has an optimized schedule, and is capable of executing it efficiently, can be in the order of 20% to 30%. Is that too optimistic? Mr. Latz ended his speech by going back to the comparison he made at the beginning between navigation and decommissioning. In the Jules Verne Trophy for the fastest circumnavigation in the world, from 1993 to 2017 there was a 49% reduction in the time taken by the winner, going from 79 days to 40, and this was due to a revolution in the design of the ships. A different way of approaching decommissioning projects could achieve this goal.

The third and last speaker was **Álvaro Rodríguez Beceiro**, ENRESA's Technical Director, who focused his presentation on the Spanish strategy for radioactive waste management. He began his presentation by explaining that the draft of the 7th GRWP is currently in the strategic environmental assessment phase, specifically in the first of seven steps. The draft has taken into account the recommendations of the combined IRRS-ARTEMIS mission on nuclear safety, radiological protection, and radioactive waste management from the International Atomic Energy Agency carried out in 2018: one related to Centralized Temporary Storage, and three to Deep Geological Storage. And it also considers the provisions of the Integrated National Energy and Climate Plan.

The reference scenario of the 7th GRWP draft proposes, with regard to spent fuel, the operation of CTS starting in 2028 (despite the fact that the licensing process has been suspended at the request of the Government since 2018), and of DGS starting in 2073.

The storage of very low, low, and medium activity waste will continue basically as it has been until now, using the El Cabril facility.

As a contingency measure in the event of an eventual delay in the planned CTS, the draft includes the construction of Individualized Temporary Storage at the sites that do not yet have one and the expansion of the rest of the ITSs in a modular manner for greater flexibility.

Regarding the DGS, there is a working group at ENRESA that is currently working on updating the most relevant aspects: generic designs, methodology for the evaluation of the site, and methodology for the evaluation of safety.

Regarding plant decommissioning, the7th GRWP draft establishes that total decommissioning should begin immediately after the shutdowns of operations according to the dates provided in the protocol and that it should last no more than 10 years. The planning, preparatory work, and the emptying of the spent fuel pools will begin three years before shutdown, and the transfer of ownership and start of the decommissioning three years after it.

Mr. Beceiro closed his speech by reviewing ENRESA's experience in decommissioning nuclear power plants (Vandellós I, José Cabrera, and Santa María de Garoña) and research and fuel cycle facilities.

There was time at the end of the session for questions, in which the audience showed great interest in the topics discussed and all the speakers were able to answer several of the questions that were addressed to them. ■


ensa
ensa.es
enwesa
enwesa.com

# PLENARY SESSION 2

## THE NUCLEAR INDUSTRY FACING COVID-19


Sponsored by: endesa

The second general session of the SNE Virtual Meeting addressed a broad perspective of cases and experiences of the nuclear industry in its response and adaptation to COVID-19. Moderated by Gonzalo Carbó (ENDESA's Nuclear General Director), the session began with an introduction highlighting the general success of the nuclear industry in managing the pandemic, keeping it operating safely and reliably, emphasizing the process of adaptation to the demanding circumstances. The objective of the session was to analyze how the nuclear industry has adapted to the pandemic in different locations, as well as to gather the main lessons learned along the way. Specifically, Speakers (the session was held in English) from the United States, France, China, and Spain participated.

The session was structured in a first block of presentations, presenting the main points of each country, followed by questions and answers in which the questions submitted by the attendees were asked.

After a brief presentation of the speakers, the corresponding international experiences were presented next:

**Gonzalo Carbó.**
Plenary Session 2 moderator.

### INDUSTRY EXPERIENCES IN THE US

**Susan H. Perkins** (Senior Director of Security and Incident Preparedness at the Nuclear Energy Institute) began by presenting the main figures for the sector in the US: the number of reactors (94), sites (55), as well as the number of groups that were in some phase of refueling in March 2020 (30). She then elaborated on the initial response plans with regard to the pandemic, clarifying that they had already developed a reference framework from the NEI in 2006. The NEI coordinated the industry response by sharing information in real-time (including with Canadian facilities and the NRC), establishing a database to follow up with frequent communications to all plants, also including suppliers, and in terms of cybersecurity.

Already in May, they concentrated the best practices observed in this operation in a guide and organized sem-

inars to share experiences during the summer. She also explained the contagion mitigation actions, noting that the challenge was in the mitigation measures outside the workplace. She highlighted the variety of measures between different states as an additional challenge.

Currently, they have not detected complications in the levels of presence of the workers, maintaining telework for support staff and continuing the operation and refueling of the plants safely. Looking to the immediate future, it is evident that the response of the industry is evolving from the reaction to optimization (for example, in the use of remote work technologies). In conclusion, she stressed that the nuclear industry has demonstrated its ability to mitigate the impacts of COVID-19 thanks to its collaborative culture, effective practices in terms of sharing operational experiences, discipline in following procedures in the workplace, and all this is reinforced by the pre-existing safety culture and training in radiological risk management.

## INDUSTRY EXPERIENCES IN FRANCE

**Laurence Piketty** (Deputy General Administrator of the CEA) began by emphasizing that nuclear energy in our neighboring country represents 70% of the electricity mix, with 58 reactors at 19 sites. During the first confinement (in spring 2020), they quickly adapted to avoid contagion among their teams, optimizing shifts, rotations, teleworking, and flexibility in working hours. Thanks to the adaptation of the industry, they were able to maintain continuity of service (described as a public service mission) by adjusting nuclear generation to the needs of the population and the industry. During this time, communication with the regulator was close. On the other hand, he stressed that, at the beginning of this crisis, the lack of masks was notable, emphasizing the importance of the supply of material.

Since September, France has observed a sharp increase in the number of COVID-19 cases, in line with the evolution of the pandemic at a global level, and most of the infections from workers occurred off-site (during social or family activities). The infections detected among the personnel working in plants were also mostly mild and have made it possible to demonstrate the effectiveness of the mitigation measures adopted in the plants. Currently, teleworking is mandatory for all those activities that allow it. He concluded by citing that the effect of this crisis has reduced production, both due to delays in refueling, as well as fuel savings or load following, although safety results have not been affected during the crisis, even improving in certain areas.

## EXPERIENCES FROM THE INDUSTRY IN CHINA

**Guo Shuzhi** (Deputy Chief Engineer and Director of Commissioning Department of the SNPDP - SPIC) began by summarizing that they currently have 48 operational plants, 14 under construction, and that none of them have been strongly impacted by the pandemic, noting that they currently did not have any positive cases in them. However, he stressed the great challenge that it has been to face it, which led them to implement joint measures in 12 areas (for example: IT, risk monitoring, among others) to minimize its impact, which was later detailed. Unified control was established under the leadership of the central government and across all plants. The measures took into account the degree of risk according to the area of application. To resume work gradually, a system of minimum work units was implemented, made up of groups of authorized personnel, the number of which was gradually increased.

In order to recover and normalize the situation, the fight against COVID-19 is continuously being pursued through continuous monitoring of the health of personnel and with information on travel to monitor risks. He concluded by underlining that controlling the pandemic continues to be a global challenge, highlighting the importance of sharing experiences to fight COVID-19 and to continue guaranteeing the safety of plants.

## EXPERIENCES OF THE INDUSTRY IN SPAIN

**José Antonio Gago** (General Director of ANAV) began by highlighting that, although the spread of the pandemic was very rapid and with devastating effects, particularly in the health field, the nuclear industry was already prepared to a certain extent due to the protocols established in 2009 for the

H1N1 virus pandemic. Later, he clarified the common attributes of radiation and viruses: they are invisible, have the potential to cause damage, and share the same protection principles (exposure times, distance from the outbreak, and protection along with the use of PPE). After a description of the Spanish nuclear park, he detailed what happened during the state of alarm (03/14/2020, extended until 06/21/2020).

Protection actions were immediately established, particularly reinforced for groups in shifts and emergency teams. He stressed that, in Spain, nuclear power plants are considered critical infrastructures that provide an essential service, so that the companies supporting the plants were also included as essential services and it was possible to face logistical issues regarding the supply of masks and other PPE, worker management in confinement scenarios, application of tools for remote work, and reinforcement of cybersecurity protocols. Examples of internal measures to mitigate the risk were: the reduction of maintenance activities for non-critical equipment, reduction of the scope of certain monitoring programs, adaptation of training plans (mostly online), and adaptation of emergency drills. Regarding external measures: activities were carried out in a hybrid way or with a telematic or remote component, such as quality audits for safety equipment and associated suppliers and CSN inspections. The refueling program and how its scope was affected was also detailed. In general, it was reduced, with the exception of Almaraz which decided to expand it in view of the proximity of its entry into long-term operation, highlighting that in no case were requests for exemption made to the regulator (except to accommodate the requirements for frequency of exercises for drills with external brigades and some nuances regarding the training programs). In all cases, protection measures were implemented to mitigate the impact of the pandemic.

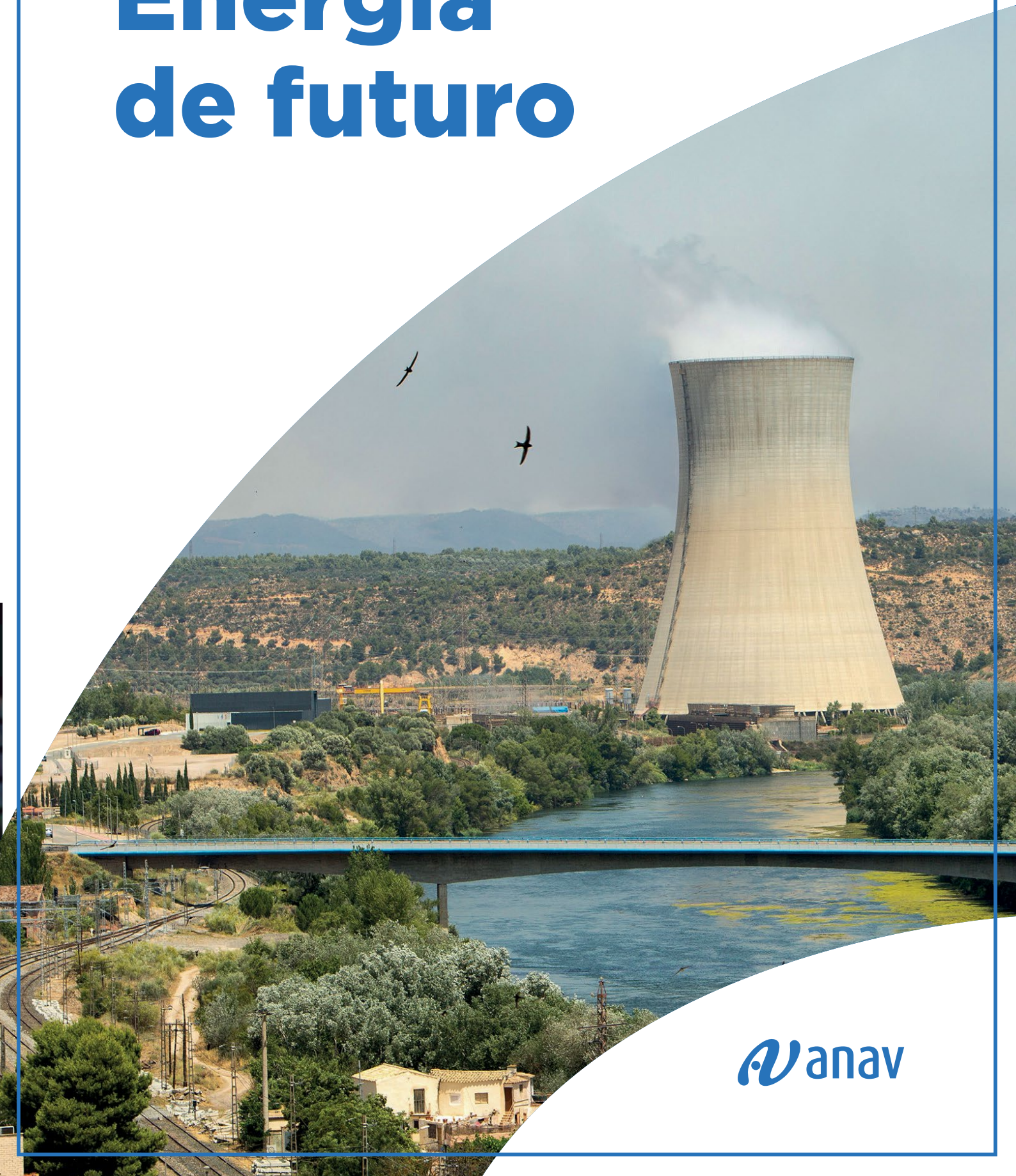
Since the state of alarm ended, measures were taken taking into account the risk of a second wave of infections, now with better capabilities for testing, and it was possible to restore accumulated activities, monitoring programs, and even resume various external missions. He concluded by summarizing the main lessons learned, such as having quickly adapted to working differently. Some of these measures have proven effective and are here to stay. The supply chain has also proven its reliability and the benefits of some initiatives in digitization have been shown, taking a great step forward in this field. The resilience of the industry has also been demonstrated, highlighting the value of its intrinsic characteristics in times of pandemic such as the exchange of operational experiences, the relevance of international organizations such as WANO, the knowledge of the personnel on the management of radiological risks, and, of course, the safety culture.

Finally, there was time for questions with several questions posed by the attendees via chat to all the speakers, which, broadcasted and moderated by Gonzalo Carbó, were answered and commented on in an interesting discussion that lasted until the end of the session.■

NuclearEspaña | sne

The digital site of the
NUCLEAR ENERGY
www.revistanuclear.es
and subscribe to our newsletter

# Energía de futuro



anav

# MONOGRAPHIC SESSION 1

## THE NUCLEAR FUTURE IN A WORLD WITHOUT $CO_2$ EMISSIONS


Sponsored by: Naturgy EMPRESARIOS AGRUPADOS

The current world situation presents an important challenge for reducing greenhouse gas emissions while increasing access to energy for millions of inhabitants of the planet.

The world is facing a double challenge represented by the need to produce more energy, to support global economic growth, and increased prosperity, while there is a need to promote a quicker transition to a future with lower carbon emissions.

Meeting the projected electricity demand for 2050 and simultaneously reducing $CO_2$ emissions will require a mix of power generation assets different from the current system.

Renewable energies cannot replace conventional thermal generation in the medium term and today nuclear energy is the only source capable of supplying large amounts of electricity without contributing significantly to climate change.

Without the contribution of nuclear power as a reliable, zero-carbon source of energy, the overall cost of achieving considerable decarbonization targets will increase significantly.

In this global framework, nuclear technology must identify the challenges and make good use of the opportunities it offers to industry and society.

In this context, three speakers presented their point of view on the situation we are experiencing and how they consider that nuclear energy can and must find its place in an emission-free future accepted by all as the only viable one for the planet.

**Neil Wilmshurst** is Vice President of the Nuclear Sector at the Electric Power Research Institute (EPRI). He manages more than $180 million annually for research activities carried out by EPRI with its global nuclear members. Wilmshurst joined EPRI in 2003 as a Senior Project Manager in the Plant Support Engineering program. In 2008, he became director of the Plant Technology department and was appointed Vice President and CNO in 2010.

During his presentation, he presented the advantages and benefits of nuclear energy over other fossil fuel-based energy sources and over renewable energies. He reviewed the current situation of nuclear power plants in the United States, the new long-term operating licenses for plants that have already been granted and are being reviewed. There is talk of extending the operation to 60 to 80 years for the current plants in operation. The new licenses will be extended until those dates.

In addition, he discussed what comes after the ambitious American national decarbonization plan, the need for alternative fuel sources, large $CO_2$ capturers, and the use of available nuclear energy for purposes other than the mere production of electricity, as has been done so far. The generation of emission-free hydrogen, the storage of energy surpluses, and desalination plants are some of the new uses envisioned for nuclear energy.

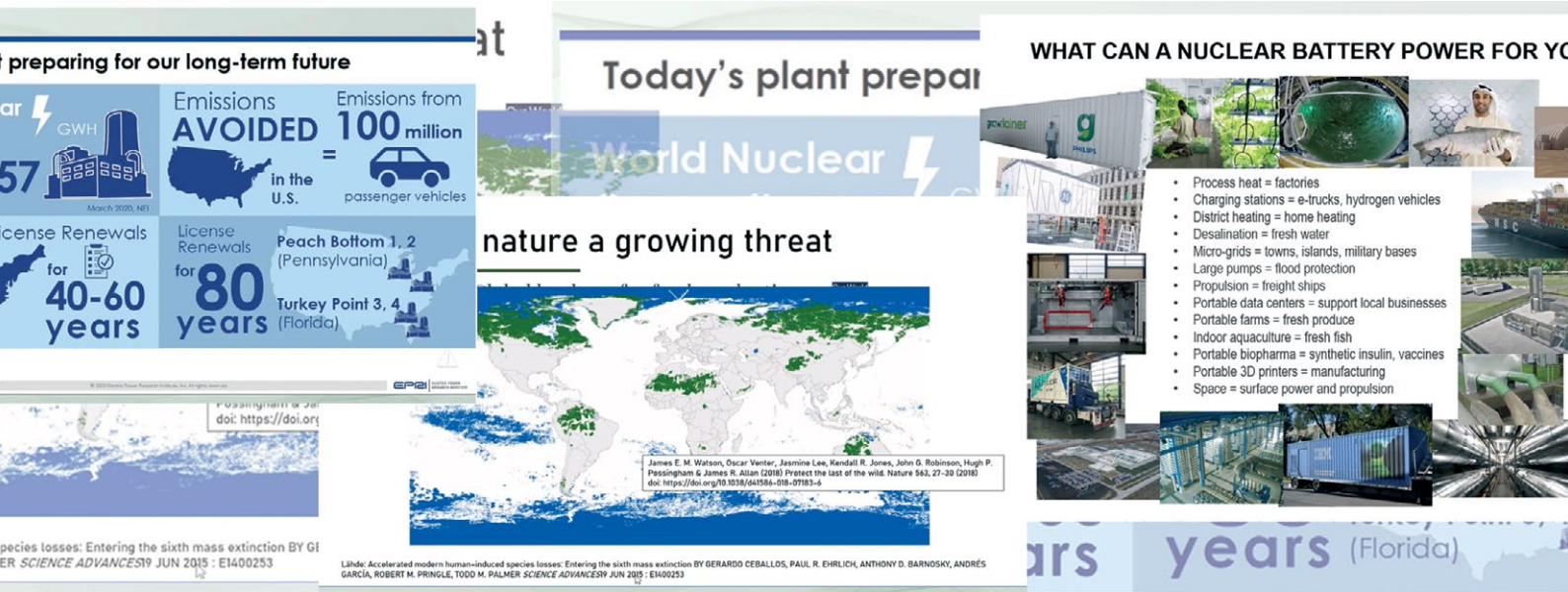
The second speaker for the session, **Atte Harjanne**, is a politician. He has been a member of the Finnish Parliament since 2019 and belongs to the Finnish "Green League" environmental party. Atte has carried out scientific research work for the Finnish Meteorological Institute on climate risks, climate security, climate and energy policy, and the use of climate and meteorological services. He has several publications on renewable energy and climate change.

During his presentation, he reviewed the current world situation, with strong projections for world population growth and high energy demand, both in developed countries, indicating a strong electrification of their economies, and in the underdeveloped world that is rapidly accessing electricity.

He provided an overview of the specific situation for Finland, with a clear commitment to nuclear energy. The position of the environmental party, as reflected in its program, is centered on the premise that the national energy plan must be efficient (economically speaking), must be based on zero or very low $CO_2$ emissions, and must make use of all the sustainable solutions that reduce the use of fossil fuels. Those solutions include any form of sustainable energy, not excluding nuclear energy.

**Jacopo Buongiorno**, the last speaker of the session, is a Professor of Nuclear Science and Engineering at the Massachusetts Institute of Technology (MIT), the director of the Center for Advanced Nuclear Energy Systems (CANES), and the director of Science and Technology for the MIT Nuclear Reactor Laboratory. He teaches undergraduate and graduate courses in thermofluid engineering and nuclear reactor engineering. Professor Buongiorno has published more than 90 articles in technical publications, in the areas of reactor safety and design, two-phase flow, heat transfer, and nanofluid technology.

In his speech, he introduced us to the concept of new nuclear batteries as a great option for the future for the direct supply of energy in urban centers, located at the points of consumption. Tritium battery and radioisotope generator are used to describe a device that uses the emissions of a radioactive isotope to generate electricity. Like nuclear reactors, these batteries generate electricity from atomic energy but differ from them in that they do not use a chain reaction. They are very expensive compared to other batteries but have a very long life and high energy density. For this reason, they are generally used in equipment that must operate unattended for long periods of time, such as satellites and automatic scientific stations in remote locations.■



# MONOGRAPHIC SESSION 2

## THE STARTUPS DESIGNING THE NEW NUCLEAR SECTOR


Sponsored by: HITACHI IDOM

Nuclear technology is evolving to solve mainly two challenges: one of them is the growing demand for electricity and the other is curbing climate change. In response to them, startups are mainly focusing their efforts in two ways: in the design of new reactors within the scope of conventional nuclear energy (fission) and giving a boost to fusion, known as "clean energy," so that it becomes a reality.

This session had the participation of four speakers from different "startups" who presented us with the lines in which they are working and that contribute to achieving the two great challenges posed. The first three speakers presented their lines of work in relation to the design of new reactors and the fourth speaker presented their line of work focused on their participation in the development of the ITER fusion reactor.

First, it was **Tara Neider**'s turn, who is Senior Vice President of Laboratory Facilities and Program Development at TerraPower Company. She has more than 30 years of experience in nuclear energy and project management. Her presentation focused on showing the technology developed and known as "Natrium Technology." TerraPower and GE HITACHI have jointly developed a new type

of reactor known as the "Sodium Fast Reactor" (SFR). With this new technology, they have been able to redefine nuclear energy, simplifying the design, lowering costs, and speeding up the construction of a new reactor. The first part of the presentation focused on explaining why sodium was selected as a refrigerant. One of the reasons is that liquid sodium is a great thermal conductor, it has a long life, and is low maintenance. In addition, it has great compatibility with the rest of the structural materials as well as an anti-corrosive behavior. The second part of the presentation focused on explaining the improvements made by this technology compared to conventional nuclear energy. She concluded by highlighting that this technology is very competitive and clean, that it simplifies the construction of nuclear systems and plants, and that it produces energy in a flexible way to be able to adapt to demand.

Second, it was Simon Newton's turn, who has worked at Moltex Energy as Director of Corporate Development

since 2018. He is responsible for Marketing and Sales. The presentation focused on presenting the company Moltex Energy and its business lines. A part of the presentation was focused on the fourth generation of the reactor known as the "Stable Salt Reactor" (SSR). The main characteristics that were presented for this reactor were its low cost, the use of recycled nuclear waste as fuel, that the energy produced is storable, and that it is clean energy since it does not produce $CO_2$. Additionally, it should be noted that its size is one-twentieth of a conventional PWR, which makes it very versatile. It is also necessary to mention that the simpler the technology, the lower the associated costs will be. That is one of the strengths when considering the evolution of these reactors. At the end of the presentation, the progress and plans envisioned in Canada were shown. As main conclusions to be assessed at all levels of society: a cheaper alternative is needed to replace fossil fuels, public perception regarding nuclear energy must change, it must be realized that renewable energies are a complementary source and not an alternative, and that it is necessary to raise awareness that electricity generation represents only 1/3 of the problem, and therefore, we must not forget that the rest of the industries also need solutions.

Third, it was **Óscar Larrosa**'s turn, who has worked at IDOM as Nuclear Manager since 2019. Taking over for Simon Newton, Óscar elaborated on the topics introduced in the previous presentation and linked his speech by starting his presentation by highlighting the three key points:

- Cost reduction through the development of SSR-W technology.
- The reduction of waste through the development of WATSS technology.
- Flexibility in demand thanks to energy storage using GridReserve technology.

The main mission is the expansion and optimization of the nuclear cycle through these three technologies in a single nuclear plant. This technology has several key factors, including the reduction of risk by eliminating or replacing the possible factors that imply such risk.

In the second part of the presentation, each of these technologies was explained in greater detail. A description of the components of an SSR-W reactor was presented, a comparison was made between a WATSS facility and a conventional recycling facility, including the main phases to obtain "Stable Salt" from solid/gaseous waste from the reactor. Finally, the GridReserve storage system was presented, which provides a tandem creation: the production of nuclear energy plus storage.

Finally, the expected evolution of this technology was shown, showing where we are today (SSR-W) to where it can evolve in the future (SSR-U and SSR-Th), whose difference lies in the fuel and associated cost.

Fourth and lastly, it was **Francisco Inglés**' turn, who is the co-founder of Obuu Tech. He began the presentation with an introduction of the company including its vision (innovation, engineering, good ideas, and a good attitude); as well as the three areas where they divide their business lines. It is worth highlighting the service offered by engineering, CAE, and prototype manufacturing. In this framework, their contribution is focused on fusion energy. Within the ITER project, Obuu Tech is the supplier for the design, certification, manufacture, and calibration of lifting and assembly equipment, specifically, they were the selected suppliers for the equipment designated as "VVTS Port SHroud Assembly Tools."

We would like to thank the four speakers for the presentations shown in this session because the topics discussed were very interesting and offered a very complete vision of where current nuclear technologies should evolve in order to solve the two challenges posed at the beginning: to be able to face the increase in electricity demand and to curb climate change by promoting clean energies that do not produce carbon dioxide.■

# WORKSHOP

## BECOME A NUCLEAR DISSEMINATOR


Sponsored by: tecnatom Westinghouse

Communication is part of our lives, and many of our actions may or may not fulfill their purpose correctly depending on whether the way in which they have been communicated is more or less correct. Because it is not easy to communicate and communicate well. And, in a sector with technical complexity such as the nuclear sector, conveying messages correctly requires certain "skills" that allow the general public to learn about highly specialized issues.

To discover some of these secrets, Alfredo García, better known as the "Nuclear Operator," the disseminator and Operator and Supervisor at the Ascó nuclear power plant led the SNE 2020 Virtual Meeting Workshop.

Under the title "Become a Nuclear Disseminator," Alfredo García highlighted the importance of taking advantage of the possibilities offered by social networks to reach citizens and to make sure that they are well informed. Thus, in his opinion, the nuclear sector has "a unique opportunity to reach people to respond properly to all the mantras and myths spilled by opponents of civil nuclear energy, and to tell the reality of this industry from a different perspective."

With this workshop, the Nuclear Operator wanted to promote outreach efforts and provide the necessary tools to help spread the word about nuclear energy on social media with the minimum available material. To achieve this, and after making an impressive introduction to his career from the Ascó Nuclear Power Plant simulator, Alfredo García explained how he has been established as a great disseminator showing his learning curve as well as the various informative techniques that he has used during these more than four years in which he has been immersed in this exciting field of communication.

The Nuclear Operator, awarded in 2018 with the Communication Prize from the Spanish Nuclear Society, was delighted to participate in this workshop and began his speech by explaining how he entered this world, "what was the spark for this character called the Nuclear Operator," he said. According to García, "it all started with Fukushima, in 2011. At that time, I was Head of the Control Room at the Ascó Nuclear Power Plant. The accident shocked me; I felt a lot of empathy for all the nuclear professionals who were working on that accident. But at the same time, I felt pain because of how [the event] was being handled in the media. Here the origin of the Nuclear Operator was


created," he said. Later, he continued, "I wrote a letter to a portal called Amazings, which is now called Naukas, an outreach platform." His editors liked it so much that "they asked me if they could publish it," he said, "and I did it under a pseudonym."

A chat was posted and opened for exchanging comments. That chat reached 5,000 comments between questions and answers. Alfredo García spent almost three days answering without stopping. One of the interested people addressed the disseminator as "Dear Mr. Operator", García continued to respond as Operator... and Nuclear Operator came to be, remaining anonymous for several years and accumulating a greater number of followers day by day.

2016 was when he began his journey on Twitter "to explain and eliminate fears about nuclear energy based on many myths," he said in his speech. And little by little, he began to disseminate. Garcia recognizes that in those initial moments was following a learning curve. "I had no experience in social networks, but I had some knowledge of communication and, little by little, I learned to navigate" in these new media with "trial and error," as he recognized. From there, he came into contact with disseminators of other subjects and areas, and the Nuclear Operator was established as an absolute reference.

But, as with many things in life, teamwork is fundamental. Alfredo García explained during the SNE Virtual Meeting Workshop that "I am a nuclear operator, but it is also based on the work and collaboration of many people. I have contact with many disseminators, direct messages, they provide me with information, etc. I also formed the Nuclear Operators Auxiliary group on Facebook. And it is growing. Teamwork is very important, the communication network is very important, because everything adds up," he said emphatically.

After this introduction, the Nuclear Operator focused his presentation on explaining what an informative style is, fundamental to achieving the successful communication and dissemination of messages so that they can be understood by society in a clear and direct way. For Alfredo García, everyone must know how to find the best way to communicate what they want to express and adapt it to their own personality. The Operator highlighted some of the practices and recommendations he follows when posting on social networks, all of them based on strict compliance with the standards for the media mixed with his own informative style, humble and forceful, without speculation and avoiding sterile controversy which is sometimes very common in social networks. In addition, he considers, the intelligent use of a sense of humor as very important for making his information more pleasant.

The use of references is also vital so that followers can expand and corroborate information. In this way, during his Workshop, the Operator assured "the credibility and reliability of what we are doing increases." All this together with the support of the scientific community. Because, in his opinion, and quoting the professor and disseminator Francis Villatoro, for the Nuclear Operator "science is consensual knowledge". Opinion, he said, "is a matter for opinion makers" and we must separate science from opinion and base ourselves on science, because "that gives us a lot of strength." And, following the approach, you have to be rigorous: "Everything we say has to be supported, support based on science and argued," the Ascó Operator and Supervisor also confirmed.

To end his speech, Alfredo García offered the attendees a list of eight tips that he discovered when he was a teenager after reading a self-help book (Your Erroneous Zones by Wayne W. Dyer), and that have served him well when facing his activity as a disseminator. The Nuclear Operator concluded by stating the following:

1. The search for approval becomes an erroneous zone only when it becomes a need rather than a desire. There is no need for outreach to be liked or responded to. You have to do it because you love it and enjoy it.
2. You can't avoid peoples' disapproval, no matter how much you want to. There will always be negative comments.
3. You can only be competent in what you put into practice. Anyone who has the vocation to explain, let him try.
4. You are the product of the sum total of your choices. We have many aspects.
5. Not succeeding at something you tried to do does not imply your failure as a person. It is simply not having achieved success in that specific task and in that present moment. We have all been wrong, and that serves as an experience.
6. Trust yourself when making a decision and learn every day from what is happening to us.
7. Simply getting started will help you eliminate your anxiety about the project.
8. Failure is just an indicator of peoples' opinion. In the end, positive lessons must always be concluded from everything we do.

After his presentation, numerous attendees who followed the session asked questions through the chat enabled on the Virtual Meeting website. Questions that ranged from knowing how much time the Nuclear Operator dedicates daily to dissemination, what else can be done to disseminate about nuclear energy, or the influence that the HBO series Chernobyl has had on public opinion about the sector, among others. Alfredo García responded to all of them and ended his Workshop where 282 attendees were connected by thanking the SNE for having him at this very special 2020 Virtual Meeting.■


In Cofrentes,
our ongoing expectation is to further improve what we are doing well

centrales nucleares no emiten $CO_2$

COFRENTES
NUCLEAR POWER PLANT

*Safe, reliable and efficient*

IBERDROLA
Generación Nuclear

www.cncofrentes.es

# TECHNICAL SESSION

## Session 1

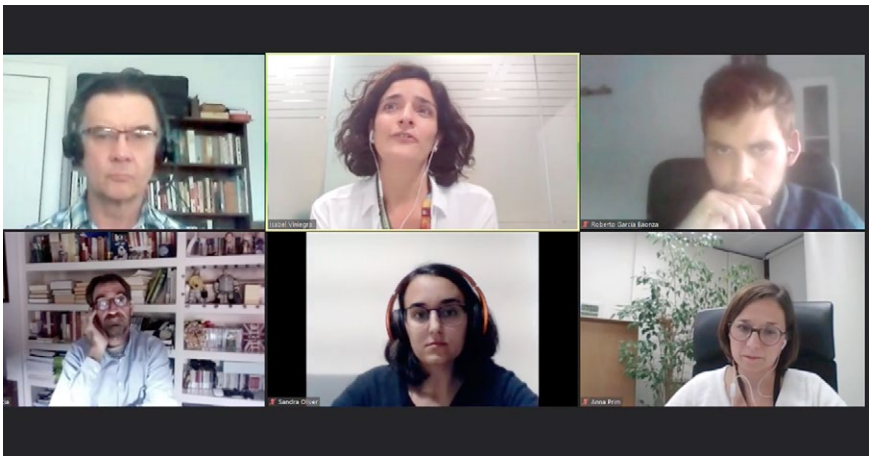
## RADIOLOGICAL PROTECTION & NUCLEAR MEDICINE (I)

Coordinated by: **ISABEL VINIEGRA**

**Gonzalo Felipe García (UPM)** presented a study on the updating of the Howitzer MCNP model, work that is part of the updating and continuous improvement activities in neutron dosimetry and benchmarking developed by the UPM Neutron Measurement Laboratory. This work has improved the accuracy of the Howitzer MCNP model by reducing the maximum relative error made regarding experimental measurements by 50%.

**William Bracey (Orano)** introduced NUHOMS horizontal dry storage containers for Spain"s spent fuel storage needs. To comply with the limit of 250 μSv/year with 100% occupation of the site limit required by Spain, improvements in the original shielding are required. A hypothetical case study was presented that evaluates off-site dose rates before and after design changes.

**Sandra Oliver Gil (UPV)** presented a tool that allows for simulating phase-space files in IAEA format with Monte Carlo simulation methods. These simulations are usually long and computationally expensive and



require detailed information from medical linear accelerators. The tool is very useful in the field of dosimetry for radiotherapy treatments, reducing simulation times by up to 70%.

**Gonzalo García (UPM)** presented a study on the response of Prescila-type neutron detectors using Monte Carlo codes for their application in environmental dosimetry in proton therapy centers. The results can be used to compare the theoretical response of equipment with the actual response obtained in the different ongoing data collection campaigns.

**Anna Prim Pujals (ANAV)** shared the actions carried out against SARS-CoV-2 in the Radiological Protection area for the Vandellós II Nuclear Power Plant. The main measures implemented in the plant were presented to minimize the risk of virus transmission in the process of entering and leaving the Controlled Zone, in routine dosimetric controls, and during the performance of specific radiological protection tasks.■

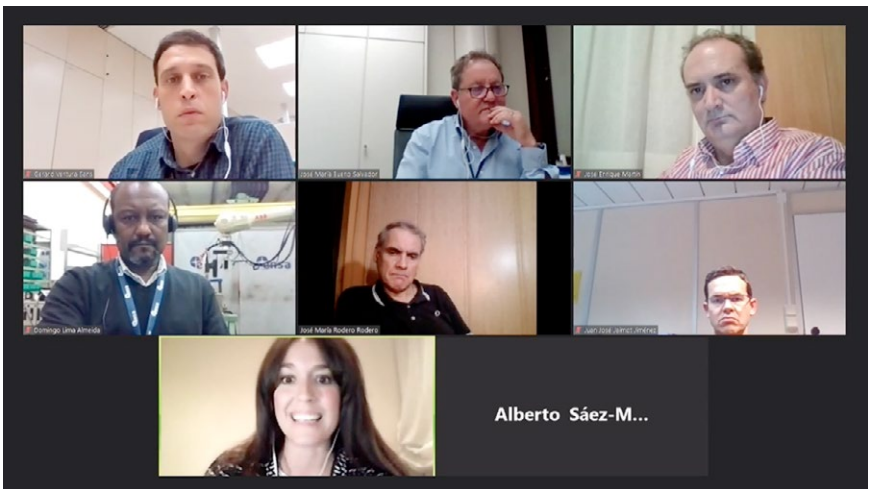
## Session 2

## ENGINEERING AND INNOVATION (I)

Coordinated by: **JOSÉ ENRIQUE MARTÍN**

In the first of the technical sessions dedicated to engineering and innovation, 32 users were connected, and seven papers were presented:

**Gema Donoso Rosa (Empresarios Agrupados)** presented an "Analysis of the Methodologies Applied to the Dedication Process According to EPRI Versus the IEC 61508 Standard for Simple Software-Based Instrumentation and Control Equipment for Use in Nuclear Safety Applications" where the process for the STZ temperature instrument from Moore Industries, SIL 2 certified by Exida, is evaluated.



**Jose María Rodero Rodero (ENUSA)** presented "Computerized Control of Depression and Measurements in Watertight Inspections with INCAN Sipping from ENUSA" where the implementation of the new Magic Box is detailed. He emphasized the recent advances that make this inspection system more sensitive and reliable.

**Alberto Sáez Maderuelo (CIEMAT)** presented the "Advanced Mechanization Processes in the Nuclear Industry" MEACTOS project where he focused on the optimization and development of new machining techniques seeking to improve the efficiency of production processes and the operational response of products.

From the **ENSA** workshop and with a robot in action, **Domingo Lima** gave us his presentation on "Robotics in the Manufacture of Large Components" where he emphasized the development of the robotic platform for the TIG NG welding process that has allowed a reduction of around 70% compared to manual times.

**Juan José Jaimot Jiménez (ANAV)** presented "Reverse Engineering of Voltage Regulators for the Ascó NPP Emergency Diesel Units." This has been an achievement in identifying and locating components with sufficient quality, which offer confidence and can ensure the durability and reliability of the component.

**José María Bueno Salvador (ANAV)** presented us with the "Review and Optimization of the Maintenance Plans for the Ascó NPP and the Vandellos NPP Components" seeking to increase reliability and, as much as possible, trying to reduce costs by applying the NEI "Efficiency Bulletins" on "Value-Based Maintenance."

**Gerard Ventura Sans (ANAV)** did the presentation on "Adaptation of the ANAV Dedication Processes to the EPRI Guide 3002002982 for the Acceptance of Commercial Grade Components in Safety-Related Applications." This new revision incorporates a series of changes that give a new focus to the processes.

At the end, there was an interesting discussion between the speakers of the session.■

# Session 3

## WASTE MANAGEMENT (I)

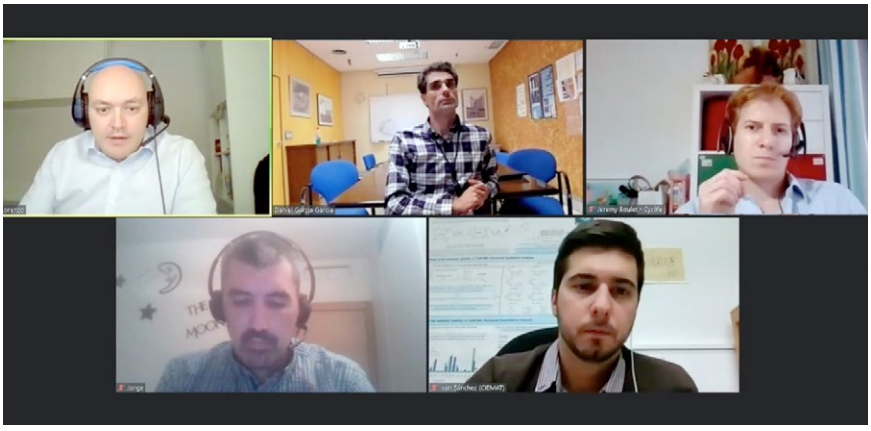
Sponsored by: orano

Coordinated by: **DANIEL DE LORENZO**

The first session on Waste Management was chaired by Daniel de Lorenzo of Framatome. The session consisted of 5 presentations and had an audience of 33 people.

The first presentation was done by **Daniel García (ENUSA)** in which he described the declassification of radioactive waste at the Juzbado nuclear fuel factory. The main benefit of this project is the reduction of volume in the VLLW cells at Juzbado and the management of future waste produced. Tests have been carried out with potentially declassifiable materials that are generated in the facility (metallic materials, wood, textile material, and plastics). The results of the tests carried out show the technical feasibility of declassifying radioactive waste from a fuel factory.

The second presentation was done by **Jeremy Boulet (CYCLIFE)** and showed EDF capabilities in decommissioning and waste management. In the management of off-site steam generators, Cyclife proposes comprehensive management that includes radiological characterization, transportation to the treatment plant, treatment based on acceptance criteria, and the return of final waste. Treatment by incineration is a proven process with 13 large and 2 small steam generators and involves a substantial reduction in volume (15% reduction) and weight (25%).



The third and fourth presentations were done by the same speaker, **Iván Sánchez (CIEMAT)**. In the first one, he covered the various aspects addressed during the development of an "irradiation loop," such as the feasibility of the design, materials, reactors, joints, and connectors, as well as the validation of the system with high radiation doses and high acidity in the reprocessing of nuclear fuel, with cycles that include the recycling of minority actinides (Am, Cm, Np) as a strategy for minimizing the waste generated and its radiotoxicity. A dynamic irradiation system has been developed that is capable of simulating the most relevant aspects of the degradation processes that affect extraction systems in development for advanced nuclear fuel cycles.

In the fourth presentation, Iván Sánchez explained a direct method to quantify the kinetics of acetohydroxamic acid (AHA) using Raman spectroscopy and its implication in the studies of extraction systems for the separation of lanthanides and actinides in advanced hydrometallurgical fuel recycling processes.

The fifth and final presentation, by **Jorge Serrano (Westinghouse)**, showed the stabilization of toxic and dangerous waste by immobilization in containers fitted with a hydraulic binder mold. The main advantages of this process compared to the one used previously are the possibility of selecting containers from a wide range, avoiding the dispersion and handling of waste during the process, minimizing the generation of secondary waste, and reducing the chemical tests to be performed on the waste.■

# Session 4

## NUMERICAL CODE + 3D SIMULATION (I)

Coordinated by: **ALBERTO ESCRIVÁ**


The speakers for the 8 presentations done in the first technical session on Numerical Code + 3D Simulation come from both private companies as well as university institutions and state research centers, providing a varied perspective on the work carried out in the area.

First, **Marta Galbán (ENUSA)** explained the work carried out for the modeling with COBRA-SFS of BWR fuel in dry storage conditions to show the calculation capacity of the COBRA-SFS code for predicting temperatures at the fuel rod level.

Next, **Agustín Matías Alonso (UPM)** presented the methodology developed at ETSI Industriales to model and simulate from individual containers to ATI models with ANSYS CFX.

The third presentation by **Andrés Hernández (UPM)** summarized the main results of the evaluation of the use of anisotropic equivalent materials in spent fuel container simulations using ANSYS CFX.

Regarding the probability of failure due to fires in electrical cables, **David Lázaro (GIDAI Group)** of the University of Cantabria presented the results of the analysis of the influence of the determination of a fire source on the failure of a vertical cable tray.

Next, **Rafael Sánchez (NATURGY)** presented the digital transformation towards 3D calculation models at CNAT's Fuel Department, showing several success stories.

In the sixth presentation, **Luis Herranz (CIEMAT)** explained the MUSA (Management and Uncertainties of Severe Accidents) project, what its objectives are and the work to be carried out.

In his presentation, **Carlos Vázquez (UPM)** presented the various approaches and analysis of the simulations carried out with GOTHIC code to reproduce the behavior of suppression pools.

Finally, Luis Herranz presented the evaluation of the predictive capacity of fission product retention in suppression pools during SBO sequences, applying it to the Fukushima Daiichi Unit 1.

At the end of the session, several questions were asked, which were satisfactorily answered by the speakers. The session was very entertaining and 41 unique users were connected through the streaming of the meeting.■

# Session 5

## MAINTENANCE, INSPECTION, AND TESTS (I)

Coordinated by: **ÁNGEL GARCIA BUENO**

Eight excellent technical papers were presented during the session, and the number of attendees in streaming mode was 24 people who had the opportunity to clarify their concerns during the time for questions at the end of the oral presentations.

In the first presentation, **Juan Rafael Cabello García (SGS TECNOS)** described the Arc Flash as one of the most common and harmful phenomena for equipment and people in electrical facilities and he showed how beyond the legal obligations imposed by the national regulations, analysis of the Arc Flash is a priority in order to know if

the workers and the facilities themselves are protected in the event of an electrical accident caused by this phenomenon, which can have considerable effects on people and property.

Next, **Luis Acosta García (TECNATOM)** explained that cables, when exposed to severe environmental conditions such as thermal stress, humidity, and exposure to radiation, have accelerated aging and deterioration, so verification is required to determine their condition and possible extension of life. For this, TECNATOM has developed Advanced Cable Characterization Equipment that combines capabilities with regard to ergonomics, weight, reliability, autonomy, standardization, and communication and integration with the most modern technologies available.

In the third presentation, **Gabriel Esteban López (IDOM)** highlighted the issues that arise in experimental or research reactors with several decades of operation to identify problems related to the management of aging suitable for the long-term operation of the structures, systems, and components that are part of these, and to establish the required actions for their maintenance throughout their useful life. In particular, he concluded that aging management activities, such as inspection, maintenance, and monitoring are key to preventing the aging of these reactors.

Following this, **Alberto Lorente Cánovas (TECNATOM)** presented the results on the application and validity of the inspection procedure for Socket-type austenitic welds using encoded Ultrasonic Phased Array (PAUT) in Nuclear Class 1 small diameter stainless steel pipe and revealed that the study and execution of the experimental evidence are essential for guaranteeing the validity and effectiveness of the inspection procedure, as well as to be able to confirm that, despite the limitations, it is the best volumetric inspection method for the detection of presumed defects.

In the fifth presentation, Miguel **Ángel Fernández Sanz (IBERCAL)** presented a new electromagnetic inspection system based on pulsed induced currents that allows for very quick and efficient inspection of the integrity condition of the pipe wall, heat exchanger casings, and storage tanks that may be affected by corrosion phenomena. The advantage of this technique with respect to other tests already existing in the industry is that it has the ability to inspect the component without having to remove the material that may be covering it, for example, paint coating, thermal insulation, cement, etc.

In the sixth presentation, **Ferrán Tarrasa Blanes (ANAV)** assessed the effort made by the Ascó Vandellós Nuclear Association to optimize refueling work and adapt it to the effects and mobility restrictions due to the pandemic caused by the coronavirus, complying with all the normative and regulatory requirements and without affecting the reliability of the facility in the next operating cycle. The analysis carried out required the participation and coordination of a large number of technicians in various areas of engineering, maintenance, and work management, resulting in a refueling program compatible with the conditions imposed by the pandemic and being able to execute all the planned tasks and without any notable setbacks.

In the second to last presentation, **Marcos J. Sánchez Ramos (GE HITACHI)** highlighted the problems that foreign materials can often cause in many activities in classic productive sectors, industrial sectors, and, particularly in the case of nuclear energy, where the intrusion of a small loose part may cause the forced shutdown of the plant to retrieve the part or repair damaged equipment. Hence the importance of raising awareness among staff, as well as establishing actions and following procedures on material control to minimize or prevent the presence of foreign substances.

To end the session, **Ignacio Marcelles Ramírez** described the non-destructive testing inspections where **TECNATOM** has recently incorporated the latest technological advances in electronics, sensor telecommunications, technology, digitization, mobility, miniaturization, and drones, focused on the objective of achieving benefits in terms of the inspectability, access, detectability, dimensioning, and positioning of defects, while at the same time achieving a reduction in personal risks, minimizing human errors, facilitating a more remote and collaborative way of working, as well as reducing inspection costs.

In general, the speakers presented their work with great precision and clarity, always keeping within the times established beforehand. The Coordinator of the session, Ángel García Bueno, thanked the speakers for the interesting technical session offered and the listeners for their attendance and telematic participation. ■

# Session 6

## FUEL (I)

Coordinated by:
**JAVIER GARCÍA RODRÍGUEZ**

The Technical Session No. 6 - Fuel I for the SNE Virtual Meeting was moderated by Javier García Rodríguez (ENUSA) and had the participation of 4 speakers. The presentations were focused on different aspects of fuel operation in reactors. The session was very enjoyable, and there were a large number of questions that were asked at the end of the presentations of great interest to the audience, who connected to the streaming of the meeting with 44 unique users.

The presentations dealt with the following topics:

- EVALUATION OF THE IMPACT OF FLEXIBLE OPERATIONS ON A CYCLE OF OPERATIONS FOR THE COFRENTES NPP by **Yolanda Tofiño (IBERDROLA)** which summarized a study on the adaptation of NPPs to the needs of the electricity market and to coexist with electricity production for the renewables industry. To do this, they must be prepared to be able to track load as flexibly as

possible without reducing the reliability of the operation and the nuclear fuel.

- OPTIMIZATION OF THE OPERATION OF THE COFRENTES NPP UNTIL 2030 by **Pilar Ortego (IBERDROLA)**. The cessation of activity for the Cofrentes Nuclear Power Plant was set for November 2030. This presentation evaluates the strategy for the duration of the operating cycles up to that date so that the fuel load can be optimized to have a final core flexible enough to meet the targets for emptying the core and spent fuel pools, and, at all times, meeting the energy requirements established in the Energy Use plan.
- CALCULATION OF HYDRAULIC FORCES ON FUEL WITH 3D VIPRE-W MODELS by **Alejandro Carrasco (ENUSA)**. This 3D methodology for calculating axial and lateral hydraulic forces will provide more realistic axial forces than those based on simplified 1D models. It will also make it possible to obtain the lateral hydraulic forces required for a new fuel deformation calculation model, which is why it is also more complete than previous methodologies.
- METHODOLOGY FOR DETERMINING ESTIMATED ACTIVITY IN DEVICES INSERTABLE IN FUEL ELEMENTS/PLUGS; IRRADIATED IN THE ALMARAZ NPP FIRST CYCLES by **Álvaro Fenoy (NATURGY IN)**. The objective is to estimate the activity generated by the activation of the materials of these devices by measuring the dose rate due to activation products. The results obtained allow for decision-making about their movement in the pool and possible management.

# Session 7
## OPERATION

Coordinated by: **FRANCISCO SUÁREZ**

Four papers were presented on various topics, covering aspects from transient simulation to performance optimization, including the diagnosis and analysis of the start of a new cycle.

In this year's virtual format, the session was broadcast to the attendees, starting with a presentation block of the 4 papers followed by questions and answers by the attendees via chat.

According to the order of presentation, the following papers were presented:

- STARTING OF A NEW CYCLE AFTER EXTENDED OPERATION, presented by **Jordi Estrampes Blanch (ANAV)**, explained the particularities of the new cycle (28) for group I of the Ascó NPP after the extension of the previous cycle (27), extended due to the new refueling dates imposed by the outbreak of COVID-19. The results of the diagnosis were presented during startup after refueling, where it was observed that a region of the core presented a deviation in the predicted average Reaction Rates, giving rise to what is known as the appearance of an "in-out" tilt incore. Although the peak factors did not represent anomalous values as they were below their respective limits. Their values were presented, as well as an analysis of possible causes and the planned follow-up. Nicolás Torres Pitarch (ANAV) is also the author of the paper.
- ANALYSIS WITH THE TRILLO PLANT ANALYZER OF THE LOSS OF A CONDENSATE PUMP WITHOUT STARTING THE RESERVE POWER STATION PUMP, presented by **Francisco Javier Hernáez Delgado (NATURGY)**, explained the aforementioned transient, emphasizing the manual actions required and associated times to avoid triggering the reactor in this case. The calculations are based on the Trillo Plant Analyzer (APT), with modeling based on RELAP. They will be incorporated into the next condensate system operation manual.
- APA ANALYSIS OF THE DYNAMIC BEHAVIOR OF THE PLANT WITH REGARD TO OPERATIONAL TRANSIENTS CONSIDERING A BLOCKED STEAM-DUMP VALVE, presented by **Andrea Mireia Cadenas Mendicoa (NATURGY)**, detailed the analysis of the aforementioned

transients simulated with the Almaraz plant analyzer. The capabilities of the simulation tool (developed in RELAP) were described to later show how the plant would behave with one of the turbine bypass valves blocked (considering that it could be blocked in different banks) in the event of 2 operational transients: the tripping of a turbopump as well as a 50% load rejection.

- IMPROVING THE ECONOMIC RESULTS OF NUCLEAR POWER PLANTS THROUGH PERFORMANCE OPTIMIZATION, presented by **Francisco Javier González Pindado (TECNATOM)**, presented the TECNATOM performance monitoring system developed for nuclear power plants. The operation of the Tecos-Solcep system for performance monitoring was detailed, which would complement common maintenance strategies to seek the maximization of economic benefit by looking after efficiency: evaluating the cost of performance deviations, the cost of counteracting deviations with maintenance, as well as the evolution of component degradation. The software structure was presented as well as its operational outline.

The session ran smoothly and ended with several questions posed by the attendees (via chat) to all the speakers, which were answered and commented on in an interesting discussion after finishing the presentations. ■

# Session 8

## SSC DESIGN AND BEHAVIOR

Coordinated by: **JOSÉ ENRIQUE MARTÍN**

In the only of the technical sessions dedicated to Design and Behavior of Structures, Systems, and Components, 18 users were connected and four papers were presented:

- **Rafael Torrealba Heredero (Empresarios Agrupados)** presented a paper on JOINTS BETWEEN CARBON STEEL AND STAINLESS STEEL: ANALYSIS OF SOLUTIONS FOR GREATER JOINT DURABILITY WITHOUT DIMINISHING THEIR RESISTANT FUNCTION. The assembly of SSC involves, more and more often, the creation of joints between carbon steel and stainless steel. In order to prevent them from becoming unsuitable, detailed engineering solutions are implemented to circumvent possible incompatibility.
- The storage capacity of the spent fuel pool for the Vandellos NPP, with the racks currently installed, means that the pool will be saturated after the 24th refueling in 2021. **Eduard Caballero (ANAV)** presented us with the solution. The presentation is entitled EXPANSION OF THE CAPACITY OF THE VANDELLÓS II NPP SPENT FUEL POOL: RERACKING.


- **Roberto Miguel Martínez (ENSA)** presented DESIGN AND MANUFACTURE FOR NUCLEAR GRADE PROCESS TANKS AND COLUMNS FOR THE HINKLEY POINT C NPP. The design methodology is based on risk analysis. According to this methodology, risk analysis is the main element that affects design and manufacturing, and from which the requirements to be met to eliminate or mitigate the identified risks are largely derived.
- Finally, **Jorge Montero Lansac (ANAV)** gave a presentation on MODERNIZATION OF THE FLEET OF AUXILIARY TRANSFORMERS FOR THE ASCÓ NPP. Through this project, the reliability and availability of these critical components are increased, while the obsolescence that affected them is eliminated.

At the end, there was an interesting discussion between the speakers of the session..■

# Session 9

## NUMERICAL CODE + 3D SIMULATION (II)

Coordinated by: **ALBERTO ESCRIVÁ**

The speakers for the 6 presentations done in the second technical session on Numerical Code + 3D Simulation come from both university institutions and state research centers, providing a varied perspective on the work carried out in the area.

First, **Gonzalo García (UPM)** presented the study conducted on neutron activation in shielding for proton therapy centers with different types of concrete using MCNP6 code and its applications in reactors and nuclear facilities.

Next, **Francisco Álvarez (CIEMAT)** explained the development in chaos polynomials for the propagation of uncertainty in advanced nuclear fuel cycles, indicating the main advantages for its use.

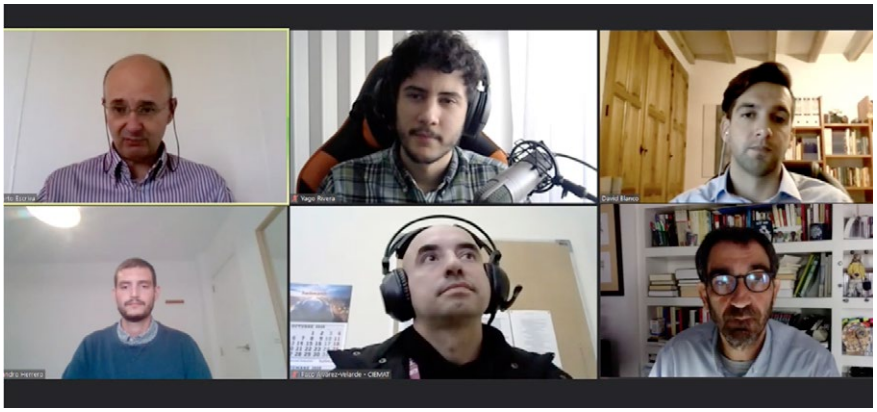
The third presentation by **Yago Ribera (IIE Institute from UPV)** summarized the simulations carried out using CFD and the quantification of uncertainty for the international

benchmark of the OECD/NEA Cold Leg mixing where a mixture of fluids of different density is produced.

Next, **Alejandro Herrero (IIE Institute from UPV)** presented the development of a processing module for verification of TRACE code conservation laws implemented within the code itself.

In the fifth presentation, **David Blanco (IIE Institute from UPV)** showed the reproduction and post-test analysis of an SBLOCA transient at the ATLAS experimental facility with TRACE.

Finally, **David Blanco**, in the last presentation, explained the work carried out to update the model for the **Cofrentes Nuclear Power Plant**, developed using the SNAP platform so that it can be executed with TRACE code.



At the end of the session, various questions were raised, which were satisfactorily answered by the speakers.

In summary, the session, enlivened by various questions and comments by the speakers, showed different experiences that have occurred at different levels and from various fields in the last year. Twelve unique users were connected to the session through the streaming of the meeting.■

# Session 10

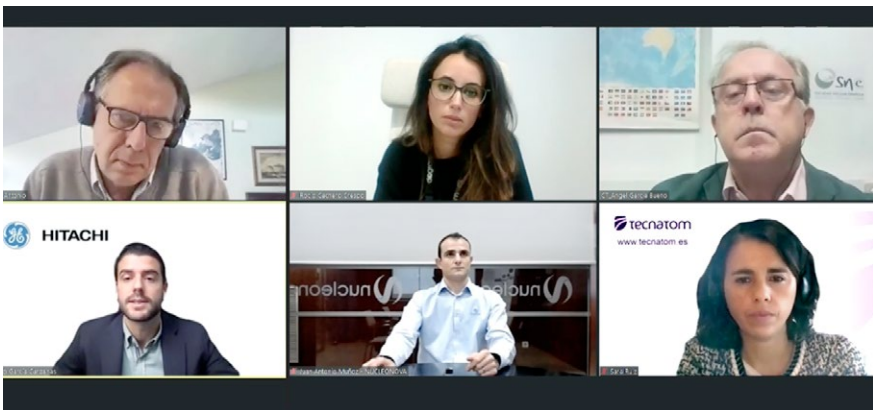
## MAINTENANCE, INSPECTION, AND TESTS (II)

Coordinated by: **ÁNGEL GARCIA BUENO**

The session was attended by 24 participants who had the opportunity to witness the presentation of some interesting technical and scientific papers in streaming mode. In total, 5 papers were presented, and the duration of the session was adjusted to the scheduled time, including questions at the end that were brought up by the presentations.

The session was initiated by **Sara Ruiz Rabanedo (TECNATOM)** who presented the development carried out in digital tools to improve data collection during the inspection work carried out at nuclear plants with the aim of, on the one hand, having all of the information associated with the inspection "in one click", and on the other, optimizing and reducing process times, minimizing associated errors. To this end, the extensive accumulated experience, the help of user inspectors, as well as the lessons learned, and the improvements identified to optimize the tool have been taken into account and as a reference.

Next, **José Antonio Ruiz Martín (TECNATOM)**, demonstrated how predictive monitoring tools, by putting the data already available from the plants to good use allows for anticipating the identification of degradations in facility components through the use of "Machine Learning" algorithms in the interest of a




predictive maintenance strategy that allows for optimizing costs. Artificial intelligence techniques based on machine learning make it possible to detect deviations from normal equipment functioning and therefore are capable of identifying the process of equipment degradation from the beginning.

In the third presentation, **Rocío Cachero Crespo (DOGRAM)** explained that, in the absence of dimensioned planes of the drive axes for control bars, a digitization process using an innovative method applying laser scanner technology for the mass capture of data without contact, and from different angles, has made it possible to geometrically analyze the upper ends of these axes and calculate the standard deviations between them in order to obtain a three-dimensional CAD model that is closest to the theoretical model. This methodology represents a challenge to implement laser scanner technology to greatly facilitate maintenance and inspection tasks at the Almaraz NPP.

Next, **Domingo García Cárdenas (GE HITACHI)** described the benefits of the I&C Plus service since the world fleet of BWR reactors faces constant challenges attributable to staff turnover and the aging of equipment and components, and that as a consequence of this, the owners of BWR plants are aware of the implications it has, both during operation and during shutdowns, where sometimes delays occur in the critical path caused by the repetition of work and that, on the one hand, considerably increase the costs, and on the other hand, results in a negative impact

on the dose targets for the personnel participating in the task.

The fifth and final presentation was given by **Juan Antonio Muñoz Tirado (NUCLEONOVA)** and dealt with the importance of supervising lifting maneuvers and cargo movement, especially when they are carried out near equipment related to the safety of nuclear power plants. Hence, it is necessary to take advantage of the operational experiences of "rigging" and guarantee its proper execution to achieve safety for people, the environment, and the facility. Likewise, he also presented an analysis of the problems caused at some nuclear power plants around the world, categorizing the causes to serve as a reference to be taken into consideration when carrying out rigging activities.

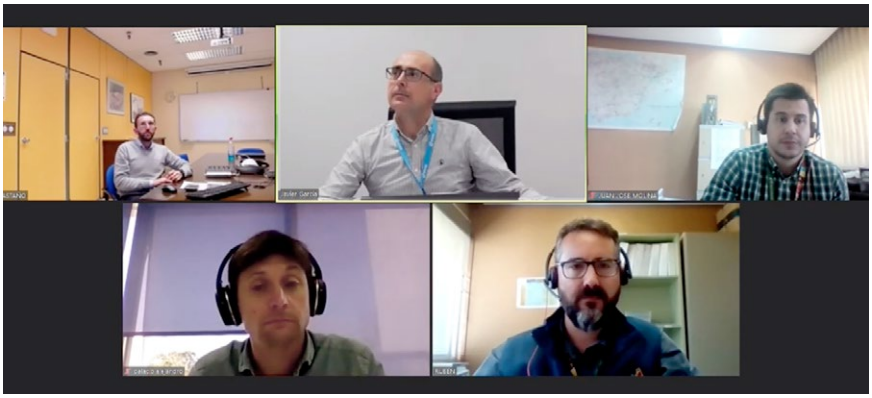
Finally, Ángel García Bueno, as Coordinator of the session, expressed his gratitude to the listeners in "streaming" mode and the speakers for having adjusted to the assigned times and congratulated them for the high technical quality of the presentations presented, which gave rise to a discussion with lots of participation as a result of the questions that were posed to the speakers.■

# Session 11

## FUEL (II)

Coordinated by:
**JAVIER GARCÍA RODRÍGUEZ**

Session was moderated by Javier García Rodríguez (ENUSA), in which 3 papers were presented. The presentations were focused on different aspects of improving the management and handling of spent fuel. The session was very visual and sparked a lot of interest from the audience on the event's website with 40 unique users, giving rise to several questions during the discussion session.



The presentations dealt with the following topics:

- GRID CUTTING EQUIPMENT WITH A GRINDER FOR REPAIRING WORN PWR COMBUSTIBLE ELEMENTS by **Jesús Castaño (ENUSA)** who presented a tool designed by ENUSA for cutting grids that, using a grinder, an abrasive disc, and a positioning system, eliminates those parts of the grids that, since they are damaged and bent, exceed the maximum contour allowed for the storage of the element. Maintaining structural integrity reduces the number of fuel elements classified as damaged, allowing them to be stored dry.
- SPENT FUEL CONTAINER LOADING EQUIPMENT AT THE COFRENTES NUCLEAR POWER PLANT by **Rubén Mascarell** and **Juan José Molina (IBERDROLA)** told us about the project that makes the construction and commissioning of the Individualized Temporary Storage for spent fuel in dry containers a reality. The multidisciplinary team covers 6 work areas: Operations, Planning and Services, Spent Fuel, Engineering, Maintenance, and ALARA. In addition to close coordination with the container designer (ENRESA).
- DESIGN MODIFICATIONS IMPLEMENTED FOR THE ENUN 32P CONTAINER FOR THE STORAGE AND TRANSPORTATION OF DAMAGED FUEL AND FUEL WITH A HIGH DEGREE OF BURNUP by **Alejandro Palacio (ENSA)** gave us a preview of the improvements implemented in the ENUN 32P, among which it is worth highlighting the introduction of a new frame design which will accommodate, among other authorized contents, cases for damaged fuel and fuel elements with a high degree of burnup, which will facilitate the emptying of spent fuel pools.■

# Session 12

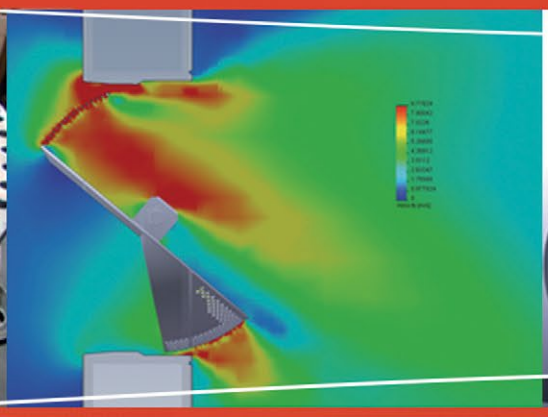
## SUSTAINABILITY

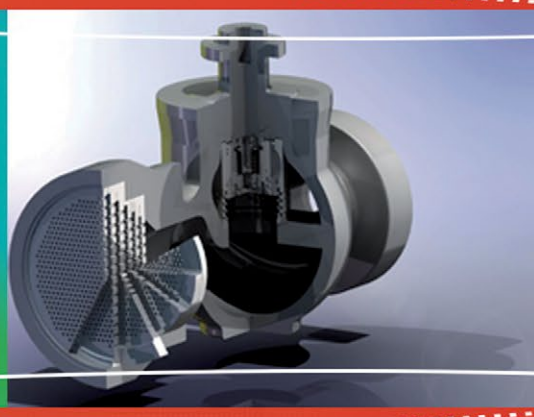
Coordinated by: **LUIS FELIPE DURÁN**

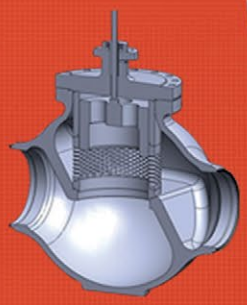
This year, the technical area of Sustainability (SDG, SER, and CSR) has been included in the technical program for the Spanish Nuclear Society Annual Meeting for the first time with the aim of reflecting the efforts of the sector in terms of sustainability and for various stakeholders from the sector to have the opportunity to show their strategies in terms of Corporate and Environmental Social Responsibility, materializing the efforts aimed at fulfilling the Sustainable Development Goals.

**Nuria Del Arco (ENUSA)** presented one of the social actions carried out at ENUSA to comply with SDG 10 "Reducing Inequalities," explaining the collaboration of ENUSA with the "Asperger Madrid" association since 2019 to highlight and promote the inclusion of people with disabilities in the labor market in companies in the nuclear sector. Next, **Samantha Larriba (UPM)** presented her work on the non-electrical applications of

# RINGO VALVULAS







# *Válvulas de Control*

Ringo Válvulas, además de su completa gama de fabricación de válvulas todo o nada; compuerta, globo retención, bola, mariposa y diafragma, es **fabricante líder** en válvulas de Control con **más de 15 años de experiencia en el sector Nuclear.** Ringo ofrece soluciones de control completas que incluyen:

- Válvulas de control lineales (globo) y rotativas (mariposa y bola)

- Rango completo de Cv (desde 0,02 hasta más de 50000)

- Diseño de internos para servicios severos, para reducir los efectos de la cavitación, flashing o exceso de ruido.

- Clase de fugas hasta nivel VI - cero fugas

- Rango completo de materiales

- Compatibilidad con todo tipo de actuadores e instrumentación

Válvulas instaladas en **más de 30 plantas en todo el mundo**

***Driving Energy***

www.ringospain.com

ISO 9001:2008 by LRQA

ISO 14001 by LRQA

OHSAS 18001 by LRQA

API 6A-0729
Licence Nr. 6A-0729

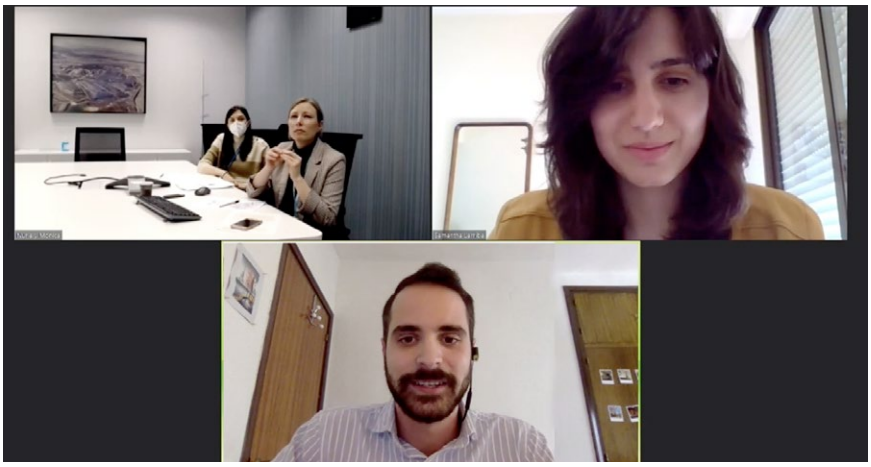
API 6D-0495
Licence Nr. 6D-0495

API 6DSS-0038
Licence Nr. 6DSS-0038

N

NPT

the new SMR reactors: heating and DHW, desalination, petrochemicals, and hydrogen production. Different analyses of the reactor's secondary circuit showed the versatility of the new nuclear power plant in facing the new climate challenge and promoting peoples' access to drinking water. To conclude the session, **Mónica Hufton (ENUSA)** highlighted the importance of ENUSA's compliance model, and how they adopt the necessary due diligence measures in the supply of uranium to prevent corruption, contributing to fairer business with people in the sector at the international level.



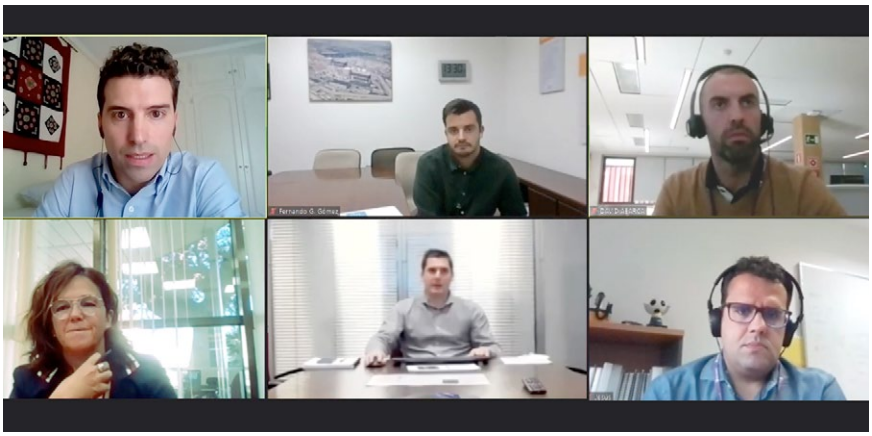
Undoubtedly, the 57 visitors to the session, during its development and the subsequent debate, showed interest in different aspects that contribute to sustainable development: social, technical, and legal. If something is clear from this session, it is that the path towards these goals is a task in which we all, from our respective professional profiles, have an important role to play. ■

# Session 13

## QUALITY, REGULATIONS, ORGANIZATION & HUMAN FACTORS (I)

Coordinated by: **MIGUEL BARREIRO**

Topics such as the prevention of occupational risks in the decommissioning environment and the short-term challenges that these entail were presented by **Juan Rodríguez Gil (ENUSA)**. We discussed the importance of leadership in crisis and emergency management, explained by **Fernando González Gómez (TECNATOM)**, while **David Abarca Ahijado** presented the influence of human factors in the nuclear, petrochemical, and aeronautical industries. The last two presentations were about a restructuring of the departments of Continuous Improvement, Human Factors, and Organizational Efficiency at ANAV, explained by **Jesús Iglesias Morán (TECANTOM)**, and the design of indicators designed to facilitate decision-making according to the presentation by **Rosaura Miret Gabriel (ANAV)**. ■



# Session 14

## THERMOHYDRAULICS & NEUTRONICS (I)

Coordinated by: **ALBERTO ESCRIVÁ**

The speakers for the 5 presentations done in the first technical session on Thermohydraulics and Neutronics come from university institutions, providing a varied perspective on the work carried out in the area.

First, **David Blanco (University Institute of Energy Engineering (IIE) (UPV))** explained the facility developed to study the behavior of horizontal jets in pools and the process followed for calculating the length of these horizontal jets of steam and incondensable gases in pools using empirical correlations.

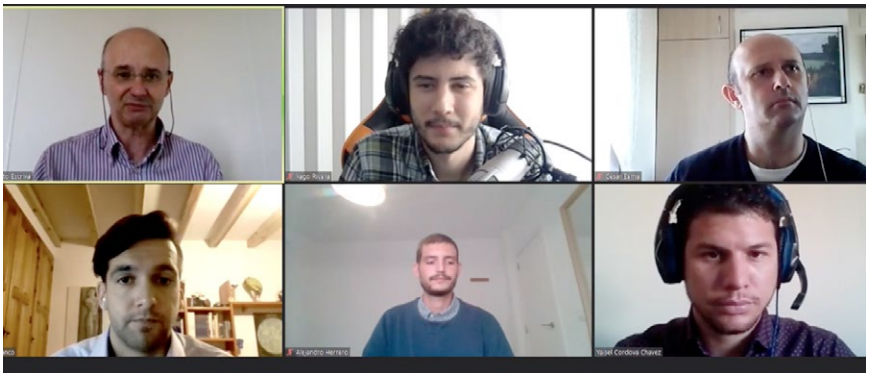
Next, **Yaisel Cordova (IIE from the Polytechnic University of Valencia (UPV))** presented direct visualization techniques using a high-speed camera and image processing methods, methods that consist of several stages. The experimental results showed that the diameter of the nozzle and the percentage of mixing play an important role in the interface and the instability of the jet.

The third presentation, by **Yago Ribera (IIE Institute UPV)**, summarized the experimental measurements

obtained at the GEPELON facility (Wave Film Generation) where the behavior of falling liquid film in vertical concurrent air-water flow is analyzed. Indicating that variables such as mean thickness, height of the disturbance waves, frequency, etc., have been measured using multiple probes.

Next, **César Berna (IIE Institute UPV)** presented the development of fractional scale analysis methodology and its application to a small rupture. It shows how to determine the change agents present in each phase for two facilities, as well as using them to define the fractional change ratio.

To conclude, **Alejandro Herrero (IIE Institute UPV)** showed the work



carried out in the benchmark for the NEA/OECD RBHT project using TRACE code. He described the modeling carried out and the different capabilities and elements of the code in order to correctly reproduce the phenomena that occur.

At the end of the session, various questions were asked, which were satisfactorily answered by the speakers. The session was very enjoyable and 12 unique users were connected through the streaming of the meeting.■

# Session 15

## DECOMMISSIONING (I)

Sponsored by: DMIM

Coordinated by: **DOMINGO GARCÍA**

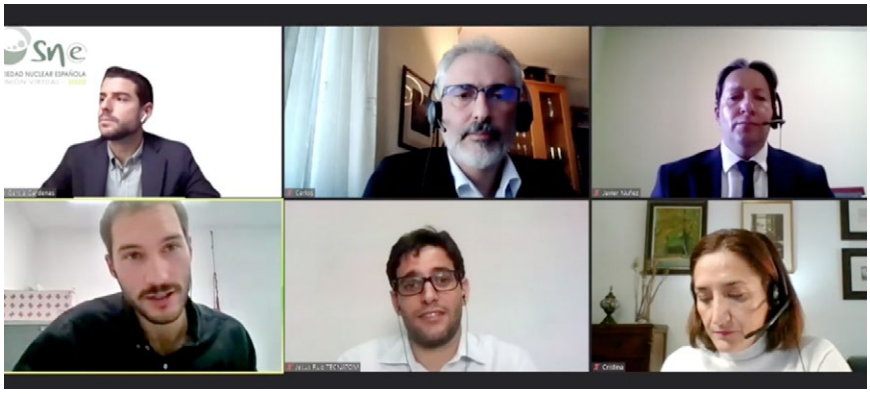
Session 15 - Decommissioning I began with a live connection with the José Cabrera Nuclear Power Plant, where **Álvaro Rojo**, Head of the Communication and Training Service at the plant, conducted an interview with the Director of Decommissioning, **Manuel Ondaro**. During the interview, the attendees had the opportunity to follow the final phase of the decommissioning of the plant and observe the demolition of the Containment Building live. After the live session, the presentations began with a total of 5 speakers.

The session proceeded normally, with a short time for questions at the end of the session. The time used by the speakers was adjusted to the duration of the session.

The presentations from the session are summarized below:

- PREPARATORY ACTIVITIES: ENGINE OF THE TRANSFORMATION FOR THE D&D OF THE JOSÉ CABRERA NUCLEAR POWER PLANT. **Fransisco Javier Núñez González**

  The decommissioning of the José Cabrera Nuclear Power Plant brought new challenges that affected the multidisciplinary design, organization, and Prevention of Occupational Risks in the face of the forced need for transformation. Systems modification plans,



auxiliary facilities conditioning, modifications of system design, structures, and components, clearances, and risk elimination were described in detail, highlighting the innovative and technological solutions implemented.

The presentation highlighted the level of importance for the preparatory activities stage and the lessons learned from this project.

Each decommissioning is a new challenge that must be faced, but with the knowledge acquired and organized at the José Cabrera Nuclear Power Plant, other challenges will be able to be faced. In this way, we can place the torches that mark the way forward to reach other future and challenging projects with a high and reliable degree of maturity based on the engine of transformation for Decommissioning: the Preparatory Activities stage.

- EXECUTION OF THE MEASUREMENT AND SAMPLING PLAN FOR THE PRELIMINARY CHARACTERIZATION OF THE TURBINE BUILDING FOR THE SANTA MARÍA DE GAROÑA NUCLEAR POWER PLANT. **Jesús Ruiz González**

  Between October 2019 and June 2020, the measurement and sampling plan for the Santa María de Garoña Nuclear Power Plant Turbine Building was carried out for its preliminary characterization, key to advancing in the authorization for the decommissioning of the plant. This project was a major challenge due to the preparation and execution of hundreds of work orders and the execution of thou-

sands of field measurements and laboratory analyses.

The planning and execution of the plan, with multiple simultaneous actions, represented a great challenge for all parties involved. A challenge that was successfully resolved through the sum of the capacities of the participating companies (GEOCISA, PROINSA, MEDIDAS AMBIENTALES, and TECNATOM) integrated under UTE4SMG, as well as through close collaboration with Nuclenor.

During this project, important lessons learned were acquired that will be useful for future similar actions.

- ENGINEERING DOCUMENTATION MANAGEMENT FOR THE DECOMMISSIONING OF THE JOSÉ CABRERA NUCLEAR POWER PLANT. **Cristina Tévar de Ozaeta**

  The documentation management for Engineering work for the José Cabrera Nuclear Power Plant decommissioning project began in 2006. Solid documentation management is essential for maintaining the traceability of the documentation generated and received in a long-term project. Its centralization in the administration of the project has served as a link in a multidisciplinary team also formed by several companies which must have updated information, access the history, and generate new documentation, with their own quality procedures and also relying on a database developed for this purpose. Thanks to this management, they have been able to pass numerous external and internal audits and form part of ENRESA's group of approved quality suppliers.

- DECOMMISSIONING ENGINEERING FOR THE JOSÉ CABRERA NUCLEAR POWER PLANT: FINAL PHASES. **Carlos Gómez Rodríguez**

  This presentation described the different phases of the decommissioning for the José Cabrera Nuclear Power Plant, which is in a very advanced state, and briefly presented the tasks and strategies for the last phases of decommissioning, the adaptation of the latest systems that support the active processes, the phasing out of facilities, the demolition of buildings, and the final site restoration work. These works will complete the total and immediate decommissioning of the José Cabrera Nuclear Power Plant, the first to come into operation in Spain and also a pioneer in undertaking its complete decommissioning.

- RADIOLOGICAL CHARACTERIZATION IN DECOMMISSIONING BY ROBOTS AND DRONES. **Eduardo Fuentevilla Blanco**

  The nuclear industry has been reluctant to apply more automated methods in radiological characterization work. In these times and with the technology now present, ENUSA is taking the initiative in the development of robots and drones to implement decommissioning tasks more effectively, efficiently, and safely.■

# Session 16

## TRAINING

Coordinated by: **CLAUDIA LÓPEZ DEL PRA**

This year, several papers were presented in the training session covering various fields of training in nuclear energy: from virtual reality methodology to universities to direct learning in Plants. And for this purpose, GE HITACHI NUCLEAR ENERGY, TECNATOM, UPC, NATURGY, ENUSA, and Fusenet participated.

The session began with a presentation from **Ricardo Moreno (GE HITACHI)**, who presented a new learning platform applying virtual reality. Through it, large surfaces can be reproduced with all the complexity that it involves, adding the detail of the real systems and the combination of the processes that can involve several people working in a safe environment. It is similar to the flight simulators that pilots use for their training. This technology is portable and can be adapted to any process such as fuel loading, among others.

The second presentation was done by **Francisco Ramírez (TECNATOM)**, who began his presentation by reflecting on current times and adapting to the virtual environment that training is experiencing. At TECNATOM, digital tools are applied that complement face-to-face training. They use knowledge management tools for this; they have trained instructors with the Moodle tool, adapting training to the virtual environment with videos, e-learning, interactive courses, 3D visualizations, games, etc. Throughout this year, the students have been satisfied, and through the new tests implemented, they have ensured their learning.

**Luis Batet (UPC)** continued the session by presenting the UPC-ENDESA Master's and the EMINE Master's, and as in the previous presentation, they have been adapted to the new virtual model. Both Master's degrees are taught in English. For the first, the master's degree is one year with work placements and a final master's project. For the second, the master's degree is 2 years in 2 different cities (Stockholm, Barcelona, or Grenoble) and summer school; as with the first, the master's degree ends with an internship and a final project. In this case, the student receives 2 different degrees. Some of the classes are done by the industry and in some cases, the student can

visit the facilities and learn directly from the professionals in the sector.

The next presentation was done by **José María Martín (TECNATOM)**, who presented "PLANT," a system applied at US plants: "blended learning" that combines distance and face-to-face training. This allows employees to attend training while minimizing the hours they are absent from their job. The materials are digital and interactive with videos etc., and the instructors are more available for personalized attention. The PLANT™ system has been successfully implemented in a two-unit plant in the south of the United States.

Regarding the training of professionals in the sector, **Raquel Escamilla (NATURGY)** presented the paper "Evolution of Training for the Operation Licenses of the José Cabrera Nuclear Power Plant." In the presentation, Raquel presented the education and training program for Jose Cabrera's personnel, which, given the nature of the decommissioning activities, evolves as the tasks progress. Systems, facilities, and buildings are gradually disappearing, new ones are incorporated, and continuous evaluation and training of personnel are required at all times.

On behalf of **ENUSA, Federico de Torres** and **Diego de Paz** presented the gamification process for training that ENUSA is implementing. In this way, they have developed a platform that strengthens learning through a dynamic, fun, motivating, and interactive methodology. Gamification applies game elements in non-playful contexts in a way that sparks the interest of employees, thus generating intrinsic motivation towards the training process.

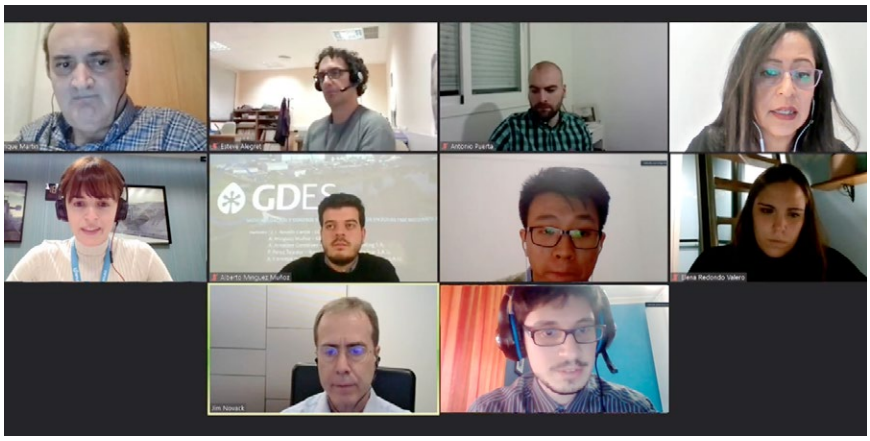
Finally, **Dario Cruz (FUSENET)** presented "Online Presence, Training, and Educational Support in Nuclear Fusion by FUSENET- The European Fusion Education Network, Training Activities, and Education in Nuclear Fusion by FUSENET - The European Fusion Education Network." FUSENET currently has around 60 member institutions in Europe including universities, research centers, and companies. FUSENET seeks to create links with different associations in Europe that promote the knowledge and dissemination of nuclear science and technology.■

# Session 17

## ENGINEERING AND INNOVATION (II)

Coordinated by: **JOSÉ ENRIQUE MARTÍN**

In the second of the technical sessions dedicated to Engineering and Innovation, 52 users were connected, and nine papers were presented:




**Adrián García Osuna (NATIONAL ACCELERATOR CENTER)**, who won the award for the final master's project with his presentation STUDY OF THE RESISTANCE TO RADIATION OF SILICON DIODES BY MEANS OF PARTICLE ACCELERATORS within the framework of a Coordinated Research Project of the IAEA.

**Ying Jie Zheng Zheng (IDOM)** presented IMPROVEMENTS IN GAMMA RAY SPECTROMETRY THROUGH NEUTRON INTERROGATION with simulations carried out with MCNP6 code.

**Esteve Alegret Coma (TECNATOM)** presented us with EXPERIENCE AND PERSPECTIVES OF USING VIRTUAL PANELS IN THE FULL-RANGE SIMULATORS OF ASCÓ AND VANDELLÓS which could allow us to expand the training possibilities by simulating other rear panels as virtual panels.

**Antonio Puerta Vicente (SGS)** gave a presentation with a topic a little different from the nuclear sector on SAFETY FOR ELECTRIC VEHICLE RECHARGING INFRASTRUCTURE.

**Jim Novack (DYNATEC)** gave a presentation on one of the booming technologies (DIGITAL TWIN) entitled RAPID CREATION OF IMMERSIVE DIGITAL TWIN ENVIRONMENTS FOR REMOTE SIMULATION, MAINTENANCE, AND COLLABORATION and its potential applications to the nuclear industry.

With the same topic as the previous speaker, **Karina Martínez (EMPRESARIOS AGRUPADOS)** presented APPLICATION OF PHYSICAL MODELING AND SIMULATION IN AN ANALYTICAL DATA PLATFORM FOR THE COFRENTES NPP, around the Industry 4.0 concept, based on EcosimPro models.

**Alberto Mínguez Muñoz (GDES)** presented VIGIA SYSTEM: OPTIMIZATION OF CONTROL AND MONITORING IN FME AREAS USING UHF RFID TECHNOLOGY. The VIGIA system was successfully implemented during the 22nd refueling of the Cofrentes NPP.

**Elena Redondo Valero (Mines and Energy UPM)** gave a presentation on THERMOHYDRAULIC ANALYSIS OF A SELF-REGULATING ISOLATION CONDENSER BY NON-CONDENSING GASES (SIRIO FACILITY), presenting the simulation results with TRACE5p5 and RELAP5-3D codes.

Finally, **Alicia Ariza Velázquez (ENUSA)** presented ANALYSIS OF PRIMARY CHEMISTRY WITH BAYESIAN-GAUSSIAN NETWORKS FOR ARTIFICIAL LEARNING. A "Bayesian-Gaussian Network" is a machine learning algorithm that can be retrained when new data is received, allowing for making predictions of some variables from others.■

# Session 18

## WASTE MANAGEMENT (II)

Sponsored by: orano

Coordinated by: **DANIEL DE LORENZO**

The second session on Waste Management was chaired by Daniel de Lorenzo of Framatome. The session consisted of 7 presentations and had an audience of 40 people.

The first presentation was done by **Fernando Turrión (IBERDROLA)** and described the construction process for the ITS (Individualized Temporary Storage) for the Cofrentes Nuclear Power Plant and the management of the project during the COVID-19 pandemic. The ITS has been planned to accommodate 24 dual-purpose containers in order to continue the operation of the plant. This need is marked by the level of filling of the fuel pools.

Second, **Miguel Ángel Rodríguez (NATURGY)** presented the Methodology for the determination of the activity of the loose head bundles for the Almaraz NPP. Once a sample of 17 of the heads was characterized radiologically, it was concluded that they can be managed as LILW. For their conditioning, a system has been designed where a basket with heads is inserted into a 220-liter drum with an inner concrete and steel sleeve. Once immobilized with mortar, the bundle is formed.

In the third presentation, **Carlos Martos (Westinghouse)** characterized the racks of the spent fuel pools for the Trillo and Garoña Nuclear Power Plants. Two campaigns were carried out with in situ gamma spectrometry on selected racks, carefully planned with the double objective of subsequently applying the activity segmentation technique and allowing the construction of mathematical models for characterizing the rest of the racks from simple dose rate measurements.

**Eduardo Serra (ENDESA)** did the fourth presentation on the International Overview of Spent Nuclear Fuel Management. The presentation analyzed the most relevant cases in the international field of spent nuclear fuel management, and their similarities with the Spanish situation.

The fifth presentation corresponded to **Glen Rae (Orano)**. It described Orano's technology for reducing the volume of waste from plant operations such as control rods, fuel channels, etc., and container capacities depending on the classification of the waste.

The sixth presentation was done by **Jesús del Castillo** and **Sebastián Vera (SITTA)**, in which they described the ASE system: Adiabatic Sonic Evaporation, a patented process for purifying fluids with total separation of pure water and solids. This is a physical process integrating evaporation and crystallization in a single stage, continuously and in an adiabatic environment, isolated from the network. The system presents removal efficiency for all the isotopes in at least 4 orders of magnitude, being able to reach up to 6 orders, with respect to the initial concentrations.

The seventh and last presentation, by **Emilio García (ENRESA)**, was dedicated to the "Status and Trends on Radioactive Waste and Spent Fuel Management" report. This report is a collaborative project between the IAEA, the European Commission, and the NEA/OECD to provide an analysis of the current situation and future trends in the management of spent fuel and radioactive waste and to include information on current inventories, expected futures, and the availability of facilities for long-term management.■

# Session 19

## THERMOHYDRAULICS & NEUTRONICS (II)

Coordinated by: **ALBERTO ESCRIVÁ**

The speakers for the 7 presentations done in the second technical session on Thermohydraulics and Neutronics come from both private companies as well as university institutions and state research centers, providing a varied perspective on the work carried out in the area.

First, **Antonio Jiménez (UPM)**, explained the model used to confirm that computational tools give consistent results for the mutual interaction between reactivity coefficients in sodium fast reactors, specifically the Doppler coefficient and sodium voiding.

Next, **Francisco Álvarez (CIEMAT)** presented an anti-reactivity estimate for the ESFR- (European Sodium-Cooled Fast Reactor) SMART reactor shutdown system, obtaining the shutdown margins for different accidents or situations.

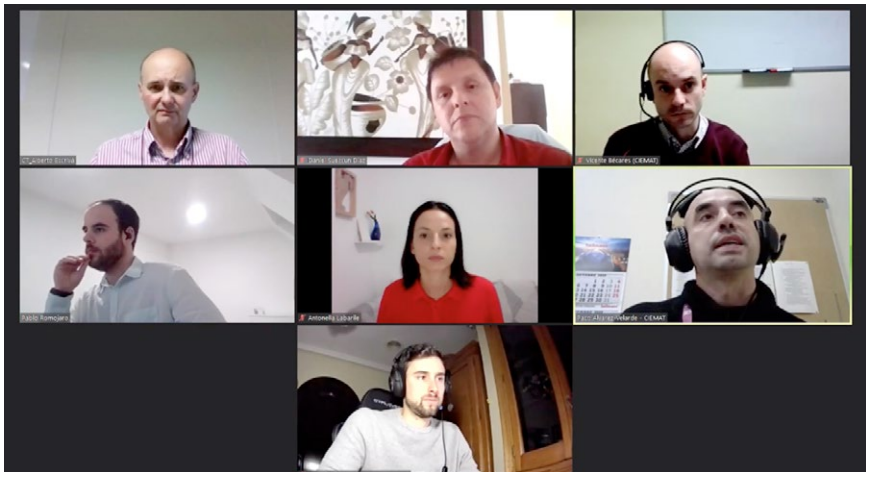
The third presentation by **Pablo Romojaro (BELGIAN NUCLEAR RE-**

**SEARCH CENTER (SCK CEN))** dealt with the analysis of nuclear data to improve the safety of sodium-cooled fast reactors, proposing a new technique to reduce uncertainty.

Next, **Vicente Bécares (CIEMAT)** presented the processing of unresolved resonances for neutronic cross-sections with AMPX and NJOY codes to isolate their effect, finding no significant differences. Criticality calculations also showed minor differences.

In his first presentation, **Daniel Suescún (SOUTH COLOMBIAN UNIVERSITY)** showed a new approach for solving the inverse equation of point kinetics. The integral that contains the dependence for neutron density can be considered as a series of infinite Bernoulli numbers, with very good results when compared with the values reported in the literature.

In the sixth presentation, **Daniel Suescún** presented a numerical study of the stochastic dynamics for



a nuclear reactor using the implicit Euler-Maruyama method to solve the point kinetics stochastic equations. The results of this are quite accurate compared to other existing methods.

To conclude, **Antonella Labarile (ISIRYM from UPV)** showed a simulation coupled in TRACE/PARCS for the BWR Oskarshamn-2 instability event, studying the effects of the cross-sections in the system and reproducing the oscillations in the reactor core.

At the end of the session, various questions were asked, which were satisfactorily answered by the speakers. The session was very enjoyable and 53 unique users were connected through the streaming of the meeting..■

# Session 20

## MAINTENANCE, INSPECTION, AND TESTING (III)

Coordinated by: **ÁNGEL GARCÍA BUENO**

The session allowed for discovering solutions that the industry is using in the face of various existing challenges in Spanish nuclear power plants. It was attended by 27 people in "streaming" mode, and 7 excellent technical and scientific papers were presented, moderated by Angel García Bueno.

The session began **Álvaro Rodríguez Prieto (SGS)** who presented the methodology developed to determine the useful life (based on storage temperature) of components used in safety-related motorized valve actuators, focusing the study on the analysis of the hardening of acrylonitrile joints due to prolonged storage, and in turn, comparing the results obtained for newly manufactured gaskets and for existing gaskets in stock. With this, they have managed to obtain a degradation model and its subsequent validation that allows for estimating useful life and maximum storage temperature.

The second presentation was done by **Carlos Molina Gabriel y Galán**

**(SCHNEIDER ELECTRIC ESPAÑA)** and highlighted the need for monitoring and diagnostic tools and services that allow for decision-making when extending the operational life of nuclear power plants, and in the sense that having a "movie" is better than a "photograph," for capturing the trend to anticipate any possible event, and thus planning repair or modernization actions that allow the assets to be kept in optimal condition, even improving performance with the new technologies incorporated in an upgrade, achieving a more resilient facility.

Next, **Daniel Fernández Romero (NUCLEONOVA)** defined the methodology carried out to face the difficulties of not having sufficient information to determine the acceptance criteria during a dedication process, information that is essential for the

success of the process and that, without it, it is impossible to validate said component. Based on this, they have defined a system for obtaining these criteria, and thus are to determine a range of values to be taken as a reference to verify with reasonable guarantees that the analyzed component will adequately perform the required safety function.

Next, and also from the **NUCLEONOVA** company, **Juan Antonio Muñoz Tirado** presented a methodology for optimizing the acquisition of spare parts during the purchase process of equipment or systems, mainly when they are acquired according to developed technical specifications, and that do not always define exactly the specific requirements for the subsequent acquisition of spare parts. Afterward, he showed some experiences in the supply of equipment, as well as the difficulties that existed in obtaining technical information on spare parts, complicating the dedication process, and finally, he detailed the strategies carried out to solve said problem.

In the fifth presentation, **Ricardo Medina Rueda (TECNATOM)** showed that as a consequence of the aging of the plants and the degradation of associated equipment, they have promoted a new way of working focused on the recovery of nuclear-class equipment with the objective of restoring it to its operating condition, and that, for expensive equipment, for example, shock absorbers, valves, electric motors, etc., it is considered as the optimal solution for reconditioning. Later, he showed the capabilities in this area and the results of different projects, indicating the methodology, improvements included in the equipment, and the savings achieved.

Later, in the sixth presentation, **José María Laporta Pastor (TECNATOM),** commented that in view of the restrictions on the marketing and use of the DOP (dioctyl phthalate) tracer aerosol in the efficiency tests for HEPA filters in HVAC systems of nuclear power plants, it was necessary to perform an assay qualification for the validation of PAO-4 (4 centistoke Poly Alpha Olefin) as an alternative product. From the analysis of the tests carried out on the air filtering system, and the results obtained, it has been concluded that there are no significant differences between the tests carried out using the DOP aerosol as a tracer gas and those carried out with PAO.

In the seventh and last presentation, **Cristina Moclán Soria (TELESPAZIO IBÉRICA)** presented a new methodology for monitoring the state of nuclear power plant infrastructures based on the combination of the synthetic aperture radar interferometry technique and the modeling of information from buildings within the plant's maintenance plans. This technology enables the monitoring and early detection of damage to the structure and enhances decision-making. Finally, she showed a real case study of the application of the methodology in a nuclear power plant in its different phases of the life cycle: construction, operation, and decommissioning.

To conclude, it must be said that the Spanish Nuclear Society once again acted as a unifying agent for all this valuable information and confirmed its ability to put a multitude of professionals and companies in contact, with different and innovative proposals that allow it to respond to the needs of the sector and thus achieve improvements in the operation of nuclear facilities. The session confirmed that the Spanish nuclear industry has the experience, knowledge, and technology necessary to face challenges that arise.■

# Session 21

## FUEL (III)

Coordinated by:
**JAVIER GARCÍA RODRÍGUEZ**

The Technical Session No. 21 in which 4 papers were presented. The presentations were focused on the structure and chemical and isotopic composition of both pellets and pods and their characterization before and after being burned. The session was very entertaining and the subsequent discussion very interesting for viewers who joined the session through streaming.

The presentations dealt with the following topics:

- APPLICATION OF DEEP NEURONAL NETWORKS IN THE AUTOMATIC INSPECTION OF $UO_2$ PELLETS. **David Verdejo (ENUSA)** who presented how artificial vision has evolved recently and how ENUSA has developed automatic pellet inspection equipment based on deep neural networks. Image analysis using deep neural networks allows for better identification of the trained patterns and greater flexibility against small variations in the images. ENUSA and the AUDIAS research group from the Autonomous University of Madrid maintain a collaboration for the development of these techniques.
- STRUCTURAL INTEGRITY OF NUCLEAR FUEL PODS WITH RADIAL HYDRIDES. **Jesús Ruiz Hervías (UPM)** told us that the objective is to investigate the relationship between hydride morphology, specifically the presence of radial

moncobra

# MAINTENANCE AND SUPPORT SERVICES FOR OPERATION OF THERMAL, HYDRAULIC AND NUCLEAR POWER PLANTS

## SERVICES

- Component maintenance
- Operational support services
- Support services for stops and refueling
- Plant decommissioning

## ACTIONS

- Preventive, predictive and corrective maintenance
- Design modifications
- Auxiliary activities in the NSSS
- Boiler and turbine adjustments

## REFERENCES

- Almaraz 1 & 2 NPP
- Cofrentes NPP
- Trillo NPP
- Vandellós 1 & 2 NPP
- Ascó 1 & 2 NPP
- Sta. Mª de Garoña NPP
- José Cabrera NPP
- Valdecaballeros NPP
- Andújar Uranium Plant
- Escombreras TPP
- Castellón TPP
- Aceca TPP
- Escatrón TPP
- Escucha TPP
- Alcudia TPP
- Velilla TPP
- Narcea TPP
- Elcogas TPP
- Los Barrios TPP

cobra

Cardenal Marcelo Spínola, 10 • 28016 MADRID • Tel.: +34 91 456 95 00
www.grupocobra.com • e-mail: moncobra@central.grupocobra.com

GRUPO SENDA

hydrides, and the failure mechanisms associated with the diametral compression test (RCT). For this, a thermo-mechanical treatment was performed to precipitate long hydrides in the radial direction. The results showed that reorientation treatment was very successful.

- APPLICATION OF RAMAN SPECTROSCOPY IN THE CHARACTERIZATION OF NEW CR-$UO_2$ NUCLEAR FUELS (ATF FUELS). **Abel Milena (CIEMAT)**. Increased fuel burn during operation presents new challenges for maintaining integrity threatened by fission gases. Doping agents such as chromium oxide ($Cr_2O_3$) improve the grain size during sintering and therefore the retention of gases. In this study, Raman spectroscopy is used as an approach for analyzing the effect of adding $Cr_2O_3$ to $UO_2$ pellets.

EVALUATION OF THE ISOTOPIC COMPOSITION MEASUREMENTS OF THE GU2 AND GU4 SAMPLES FROM THE ARIANE PROJECT. **Pedro Ortego (SEA)** showed us the evaluation of the results obtained from these samples, which resulted in the rejection of the results of the GU2 sample and full acceptance of the GU4 results. These evaluations are framed within a Collaboration Agreement in R&D in isotopy for irradiated fuel 2020-2023 established between the CSN and SEA.■

# Session 22

## ENGINEERING AND INNOVATION (III)

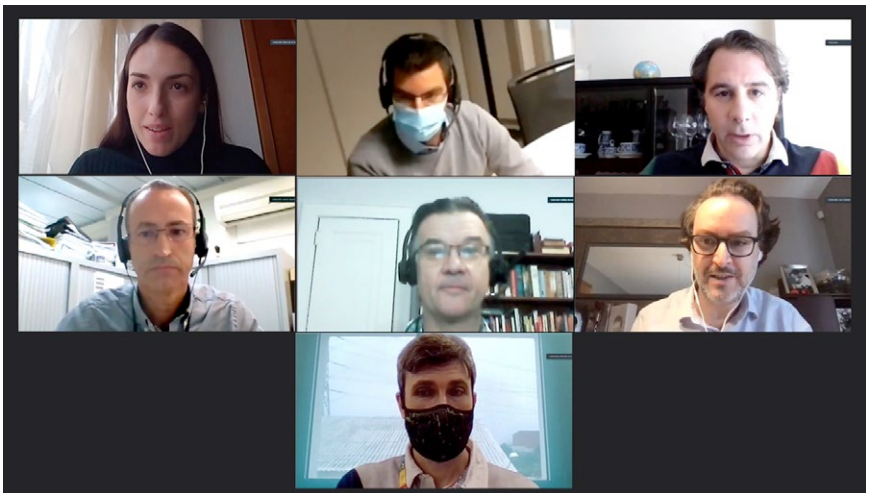
Coordinated by: **EUDARDO SERRA**

Seven papers were presented in the hour and a half available, a real challenge that the speakers were able to overcome by adjusting their presentations to the allotted time. The interest in the topics to be discussed was reflected in the number of live virtual attendees for the session: a total of 57 unique users, a figure that will undoubtedly be increased with on-demand views later on.

The presentation began with **Álvaro Díaz** who explained the feasibility study developed at **EMPRESARIOS AGRUPADOS** for the use of biogas as an alternative energy source at the DONES facility project.

His colleague **Cristian Prieto** spoke next about the project to replace the compressors for the emergency cooling units for the Emergency Water Supply Building at the Trillo NPP, a presentation related to the one done later by **Javier Deltoro** and **Raquel Flores** from **IBERDROLA GENERACIÓN NUCLEAR** about the installation of a new cooling machine for the Cofrentes NPP Non-Essential Chilled Water System.

In his presentation, **Juan Sabater (ANAV)** explained the exercise that they have designed at the Ascó-Vandellós II Nuclear Association to quantify the possible conservatism of the original floor spectra calculations in nuclear power plants, using the case of the Vandellós II NPP as an example in order to improve the estimation of actual margins.



Connecting from the United States, **William Bracey** explained how **TN Americas**, along with the Ingecid Spanish engineering firm, has modified the design of the Matrix dry spent fuel storage system, optimizing it for the conditions that exist in Spain.

The presentation by **Jaume Gaseni** from **ANAV** focused on the refurbishment project for the Ascó I and II NPP Fuel Management System to solve the obsolescence and reliability issues that the passage of time revealed.

Elena de la Fuente concluded the session, a student for the Double Master's in Industrial Engineering and Nuclear Science and Technology from the ETSII from UPM, who presented her work on scaling a passive isolation capacitor for a BWR reactor, developed for the European PIACE project.■

# Session 23

## FUSION (I)

Sponsored by: ensa

Coordinated by: **SOFÍA CORINO**

During this session, we were able to attend five presentations in the field of Fusion and the average attendance was 14 users. The presentations of all the speakers were very interesting, with clear conclusions and also adjusting to a great extent to the established time.

The first of them was given by **Juan de Lorenzo de la Peña (EMPRESARIOS AGRUPADOS)**, who, in his presentation entitled SUSTAINABILITY ANALYSIS FOR ITER NUCLEAR SAFETY CONTROL SYSTEM EQUIPMENT presented us with the process for evaluating compliance with the project requirements for each item of the equipment selected to form part of the final design of ITER's SCS-N (Safety Control System - Nuclear). This

project is being carried out within the framework for the application of the IEC 61513 standard.

Second, **Laura María Ruesga (EMPRESARIOS AGRUPADOS)**, gave her presentation entitled HUMAN FACTORS ENGINEERING APPLIED TO ITER'S CENTRAL NUCLEAR SAFETY SYSTEM where she explained the activities necessary to be developed in the field of Human Factors Engineering applied to the ITER nuclear fusion project, specifically within the scope of the Central Nuclear Safety System (CSS-N). She also emphasized that each of the activities to be carried out must follow requirements imposed by both IEC 60964 (design) and IEC 61771 (verification and validation) standards, as well documentation specific to the ITER project.

Third, **María del Carmen Pérez Melguizo (TECNATOM)** presented with her paper entitled THE CHALLENGE OF ASSEMBLING THE ITER VACUUM VESSEL AND THE ULTRASONIC INSPECTION OF ITS WELDS where she showed the solution developed to handle the inspection of linear (splice plates) and circular (biscuits) seal welds using UT Phased-Array procedures.


Fourth, **Luis Blanco (EQUIPOS NUCLEARES S.A. SME)** presented with his paper entitled ENSA'S PARTICIPATION IN THE CONSTRUCTION OF THE ITER FUSION REACTOR where he explained the scope within the framework of the ITER project including the validation of 16 groups of systems/equipment using the "Design Review" protocol and testing on 1: 1 scale models.

Fifth and finally, **Eduardo Iraola de Acevedo ( POLYTECHNIC UNIVERSITY OF CATALONIA)** presented his paper PARAMETRIC STUDY OF TRITIUM TRANSFER IN LIQUID METAL CHANNELS UNDER MAGNETIC FIELDS FOR NUCLEAR FUSION REACTORS, where the main objective of this final master's paper is the study of the influence of certain relevant magneto-hydrodynamic parameters (MHD) on tritium transport, presenting four different cases.■

# Session 24

## THERMOHYDRAULICS & NEUTRONICS (III)

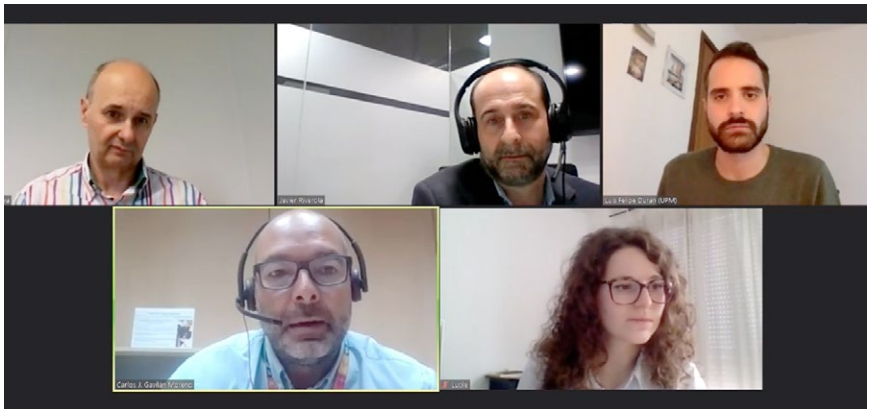
Coordinated by: **ALBERTO ESCRIVÁ**

The speakers for the 5 presentations done in the third technical session on Thermohydraulics and Neutronics come from both companies and university institutions, providing a varied perspective on the work carried out in the area.

First, **Lucile Fallot** presented the modeling for the EPR reactor cooling system with MELCOR 2.2. The complete model consists of 176 control volumes, 249 flow paths, and 120 heat transfer structures, and the correct modeling was verified by simulating a steady-state under normal operating conditions. This presentation is eligible for the Master's Final Project Award.

Next, **Luis Felipe Durán (POLYTECHNIC UNIVERSITY OF MADRID (UPM))** showed the work done to generate a realistic model of the NuScale SMR modular reactor core which shows the capabilities of the UPM simulation platform for obtaining Best Estimate results, observing the physics of the reactor in detail.

In the third presentation, **Luis Felipe Durán** analyzed various radial discretizations for a fuel element model for the NuScale reactor to be used in the COBAYA-CTF platform. The objective is to select the discretization that achieves the most realistic results with the lowest computational cost.



Next, **Javier Riverola (ENUSA)** explored the use of neural networks to predict heat flow as an alternative to the aforementioned statistical correlations for PWR reactors with current fuel designs on some experimental databases, reflecting on the advantages and drawbacks of neural networks compared to traditional statistical correlations.

To conclude, **Carlos Gavilán (IBERDROLA)** presented an analysis of thermo-hydraulic instabilities of BWRs using entropy in the period of recurrence for the system orbits, considering that this methodology is a more reliable measure of repeatability.

At the end of the session, various questions were asked, which were satisfactorily answered by the speakers. The session was very enjoyable and 50 unique users were connected through the streaming of the meeting.■

# Session 25

## MAINTENANCE, INSPECTION, AND TESTS (IV)

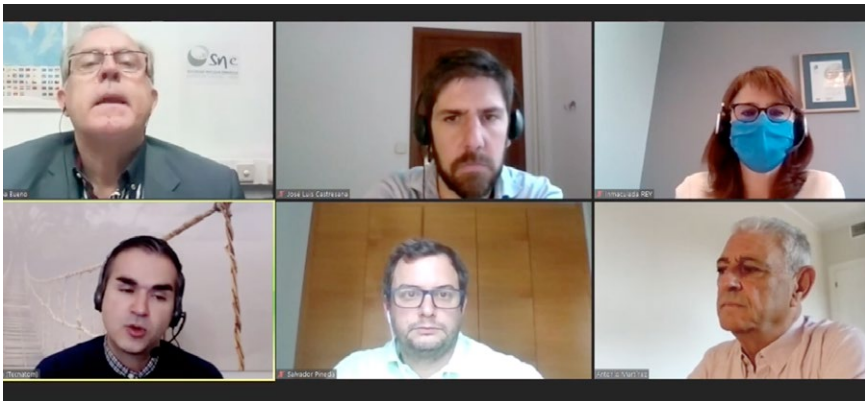
Coordinated by: **ÁNGEL GARCÍA BUENO**

The session was adjusted to the scheduled time and allowed for discussing the different solutions that the industry is using in Spanish and French nuclear power plants. It was moderated by Angel García Bueno, and in it, 6 excellent technical presentations were presented, with a "streaming" attendance of 20 people.

The session was opened by **Amador Sillero (TECNATOM)** who commented that in view of the life extension of nuclear power plants, it is necessary to verify the status of certain civil works structures, such as the walls of the containment building or the biological wall, among others. To this end, and based on the experience historically acquired in the field of non-destructive testing after many years of development of inspection techniques, a technique based on infrared thermography has recently been developed, and this is considered optimal since it allows for the detection of delaminations inside the material before they surface.

In the second presentation, **Antonio Martínez (GDES)** explained the process for eliminating accumulated deposits in the interior water distribution system for the two natural draft towers for the Cofrentes NPP. The action was due to having recently observed a decrease in the efficiency of the cooling towers and as an associated cause was that the system was more or less covered by layers of mainly calcium carbonate. These layers caused the obstruction of the dispersers and reduced their proper functioning. After the successful cleaning process, the towers recovered their design efficiency.

Next, **Salvador Pineda (GDES REVANTI)** did two presentations in a row. In the first, he described a new technique for repairing the interior of the moisture separating superheaters and their purge collection



tanks due to wear caused by the effect of erosion-corrosion that sometimes occurs on the side and bottom of said equipment and which, over time, can cause thickness losses that make the equipment unusable. The repair consists of a multilayer coating of metallic alloys using a manual "arc spray" system and the process was validated using control specimens and conducting adhesion and thickness tests by metallographic cutting.

He then explained GDES' participation in the construction of the ITER platform buildings, in which it is specifically responsible for the application of various specific coatings inside the buildings under construction where the ITER nuclear fusion reactor will be located and its outbuildings. The different technical coating solutions to be applied and the control methods that guarantee the proper application of these were described according to the technical requirements of each room or cubicle of the facility.

In the second to last presentation, **Inmaculada Rey (SCHNEIDER ELECTRIC ESPAÑA)** presented the activities and requirements for a testing laboratory whose activity is oriented towards assessing the conformity of low voltage protection and performance equipment, bearing in mind the product and testing standards that apply to this type of equipment, considered key to the safety and continuity of operation of electrical facilities. On the other hand, and given the criticality and demands of the nuclear power plant sector, in addition to the need for flexibility in situations that do not allow for waiting, its S-Lab laboratory offers maximum flexibility without compromising the quality required.

To end the session, **José Luis Castresana (TECNATOM)** described the development and fine-tuning of an inspection system that, combining the ultrasonic inspection method and the eddy current method, allows for quick and accurate inspection of nozzle penetrations where intranuclear instrumentation sensors access the core region of the vessels of PWR plants. The inspection system consists of mechanized equipment and an inspection module that was initially validated in the laboratory and, finally, was successfully used to inspect the 50 existing nozzles at the Almaraz 1 NPP.

The content of the interesting presentations sparked the interest of the attendees, as evidenced by the questions asked to the speakers, which were answered without any issues. Finally, the moderator congratulated the speakers and virtual attendees for the good development of the technical session.■

# Session 26

## FUEL (IV)

Coordinated by: **JAVIER Gª RODRÍGUEZ**

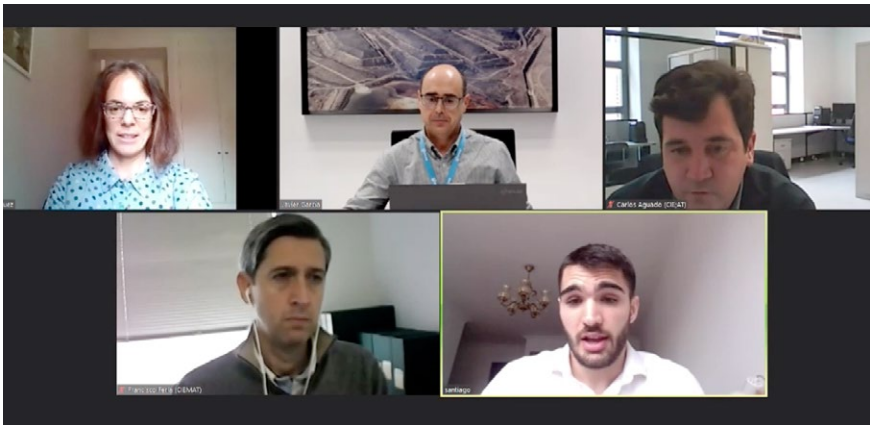
6 papers were presented. The presentations were focused on research work aimed at knowing the behavior of spent fuel in its storage. Once again there was great participation by the virtual attendees who reached 27 unique users.

The presentations dealt with the following topics:

- SIMULATION OF URANIUM THERMAL INERTIA FROM AN EQUIV-

ALENT MATERIAL IN SPENT FUEL PODS WITH STAR-CCM +. **Santiago López García (UPM)**. This study aims to validate a methodology that to avoid the modeling of uranium pellets in transients (great computational savings), in such a way that, from the calculation of equivalent materials and by suitably modifying the properties of the pods, it is possible to introduce the effect of thermal inertia of the pellets.

- METHODOLOGY FOR ASSESSING THE INTEGRITY OF SPENT FUEL BARS IN THE PROCESS OF REFLOODING AFTER DRY MANAGEMENT. **Francisco Feria (CIEMAT)** shows us a methodology based on FRAPCON-xt for thermo-mechanical analysis of a highly burned fuel bar when subjected to drying conditions and subsequent reflooding. About the maximum pod circumferential tension parameter due to thermal shock.
- AUTOMATION OF CRITICAL ANALYSIS OF BWR SPENT FUEL POOLS AT THE PEAK OF REACTIVITY. **Miriam Vázquez Antolín (ENUSA)**. Criticality analyses on BWR spent fuel pools should be performed at the peak of reactivity after burning the Gd. This value depends on the design of the fuel and the conditions in which it has operated. ENUSA is updating its methodology for criticality calculations in BWR fuel pools.



- THERMO-MECHANICAL ANALYSIS FOR A SPENT NUCLEAR FUEL CONTAINER. **Julio Benavides (UPM)** showed us the temperature distribution obtained by means of CFD simulation, which have been introduced in an ABAQUS finite element (FE) code. ABAQUS has made it possible to carry out mechanical analysis for the container, obtaining the thermal expansions and the mechanical stresses they cause.
- FRAPCON-XT INTERNAL PRESSURES VALIDATION FOR THE CHARACTERIZATION OF SPENT FUEL BEHAVIOR AT DRY STORAGE. **Carlos Aguado (CIEMAT)** showed us the importance of precise characterization for the internal pressure of fuel rods due to its direct relationship with integrity degradation mechanisms. This study validates the results of FRAPCON-xt against experimental data.
- MAJOR SENSITIVITIES IN FRAPCON-XT MODELING OF HIGH BURN-UP FUEL RODS DURING DRY STORAGE TO DESIGN AND IRRADIATION VARIABLES. **Carlos Aguado (CIEMAT)**, a continuation of the previous presentation. Sensitivity analyses can help to understand effects and identify relevant parameters for predictions. This is done on the stress of the pod at the beginning of dry storage.■

# Session 27

## NUCLEAR SECURITY, LICENSING & PSA (I)

Coordinated by: **ANA ALONSO**

Session was moderated by Ana Alonso (Westinghouse). In it, 7 papers were presented, which dealt with the following topics:

- THE IAEA'S "GRADED APPROACH" IN THE SEISMIC PROJECT FOR MEDIUM AND LOW HAZARD NUCLEAR FACILITIES. **Francisco Beltrán (BELTRÁN INGENIEROS)**. An application of the "graded approach" in selecting the earthquake plan for a nuclear research facility was presented.
- IMPACT ON FIRE RISK FOR THE IMPROVEMENTS IMPLEMENTED AS A RESULT OF INSTRUCTION 30 FROM THE NUCLEAR SAFETY COUNCIL AT THE COFRENTES NUCLEAR POWER PLANT. **Tomás Villar (IBERDROLA)**. The current revision of the Cofrentes fire PSA was presented, which includes the improvements for IS-30, and the risk of fire in a scenario in which said improvements had not been done.

- ASSESSMENT OF A CORRELATION FOR HYDROGEN AND CO REMOVAL BY PASSIVE AUTOCATALYTIC RECOMBINER. **Joan Fontanet (CIEMAT)**. The work carried out by CIEMAT on the evaluation and critical

review of patented correlations for the efficiency of gas recombination was presented.

- THE CHALLENGES OF HUMAN FACTOR ENGINEERING IN THE LICENSING OF MODULAR REACTORS. **Borja Hervás (TECNATOM)**. The method which must be followed for new designs in relation to human factors engineering was reviewed to comply with relevant aspects of safety.
- ESTIMATION OF AGE-DEPENDENT RELIABILITY PARAMETERS CONSIDERING IMPERFECT MAINTENANCE AND A THRESHOLD AT THE STARTING POINT OF EQUIPMENT AGING. **Rubén Mullor (UNIVERSITY OF ALICANTE)**. The proposal for the estimation of parameters that is put into practice from the data from a safety team for a Nuclear Power Plant was presented.
- IMPACT OF THERMOMECHANICAL PHENOMENA ON THERMO-HYDRAULIC ANALYSIS. APPLICATION TO LBLOCA SEQUENCES. **Jorge Sánchez Torrijos (UPM)**. An alternative line of work for transient thermo-hydraulic and thermo-mechanical codes was presented.

PULSAR AND IAEA CRP J15002 PROJECTS. WARNINGS, BEST PRACTICES, AND RECOMMENDATIONS ON USE OF SOFTWARE TOOLS FOR MAKING DECISIONS RELATED TO EPR. Rafael J. Caro. The IAEA research project, from the title of the paper, was presented.■

## Session 28

## QUALITY, REGULATIONS, ORGANIZATION & HUMAN FACTORS (II)

Coordinated by: **ÁNGEL GARCÍA BUENO**

In Technical Session 28, the speakers discussed topics as diverse as the need to rethink relationships in the working environment and what we will find when returning to face-to-face work from the point of view of the changes that we will have to deal with regarding the company-worker dichotomy presented by **Eliana Guillén (TECNATOM)**. The changes made in the NATURGY Quality Department due to an internal restructuring of the company were also presented, shown by **Gregorio Socorro (NATURGY)**, as well as the impact that the pandemic had on the management of internal audits and suppliers and the challenge of adaptation to a remote approach as these evaluation audits could not be carried out in person, which was presented by **Robert Ventura (ANAV)**. We concluded this second session with the presentation from **Ferrán Tarrasa (ANAV)** who explained the proper use of checklists in technical environments and their connection with other sectors such as aviation and medicine.

The content of the presentations sparked the interest of the attendees, as demonstrated by the questions asked to the speakers. The session was carried out without technical interruptions and with a smooth pace that made it easy to follow them.■

## Session 29

## DECOMMISSIONING (II)

Sponsored by: orano

Coordinated by: **DOMINGO GARCÍA**

- THE FUTURE: OPTIMIZING NUCLEAR DECOMMISSIONING. E**nrique Benavides.**

  The presentation reviewed some of the actions that can lead to delays and extra costs for decommissioning. Analysis and implementation require a very detailed study that is difficult to integrate into planning schedules. The preparation of the license and the structure of the project organization are basic pillars from which to start. The management of waste and materials, execution contracts, management of spent fuel, and the approach to other industrial sectors (gas, oil) in the management of decommissioning are basic points for the analysis and encourage everyone in its development.
- INTERNATIONAL ANALYSIS OF THE DECOMMISSIONING OF NUCLEAR POWER PLANTS. **Juan Manuel Camarero.**

  The decommissioning of nuclear power plants is and will be in the not-too-distant future become a great challenge for the national and international nuclear industry. To undertake decommissioning successfully, it is important to acquire information in the form of lessons learned from decommissioning already carried out both in our country and in neighboring countries. Similarly, coordination between the different companies/institutions involved in them will be of vital importance in order to reduce both costs and project times, maintaining safety above all else.
- DECOMMISSIONING OF THE QUERCUS PLANT FOR THE MANUFACTURE OF URANIUM CONCENTRATE. **María Luisa Bordonaba Pérez** & **Esther Sánchez Benavente.**

  The decommissioning and closure project for the Quercus uranium concentrate manufacturing plant located in Saelices el Chico (Salamanca) is affected by the problem of acid drainage created at the

## SERVICIOS NUCLEARES

Descontaminación
Tratamiento de Residuos
Desclasificación de Materiales y Terrenos

## MANTENIMIENTO

Limpieza Industrial
Mantenimiento Mecánico
Mantenimiento de Obra Civil
Mantenimiento y Servicios de Pintura

## CONSTRUCCIÓN

Obra Civil
Edificación
Promoción

## TELECOMUNICACIONES

Diseño, ingeniería de detalle, suministro, pruebas FAT y SAS de Sistemas
Procedimientos y Supervisión
Cursos de Formación O & M

Beethoven, 10
43007 Tarragona
www.marsein.com

Telf: 977 245 880
Fax: 977 245 875
marsein@marsein.com

marSein

TÜVRheinland CERT ISO 9001 ISO 14001 BS OHSAS 18001

IAF

ENAC CERTIFICACION

site that it shares with the old mining operations from which the processed minerals were extracted. The work will be carried out in three phases: in Phase I, the industrial mineral processing facilities and the static leaching mineral cleaning site will be decommissioned; In Phase II, water management activities will continue, and on-going remediation actions and projects will be intensified to avoid the generation of acidic water, and in Phase III, the remaining facilities and structures will be dismantled, including the refurbishment of the Tailings Dyke as a fundamental structure for the safe and final disposal of the radioactive waste deposited there. Phases II and III will be progressively adapted to the circumstances and evolution of the site.

Its owner, ENUSA INDUSTRIAS AVANZADAS, plans to start the execution of Phase I after the year 2021, once it has obtained, among others, the mandatory authorization as a first category nuclear fuel cycle radioactive facility.

- MITIGATION OF WASTE AND RISK HAZARDS IN A REACTOR DISMANTLING PROJECT. **Stephanie Laurier.**

  Lessons learned on the ground around the world have shown that early preparation focused on waste and risk management brings tangible benefits to the deployment of decommissioning projects. Thanks to 14 completed D&D projects and 7 on-going in Germany and the US, Orano has been able to establish an experience feedback program.

  The presentation focused on program and project management, accelerated planning to significantly minimize costs, and D&D operations for spent fuel and waste management to streamline the bottom line and reduce risks.

- NUCLEAR DECOMMISSIONING & DISMANTLING ACROSS THE BWR FLEET. **Marcos J. Sánchez Ramos.**

  Recently, D&D projects have increased globally as a result of the nuclear shutdown many countries have faced in recent years. GE HITACHI leads the decommissioning industry with the Primary Segmentation System (PSS), a global solution with local execution that enables all internal components and the reactor vessel to be efficiently processed with state-of-the-art technology and a unique segmentation methodology.

  During the presentation, the current status of the ongoing projects for the Oyster Creek and Pilgrim Nuclear Power Plants was explained, which are being executed on time and at cost due to the extensive experience acquired from other international decommissioning projects such as the segmentation of vessel internals completed at the Oskarshamn Nuclear Power Plant (OKG) 1 & 2 in Sweden.

- WASTE STRATEGY DEFINITION AND TECHNICAL SOLUTIONS FROM ORANO. **Yannick Pons**.

  Orano, with its experiences in its own facilities and its experiences for external clients, can offer various solutions and support in the management of nuclear waste and thus contributes to reducing costs and saving time, with the guarantee of a solution that works in the market. The presentation allowed for a brief but overall vision of what ORANO proposes in the management of nuclear waste.

- ALARA JUSTIFICATION FOR THE RELEASE OF THE JOSÉ CABRERA NUCLEAR PLANT SITE WITH RESTRICTED USE . **María Elisa Gimeno Blesa**.

  In this presentation, the methodology applied to justify the release of the José Cabrera NPP site for restricted use (industrial use) was presented. This methodology is based on that indicated in NUREG-1757 and consists of performing a cost-benefit analysis to assess the performance of additional restorations that allow for release without use restrictions. The results have made it possible to verify that the proposed Release Levels are ALARA and therefore justify the release of the site for the intended industrial use.■

# Session 30

## RADIOLOGICAL PROTECTION & NUCLEAR MEDICINE (II)

Coordinated by: **ISABEL VINIEGRA**

**Gonzalo Felipe García (UPM)** presented a comparative study between neutronic fields produced with Arc Therapy (PMAT) versus those generated with conventional intensity-modulated proton therapy treatment. Arc Therapy with monoenergetic protons is a proton therapy modality in the research and development phase which aims to take advantage of irradiation of tumor volume under fields with a full 360° angle using monoenergetic protons.

**Irati Andrea Oleag (IDOM)**, as part of an internal innovation project, IDOM has carried out computational simulations with MCNP software to investigate which set of materials available on the market are optimal for shielding a 14 MeV neutron

generator, keeping in mind key concepts such as the weight of the assembly, the economic cost, and always following the ALARA principle. For the case of equivalent volume, beryllium appears as the best reflector for low energy neutrons, carbon for higher energy neutrons, and steel appears as the best material for shielding neutrons between 10 and 15 MeV.

**Marina Sáez Muñoz (UPV)**. The environmental radioactivity laboratory participates as a support laboratory in case of a radiological emergency, such as nuclear or radiological accidents and terrorist attacks with the use of dirty bombs. In these cases, two of the main radionuclides to be determined are radiostrontiums (89Sr and 90Sr). A rapid method is presented for the determination of these radiostrontiums in aerosol and vegetation filters based on the use of plastic scintillation resins.

**Gonzalo García (UPM)** presented a project that is part of the contributions to neutron dosimetry and shielding against neutrons in proton therapy facilities developed in recent years by researchers from the ETSII-UPM. The work includes the development and modeling, using the MCNP6 code, of a new neutron area monitor, totally passive, based on dysprosium activation.

**Aina Noverques (UPV)** presented a research study that focuses on the evolution of radon transfer from water to air on a pilot scale. Initially, in the tests carried out, radon levels are measured simultaneously in water, previously enriched, and in air. This allows for an experimental study for radon behaves in both media, as well as the growth rate in them for the conditions tested. Subsequently, once the radon source is removed, the same sampling and analysis procedure is followed, considering the decay of radon and its consequent decrease in the concentration of radon in water and air.■

# Session 31

## COMMUNICATION

Coordinated by: **LAURA GALA**

During this session, how communication and dissemination of nuclear science or technology can become tools that generate a positive impact in situations as extraordinary as a hypothetical nuclear emergency or a pandemic were explained in detail.

In the first presentation, **Roser Sala (CIEMAT)** presented a pilot study (the European CONFIDENCE project), where, through the perception of a sample of non-expert participants on the information contained in SMS messages, she showed which variables are necessary to achieve effective communication in the event of a radiological or nuclear emergency.

For this, she stressed that the information must arrive as soon as possible, be concise, transparent, and use language that is easy to understand, using not only SMS, but also WhatsApp, notifications, social networks (preferably Twitter), radio, public address in nearby areas or in person, and always certifying that it comes from trusted sources.

Next, **Pablo García (NUCLEAR YOUNG PEOPLE)**, presented the strategy of this commission to adapt its outreach activity, which has become totally digital, to the COVID-19 situation. To achieve this, they have used platforms for lectures, basic courses, seminars, interviews, and participation in forums, in streaming format, and responding "on-demand," especially on social networks.

Some of the most notable conclusions have been that the audience numbers are much higher than for face-to-face activities since it is possible to reach audiences from Latin America and that all this process has led them to establish themselves as one of the reference points for the dissemination of nuclear science and technology in Spanish.

Finally, **Carolina Hernández (WiN SPAIN)** showed that in a world where digital communication travels faster than Cherenkov radiation, information must not only be clear, concise,

and truthful, but also extremely up to date. For this reason, she explained that they have created a communication commission that allows them to increase their presence on social networks, build the "WiN brand" and promote collaboration with disseminators and communicators on nuclear energy and its applications.

She also presented the results of this effort, more than 1,500 followers on Twitter, 450 on Instagram, 410 contacts on LinkedIn, and about 250 followers on Facebook who support her good work.

To conclude, given the interest that the exhibitions sparked and given their evolutionary nature, the speakers were invited to present the progress achieved by their respective projects at the next edition of the Annual Meeting.■

# Session 32
## WASTE MANAGEMENT (III)

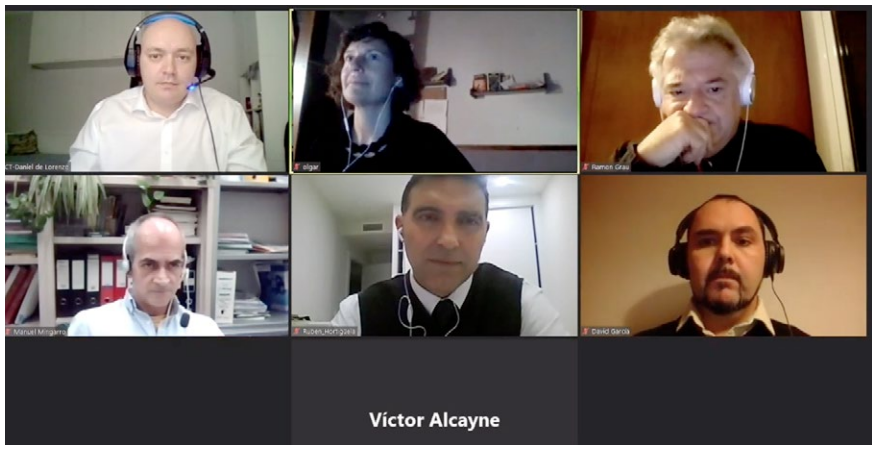
Coordinated by: **DANIEL DE LORENZO**

The session consisted of 5 presentations and had an audience of 16 people.

The first presentation was done by **Manuel Mingarro (CIEMAT)** and showed the experimental results of the diffusion of HTO, $^{36}$Cl, $^{85}$Sr, and $^{133}$Ba in FEBEX bentonite as a function of the dry density of compaction and temperature. By increasing the compaction density, transport through the porous medium that is bentonite becomes more difficult, decreasing the diffusion coefficient, while for the same compaction density, an increase in temperature accelerates diffusive transport and the apparent diffusion coefficient increases significantly.

**David García (AMPHOS)** company did the second presentation referring to the comparative study of actinide and lanthanide adsorption processes in clays. The main objective of the work is the creation of a reliable and proven adsorption parameter database, with direct application in safety exercises and performance evaluation for temporary and definitive radioactive waste storage facilities.

The third presentation was done by **Olga Riba (AMPHOS)** and presented a 1D Model of reactive transport for the alteration of spent fuel that integrates radiolysis and solute transport. The model has been validated by simulating different spent fuel dissolution experiments, evidencing its ability to reproduce experimental data obtained in the presence of $H_2$(g) and Fe(s).




In the fourth presentation, **Víctor Alcayne (CIEMAT)** presented the measurement of the effective capture sections of the $^{244}$Cm and $^{246}$Cm isotopes by means of experiments conducted at CERN's n_TOF facility. Its importance lies in the fact that both isotopes can form heavier elements in the reactor such as Bk or Cf and they are two of the minor actinides with a large contribution to the residual heat in irradiated fuel. The analysis of the experiments leads to a significant reduction in the uncertainty of the measurement compared to previous experimental data.

The last presentation was done by **Ramón Grau Girona (CONDORCHEM ENVITECH)** and **Rubén Hortiguela Martínez (ANAV)**, and they presented the selective elimination of Co-60, Cs-137, and/or Sb-125 in liquid effluents with high conductivity by adding granular adsorbents. These granular adsorbents have been successfully tested at the Ascó NPP laboratories where, in addition to selectively removing each isotope in a matrix with high conductivity, the adsorbent materials are miscible with each other, allowing them to be mixed in the proportions determined by the activities of the isotopes of interest.■

# Session 33
## NUCLEAR SECURITY, LICENSING & PSA (II)

Coordinated by: **ANA ALONSO**

7 papers were presented, which dealt with the following topics:

- THE IMPORTANCE OF CHARACTERIZING INPUT UNCERTAINTIES IN SEVERE ACCIDENT ANALYSES. THE EFFECT ON POOL SCRUBBING MODELING IN THE FUKUSHIMA UNIT 1 SEQUENCE. **Rafael Bocanegra (CIEMAT)**.

  A study focused on the characterization of the input parameters necessary for calculating fission product scrubbing in the suppression pool for a BWR nuclear reactor.
- RISK-BASED PRIORITIZATION IN THE CONTEXT OF TECHNOLOGICAL OBSOLESCENCE. **Isabel Marton (UPV)**.

  A study based on the prioritization of obsolescence issues and an application example for obsolete safety-related equipment.
- APPLICATION OF PROBABILISTIC SAFETY ANALYSIS METHODOLOGY WITH TIME-DEPENDENT SUCCESS CRITERIA. APPLICATION TO LONF-ATWS SEQUENCES IN PWR REACTORS. **Jorge Sánchez Torrijos (UPM)**.

  A study is presented within the framework of the probabilistic safety assessments (PSA) of ATWS

sequences in Westinghouse PWR reactors and the methodology used for obtaining the evolution of the success criteria throughout an operating cycle.

- DEFENSE IN DEPTH AND DIVERSITY IN DIFFERENT REGULATORY ENVIRONMENTS. **Ricardo García Aparicio (TECNATOM)**

  The approach of two regulatory frameworks, 10CFR50 and IAEA, on the safety strategy for nuclear facilities was presented.

- THE LATEST IN EMERGENCY MANAGEMENT AT THE COFRENTES NPP: ALWAYS PREPARED. **Nereida Sánchez (IBERDROLA)**.

  The emergency management system implemented by the Cofrentes NPP was presented as well as the comprehensive approach to emergency management.

- THE SALTO MISSION (IAEA) AT ANAV AND ITS APPLICATION FOR THE LONG-TERM OPERATION PLAN. **David Martínez Veciana (ANAV)**.

It was presented how the SALTO (Safety Aspects of Long Term Operation) missions are being prepared for the Ascó and Vandellós II plants.

- CONTRIBUTION OF PORTABLE EQUIPMENT FOR RISK REDUCTIONS IN SHUTDOWNS. **Xavier Garreta (VANDELLÓS II NPP)**.

One of the actions for the Vandellós II NPP was presented to improve safety with regard to events beyond the design bases, the acquisition of portable equipment, and its support for fixed plant equipment in the highest risk operating states.■

# Session 34

## FUSION (II)

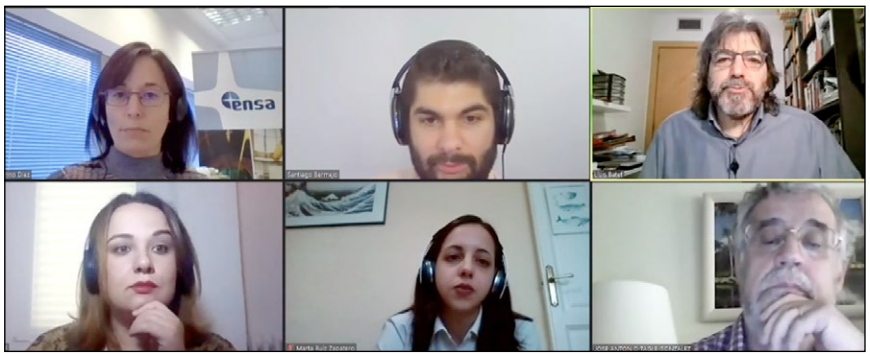
Sponsored by: ensa

Coordinated by: **SOFÍA CORINO**

During this session, we were able to attend five presentations in the field of Fusion and the average attendance was 15 users. The presentations from all the speakers were very interesting, with clear conclusions, and also very much in line with the established time.

The first of them was given by **Santiago Bermejo (EMPRESARIOS AGRUPADOS)**, who in his presentation entitled DESCRIPTION OF THE DESIGN BASE REFERENCE EVENTS FOR THE ANALYSIS OF DONES ACCIDENTS presented the methodology for the analysis of consequences of the design base reference events and proposes to take the previously identified initiating events and study the behavior of the systems in these scenarios through their success or failure.

Second, **Marta Ruiz (EMPRESARIOS AGRUPADOS)** presented her paper entitled CHALLENGES IN THE PREPARATION OF BASIC DESIGN DOCUMENTS FOR THE DONES PROJECT where the different challenges that have been encountered were addressed, and how they were solved, either overall for all systems or individually in certain particular cases, working with the available tools and always in support of the project's safety standards.



Third, **Elena Fernández (EMPRESARIOS AGRUPADOS)** presented her paper entitled METHODOLOGY FOR SAFETY CLASSIFICATION OF STRUCTURES, SYSTEMS, AND COMPONENTS FOR THE DONES FACILITY where the methodology created for the safety classification of the Dones facility was presented. The challenges encountered and the solutions proposed were highlighted to make this methodology as functional as possible, and in turn, to fit it into the Spanish regulatory framework.

Fourth, **Lluis Batet (UPC)** presented his paper entitled DYNAMIC ANALYSIS OF A SUPERCRITICAL $CO_2$ POWER CONVERSION SYSTEM FOR DEMO USING A MODELICA where the dynamic modeling of the reference $CO_2$ cycle was presented using the Modelica language and whose objective is the future definition of control strategies. The flexibility and ability to simulate dynamic conditions was shown, demonstrating its potential and interest for future developments.

Fifth and finally, **José Antonio Tagle (UAM)**, presented his paper FUSION ENERGY AS AN ENERGY ALTERNATIVE IN THE ENERGY TRANSITION: ELECTRIC UTILITIES AND FUSION MARKET PERSPECTIVE, where the main objective of this presentation was to try to answer the 4 main questions for fusion: Is it an alternative energy source? When can a nuclear fusion plant be ready? What should be the next steps? Is fusion power on schedule?■

# Session 35

## DECOMMISSIONING (III)

Sponsored by: moncobra INGECID

Coordinated by:: **DOMINGO GARCÍA**


- 3D DIGITAL SIMULATION OF COMPLEX DISMANTLING PROJECTS USE CASE: CHINON A2 DISMANTLING PROJECT. **Paola Ontiveros.**

  The presentation focused on the simulation of the Chinon A2 reactor decommissioning scenario using DEMplus® for nuclear software. The reactor, located in the Avoine community in France, is the first AGR-type UNGG reactor to be dismantled worldwide; it is highly complex due to its large size and mainly due to the number of graphite blocks contained within the core.

  The use of this digital technology has allowed EDF to answer several questions about the processes envisioned for decommissioning, as well as anticipating and managing uncertainties. On the other hand, thanks to its 3D BIM technology, the simulation carried out has made it possible to centralize all the information of the project. By becoming a single repository of information, it has allowed for sharing the project effectively with the interested parties and in the same way to carry out optimizations to the reference scenario that are easily comparable between them.

- PROYECTO SHARE: DETERMINING A ROADMAP FOR INNOVATION IN DECOMMISSIONING. **Emilio García.**

  The "SHARE" project (StakeHolder-based Analysis of REsearch for Decommissioning) is being developed within the framework of the EURATOM Horizon 2020 program with the aim of proposing an inclusive roadmap for research, in technical and non-technical fields, that allows Stakeholders to jointly improve safety, reduce costs, and mitigate the environmental aspects of decommissioning through a consultative and participatory process for the decommissioning community worldwide. The paper presented the project as a whole, reporting on the status of the work in progress and sharing the first preliminary results obtained.

- DIGITAL SOLUTIONS FOR DECOMMISSIONING. **Joaquín Toubes Tova.**

  The presentation was focused on digitization, which is considered key for carrying out efficient management of the decommissioning of nuclear facilities. TECNATOM is currently working on the application of digital technologies to try to respond to certain needs such as: improving waste management, making predictions of the volumes of waste generated during operation and decommissioning based on "what if" scenarios, facilitating monitoring activities, work management, and task planning, increasing productivity and improving document management, having knowledge of the current condition of the plant, making it possible to ensure the operability and integrity of certain systems that are critical during the first phases decommissioning or even improving training and education.

- TRANSMISSION OF KNOWLEDGE AND TRAINING THROUGH THE SOUL APPLICATION TO FACILITATE THE TRANSITION FROM OPERATION TO DECOMMISSIONING IN A NUCLEAR PLANT. **Ángel Gómez Sáez.**

  During the transition phase to the decommissioning of a nuclear power plant, it is necessary to carry out a significant reorganization of personnel, adapting the organization from an operation-centered approach to a completely different approach such as decommissioning. The operational waste management and decommissioning processes are new processes that can be reduced through the use of digital means such as the SOUL application, developed by TECNATOM. This training has already been tested satisfactorily at the Santa María de Garoña Nuclear Power Plant during the health emergency caused by COVID-19, obtaining very good evaluations from the students and acceptance by the Nuclear Safety Council.

- PROTOTYPE FOR RADIATION MEASUREMENT INSIDE OF BURIED OR EMBEDDED PIPES. **Pablo Piñeiro.**

  During the presentation, the new equipment developed to measure for the characterization of buried or embedded pipes was presented, allowing their radiological characterization and providing new solutions for future decommissioning. Additionally, the design details for its use, data acquisition, decontamination, etc., as well as the tests obtained in the laboratory with satisfactory results were shown.■

# POSTER SESSION

Coordinated by: **CLAUDIA LÓPEZ DEL PRA**

This year, the poster session was very interesting with the participation of **EMPRESARIOS AGRUPADOS, INPROCESS TECHNOLOGY & CONSULTING GROUP, TECNATOM,** and **CIEMAT**. The virtual meeting page hosts the 6 posters presented, which were available to the attendees throughout the virtual meeting day. During the session, the speakers had 3 minutes for a brief presentation and the remaining minutes were used to answer the questions asked and generate discussion.


The session was opened by **Claudia López del Pra** who presented the activities that CIEMAT carries out for the knowledge management for the EURAD project. EURAD from the European Union brings together all the knowledge of management, implementation, technology, and research for radioactive waste management in Europe. Regarding knowledge management, all existing knowledge is being compiled to ensure its perpetuity, and training and mobility activities were presented.

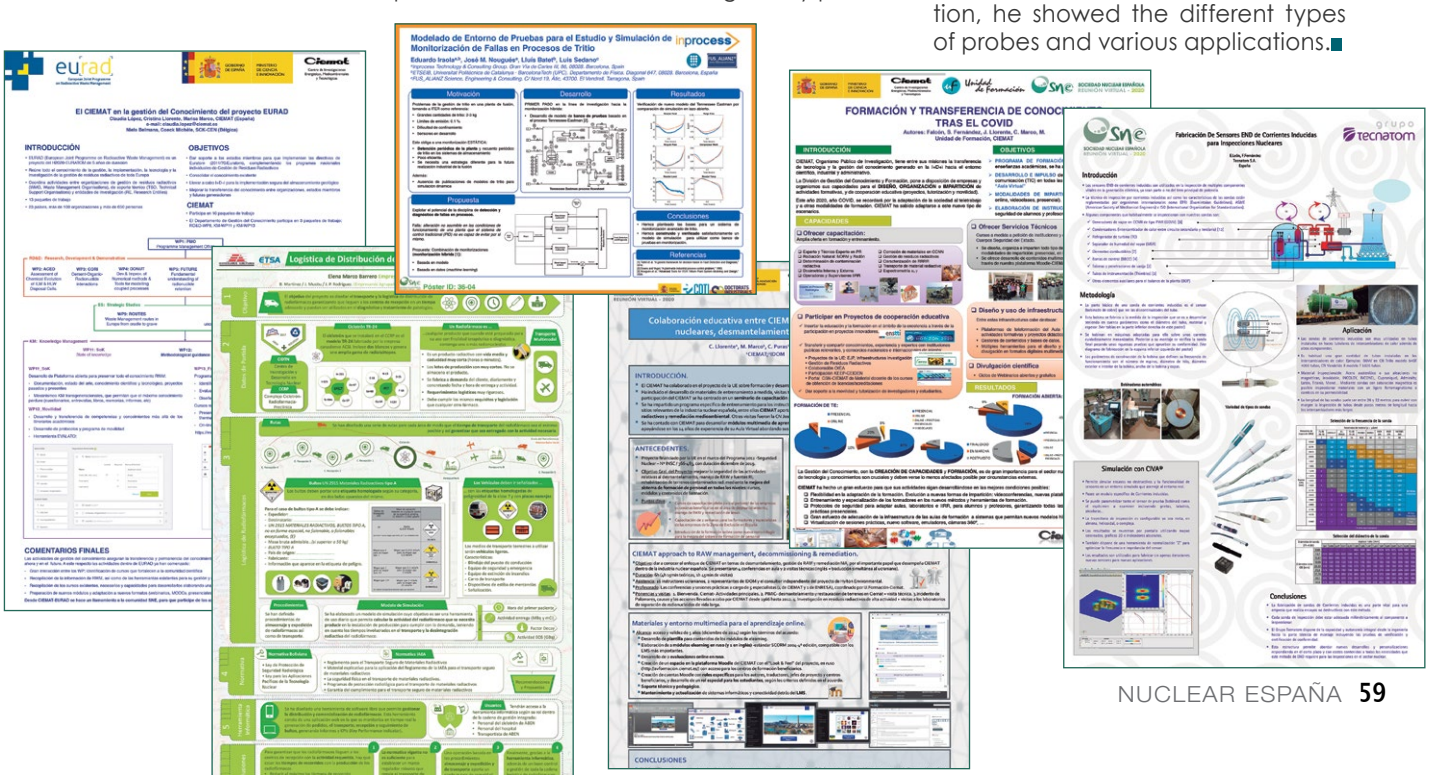
The next poster was presented by **Elena Marco** of EMPRESARIOS AGRUPADOS who explained the modeling and simulation for radiopharmaceutical distribution logistics in Bolivia. All logistics are implemented in a simulation tool that analyzes the times and modes in which radioisotopes are transferred, ensuring that they reach their destination safely and within the specified time.

The third poster presentation was done by **Eduardo Iraola** of INPROCESS TECHNOLOGY AND CONSULTING GROUP who told us about the tritium monitoring provided planned at ITER and how the stoppage of operation is proposed periodically for its follow-up. On the other hand, a monitoring strategy based on the combination of machine learning and plant simulation is proposed.

The following poster was presented by S**usana Falcón** of CIEMAT who told us how CIEMAT's training activities for radiological protection and nuclear technology have been adapted to the current COVID-19 situation, either through videoconferences or online platforms such as Moodle. Some of their activities are face-to-face, so strong safety protocols are followed to ensure safety in the classrooms.

The fifth poster was by **Cristina Llorente**, also from CIEMAT, who told about the collaboration with IDOM for a project on nuclear waste, decommissioning, and land remediation. Among their activities, they have developed various multimedia modules, which are available in Russian, which have facilitated the training of various Ukrainian trainers and are available for a minimum of 5 years, in addition to providing them with technical and pedagogical support.

Finally, **Efrén León** of TECNATOM told us about the last poster presenting induced current END sensors. This technology is a non-destructive testing method based on electromagnetic fields, which allows for evaluating and characterizing defects in materials without producing any type of alteration in them. In the presentation, he showed the different types of probes and various applications.■



# The best PAPERS

**QUALITY, REGULATION, ORGANIZATION AND HUMAN FACTORS AREA**
**LISTAS DE COMPROBACIÓN, SALUD PÚBLICA Y LOS PROCESOS DE INGENIERÍA EN ANAV**
Ferrán Tarrasa Blanes

**FUEL AREA**
**INTEGRIDAD ESTRUCTURAL DE VAINAS DE COMBUSTIBLE NUCLEAR CON HIDRUROS RADIALES**
Jesus Ruiz-Hervias, Miguel Cristóbal Beneyto, Daniel Pérez Gallego

**DECOMMISSIONING AREA**
**MITIGATING RISKS IN NUCLEAR REACTOR DECOMMISSIONING**
Jean-Michel Chabeuf

**SSC DESIGN AND BEHAVIOR AREA**
**MODERNIZACIÓN DE LA FLOTA DE TRANSFORMADORES AUXILIARES DE C.N. ASCÓ**
Jorge Montero Lansac

**WASTE MANAGEMENT AREA**
**CONSTRUCCION DEL ATI DE C.N. COFRENTES - GESTION DE LA PANDEMIA**
Fernando Turrión López y Jesús Hernando Pérez

**ENGINEERING AND INNOVATION AREA**
**THERMOHYDRAULIC ANALYSIS OF AN ISOLATION CONDENSER SELF-REGULATING BY NON-CONDENSABLE GASES (SIRIO FACILITY)**
Elena Redondo Valero, Elena de la Fuente García, César Queral, Gonzalo Jiménez, y Pierdomenico Lorusso

**MAINTENANCE, INSPECTION AND TESTS AREA**
**ESTUDIO DEL ARCO ELÉCTRICO (ARC FLASH) EN CENTRALES NUCLEARES**
Juan Rafael Cabello García

**RADIATION PROTECTION & NUCLEAR MEDICINE AREA**
**EVOLUCIÓN DE LA TRANSFERENCIA DE RADÓN DEL AGUA AL AIRE A ESCALA PILOTO**
Aina Noverques, Belén Juste, María Sancho, Gumersindo Verdú

**SIMULATION WITH NUMERIC CODES + 3D AREA**
**POLYNOMIAL CHAOS EXPANSION FOR UNCERTAINTY PROPAGATION IN ADVANCED NUCLEAR FUEL CYCLES**
A.V. Skarbeli y F. Álvarez-Velarde

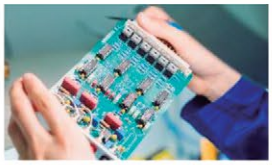
**FUSION AREA**
**ANÁLISIS DINÁMICO DE UN SISTEMA DE CONVERSIÓN DE POTENCIA DE $CO_2$ SUPERCRÍTICO PARA DEMO MEDIANTE MODELICA**
Lluis Batet, Simone Ferrero, José Ignacio Linares, Eva Arenas, Alexis Cantizano y Laura Savoldi

**THERMOHYDRAULIC & NEUTRONIC AREA**
**UTILIZACIÓN DE REDES NEURONALES PARA PREDECIR EL FLUJO DE CALOR CRÍTICO EN UN REACTOR**
Javier Riverola Gurruchaga

**POSTER AREA**
**MODELADO DE ENTORNO DE PRUEBAS PARA EL ESTUDIO Y SIMULACIÓN DE MONITORIZACIÓN DE FALLAS EN PROCESOS DE TRITIO**
Eduardo Iraola, José Mª Nougués, Lluis Batet y Luis Sedano

## Fabricación y Reparación:

- Diseño y modificación de **equipos**.
- Fabricación de **equipos a medida** y **circuitos impresos**.
- Reparación de **tarjetas electrónicas**
- Ingeniería inversa.

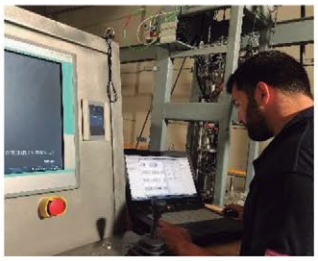


## Servicios de Ingeniería:

- Realización de proyectos **llave en mano** o **incorporación** en cualquier de las fases del proyecto: diseño, gestión de suministros y materiales, supervisión de obras, instalación y montaje, puesta en marcha, formación, mantenimiento una vez en funcionamiento.

## Automatización y Control:

- **Automatización** industrial.
- Integración de **redes** de **comunicación industrial**.
- Integración de **sistemas** de **seguridad programables en PLC/AS**.
- Modernización de **sistemas de control**.
- Diseño y fabricación de **cuadros** de **control y potencia**.
- **Mantenimiento** de **grúas** y **sistemas** de **elevación**.



MANSERVA

**Valladolid – Tarragona – A Coruña**

## Mantenimiento:

- **Mantenimiento** de equipos de **electrónica** de **potencia**: reguladores de tensión, rectificadores, cargadores de baterías y UPS, revisión de cabinas eléctricas y CCM's, revisión de baterías. **Ingeniería** y **consultoría**. **Suministros**.
- **Mantenimiento predictivo** en transformadores, máquinas rotativas, interruptores, transformadores de medida, etc.
- Calibración y revisión de **protecciones eléctricas.**
- **Puesta** en **marcha** de subestaciones eléctricas

## Formación:

- Formaciones de **reguladores de tensión, rectificadores / cargadores, protecciones eléctricas**, sistemas de **manejo de combustible**, **máquinas rotativas**.

**Tel. 983 208 722 - manserva@manserva.com**
**www.manserva.com**

ALMARAZ
TRILLO

*La energía nuclear es una alternativa limpia, segura y competitiva*

**Centrales Nucleares Almaraz - Trillo**
Avda. de Manoteras, 46 bis, Edificio Delta Norte III. Planta 5ª 28050 Madrid.

# CLOSING SESSION

**JAVIER GUERRA.**

**President of the Spanish Nuclear Society**

For the SNE, and I think for all of us, it has been a year of digitization, partly forced, partly scheduled: we launched a new digital magazine, a new website; all our activities have been digitized, just like this virtual meeting that concludes today and puts the digital finishing touch on the year 2020. A challenge that we have been tackling thanks to great professionals who are the pillar and leading asset for our sector.

I want to thank your participation and convey the recognition of the entire SNE Board of Directors to all the people who have made the development of the activities from these days possible. To you, attendees, to those who have been speakers, and especially to all the people who have been directly involved in the organization: the Organizing and Technical Committees, the Society Commissions, and our collaborators: Grupo Senda and Videology. All of them have worked intensely during these months to make this meeting a reality.

I also want to extend this acknowledgment to the sponsors and exhibitors since, without their support, this event would not have been possible. This meeting is also a meeting point for all companies in the sector and I would like to confirm that the more business side of this meeting has also been up to par.

I would like to think that we are all taking something home from this virtual meeting that we say goodbye to today. And, personally, I am left with the exemplary response of our sector and our professionals to the crisis of the global pandemic that we are immersed in due to the effects of COVID-19 and, also with this change of direction for the nuclear vision that is already making itself felt in Europe and confirming the conviction that maintaining the long-term operation of our plants is the best option towards a completely decarbonized energy mix.

I also want to mention the need for innovation in our industry, which must be accelerated urgently, so that nuclear energy continues to be part of the world energy mix, competing with and complementing other emission-free energy sources. I am convinced that we will succeed by the weight of reason and for the health of the planet.

You can count on the SNE to work, as we are doing, to convey to society a different vision of our sector and nuclear energy. And here, as always, I am going to ask for your help and your involvement. The more voices we have, the louder we can speak, the further we can go. Thank you very much.

### HÉCTOR DOMINGUIS.
### Vice President of the Spanish Nuclear Society

During the toughest months of the pandemic, nuclear professionals have added our work and effort to that of the rest of the essential services, to guarantee the electricity supply that our country needed.

We have reinvented ourselves and adapted to the new demands of health safety. In record time, we have assumed the process of digitizing our jobs so that the wheel does not stop turning ... and, looking back, we have made it very clear that we still want to work with enthusiasm and strength to take on new challenges.

The best proof is the great success in the organization and the level of attendance for this Virtual Meeting, with which we have reinvented ourselves to face the mobility limitations that the pandemic has imposed on us and that has allowed us to explore new paths and to incorporate world leaders from our industry into our line-up of speakers.

Therefore, my congratulations to the Organizing and Technical committees.

All the people connected to the organization of the event have worked in record time, with great enthusiasm, overcoming the barriers of distance, so that this Virtual Meeting has the level it has had and so that we leave with an excellent final result.

Thanks also to the countless people who have collaborated selflessly with the organization of all the parallel activities… which, as always, add great value to this meeting.

And of course, thanks to all of you who have been present these days in the different sessions and scheduled activities for your support and participation.

I will end these acknowledgments with special recognition for all the sponsoring and collaborating companies who have been involved by participating in the various activities in recent days.

The message that has been heard the

most in conversations with many of you has been "count on us," a phrase that perfectly defines the spirit of our Society and of all the people that make it up.

Now, I would like to share with you some data from these 4 days as a quick summary:

- 32 companies have contributed to the realization of this event.
- We have enjoyed 8 technical and oral presentation sessions and 1 poster session during which experts in each subject have presented 203 papers from all areas.
- In the Single Subject sessions, we talked about the future:
  - About our role in meeting the demand for electricity and reducing $CO_2$ emissions within the framework of the projections for 2050.
  - And about the new ecosystem of "startups" whose role is increasingly relevant in the future of the nuclear industry.
- The general sessions have been the framework for our reflections on sustainability in waste management and have allowed us to learn about the new General Radioactive Waste Plan from ENRESA.

In addition, we have had the opportunity to address the challenge of COVID-19 and the response of our industry at a global level, with national and international experts who have shared their experiences with us.

In short, an extensive and intense program that shows that our industry and our society are more active than ever. Meetings, of experts and for experts, to which we have connected a total of 480 attendees from all over the world.

Anyway ... a great success, given the circumstances.

And as a final message, I would like to share a brief reflection with you.

There is a series of facts and realities, that everyone in our context is very aware of. Facts like:

- Nuclear energy is a **reliable, stable, safe, non-polluting, and independent source of energy**.
- A source of energy that **responds to situations as critical as the one we are going through; endorsed by the excellence** of more than 28000 professionals in Spain alone.
- That nuclear energy continues to be **the energy that we consume the most in Spain**; and it is the energy that **avoids the most $CO_2$ for the atmosphere**.
- It is **clean energy** and therefore **strategic in the fight against climate change**. Since, to date, worldwide, it prevents more than 2000 million tons of $CO_2$ per year.

We know this, we have accepted this and internalized it, even to such an extent that, sometimes, we take it for granted.

But it is essential that this reality, that is obvious to us, be disseminated and known beyond our professional field so that the rest of the world knows that:

- Nuclear energy **plays a leading role in the supply of electricity in Spain**. Not only in the face of the current health and economic crisis, but also in the face of the environmental crisis caused by global warming.
- Renouncing the benefits of nuclear generation can seriously **compromise the fulfillment of the environmental objectives** that we have envisioned.
- The fight against **climate change is one of the greatest challenges facing humanity** and one of the greatest opportunities of the industrial age.

And we must assume, as a personal and individual responsibility, each one of us as nuclear professionals, to convey the values and reality of this energy source.

All nuclear professionals, of course with our Society at the forefront, must assume a role as public spokespersons for nuclear energy so that there is no doubt that in the **medium term it is NOT possible to get rid of Nuclear energy** without risking the security and stability of the electricity supply in Spain.

And most importantly, without jeopardizing compliance with environmental policies and the fight against climate change.

Along these lines, last Monday, the new website for the Spanish Nuclear Society was presented, a dynamic space with new functionalities and extensive information on nuclear technology, both for professionals in the sector and for the general public, one more step in the outreach work of our Society.

Work that we must carry out incessantly and that I hope that next year we can continue, this time, and if conditions allow it, in person, seeing each other's faces, resuming the personal contact that we miss so much ..., in the beautiful city of **Granada at the forty-sixth annual meeting for the Spanish Nuclear Society**, with **ENDESA** as the host company, in 2021.

We will see you all there; to share knowledge, collaborate, strengthen ties, and strengthen friendships under the beautiful sunset of the Alhambra.

### JOSÉ MANUEL REDONDO.

### Deputy Director of Nuclear Energy for the Ministry for the Ecological Transition and the Demographic Challenge (MITECO)

First, I would like to thank the President of the Spanish Nuclear Society, Javier Guerra, for inviting me to participate in the closing session of this virtual meeting, the holding of which highlights the ability of the Spanish Nuclear Society to adapt to this health crisis that has been thrust upon us that we do not know when we will get out of it.

Certainly, when on March 5 I had the opportunity to participate in the Session on experiences and perspectives of Spanish nuclear power plants, no one would have imagined that the declaration of a state of alarm was coming 9 days later and that the world was going to have to go through this pandemic situation that we are going

through, with the sad consequences that we all know. And the worst thing is not what we have been through, but, as I said, the fact that the prospects are far from reassuring.

Moving on to the industry that concerns us, one of the issues that has emerged in this health crisis has been the need for nuclear power plants to adapt their operation to the massive incorporation of renewable energies that is taking place and that is going to be accentuated in the future, something that is not new, but that in the situation of demand reduction that occurred in the first months of the state of alarm has become evident in a very significant way.

This shows that, making use of a term frequently used in recent times, the "paradigm" of an approximation as close as possible to 100% in the "Load Factor" as a parameter that shows the reliability in the operation of a nuclear power plant has lost its status as such.

In any case, once electricity demand returned to relative normality, nuclear energy has once again resumed its usual role, as was shown last October when this energy accounted for 21.6 % of electricity produced, ranking second after wind energy, with 27.3%.

In this sense, it should be remembered that, in the first three quarters of the year, renewable technologies, including hydro, contributed almost 10 TWh of generation which, added to the 19.5 TWh from nuclear, have made 85% of the peninsular electricity generation free of $CO_2$ emissions.

I now turn to the traditional review of the most relevant issues that the Sub-Directorate General for Nuclear Energy has worked on lately.

First, on July 23rd, a Ministerial Order was approved granting the renewal of the operating authorization for the two Units of the Almaraz nuclear power plant. This Order establishes that, for Unit I, the authorization will be valid until November 1, 2027, and for Unit II, until October 31, 2028, these being the respective dates for the definitive cessation of operation for these Units.

These dates are those included in the Protocol of Intent signed between ENRESA and the owners of the NPPs in March 2019 based on the 2021-2030 Integrated National Energy and Climate Plan (INECP) in which the contribution of nuclear energy to the energy mix and the orderly cessation of operation of the Spanish nuclear power plants is included in the 2027-2035 time period.

Also, on July 23rd, another Ministerial Order granted the renewal of the operating authorization for the Vandellós II nuclear power plant. In this case, and also in accordance with the aforementioned Protocol of Intent, the renewal was granted for a period of 10 years.

On the other hand, on March 26th, the owner of the Cofrentes nuclear power plant requested the renewal of the current operating authorization (which is valid until March 20, 2021) until November 30, 2030.

Likewise, on March 27th, the owner of Ascó I and Ascó II, whose current authorization is valid until October 2nd, requested the renewal of the authorization of Ascó I for a period of nine years and for a period of ten years for Ascó II.

I would now like to refer to the 7th General Radioactive Waste Plan (GRWP), whose proposal was submitted by ENRESA to the Ministry on March 10th.

As many of you know, the currently in force 6th GRWP dates from 2006 and, although ENRESA, in compliance with the obligations it has assigned in Royal Decree 102/2014 for the responsible and safe management of spent nuclear fuel and radioactive waste, which regulates its activity, has submitted proposals to the Ministry in 2010, 2013, 2014, and 2015, and these proposals were never processed.

And if they were not processed, it was because the approval of a new GRWP made it necessary to set the useful life of nuclear power plants, and it was not realistic to continue maintaining the 40 years of useful life that had been contemplated since the 5th GRWP from 1999, when, as time went by, some plants had already exceeded this useful life and others were close to doing so, so this decision was not to be made.

This situation of lack of an updated GRWP, something that is required by Directive 2011/70/Euratom which establishes a Community framework for the responsible and safe management of spent nuclear fuel and radioactive waste has caused The European Commission, within an infringement procedure, to send what is known as a "Reasoned Opinion" to Spain last November as a step prior to filing a complaint with the European Courts.

Finally, in the aforementioned Integrated National Energy and Climate Plan (INECP), a calendar for the cessation of operation is established, which assumes an average useful life of the power plants of 45.7 years.

This is one of the fundamental components of the reference scenario on which the 7th GRWP is based. Other components are:

- A planning horizon from 2020 to 2100.
- An open fuel cycle, in which reprocessing is not included.
- The start-up of the CTS in 2028 with a Container Holding Warehouse planned in 2026.
- The launch of Deep Geological Storage (DGS) in 2073.
- And, with regard to the decommissioning and closure of nuclear power plants, the following is envisioned:
  - Immediate, total decommissioning after cessation of operation.
  - A projection for the start of preparatory work for decommissioning at least 3 years before cessation.
  - A projection for the start of decommissioning at least 3 years after cessation.
  - And an expected decommissioning duration of 10 years.

Following the review by the Ministry of the 7th GRWP proposal presented by ENRESA on March 16th, the General Directorate of Energy Policy and Mines sent a draft of the 7th GRWP to the General Directorate of Environmental Quality and Evaluation for the start of the Strategic Environmental Assessment that this Plan must be submitted to as provided in Law 21/2013 on environmental assessment.

Within this procedure, on October 29th, said General Directorate of Environmental Quality and Assessment approved what is known as the Scope Document for this Strategic Environmental Assessment and, taking this Document into account, ENRESA has to prepare the Strategic Environmental Study and a review of the draft of the 7th GRWP which will be submitted to public information and consultation for a period of 2 months.

Subsequently, after analyzing the comments received, ENRESA will prepare a new review of the 7th GRWP and, if necessary, a new Strategic Environmental Study. Additionally, the 7th GRWP must have a report from the CSN, and in its processing, the Autonomous Communities must be heard from on spatial planning and the environment.

The review resulting from the previous procedure will be sent to the General Directorate of Environmental Quality and Evaluation so that the technical analysis of the file can be carried out and the Strategic Environmental Statement can be issued by the Secretary of State for the Environment.

Finally, and at the proposal of the Ministry, this 7th GRWP will be approved by the Council of Ministers and it will be reported to the Parliament.

I would like to remind you that, for informational purposes, the first draft of the 7th GRWP is available on the MITERD website.

To conclude, I would like to congratulate, first of all, the Spanish Nuclear Society and, especially, its President who, by holding this virtual meeting over these three days, has been able to make a virtue of necessity to continue sharing knowledge and exchanging experiences.

And, secondly, to the Organizing Committee and the Technical Committee, as well as to all those who have participated in the different sessions that have been held throughout these three days who, with their effort and dedication, have contributed to the success of the meeting.

However, I would not like to say goodbye without, as has been done by the whole of Spanish society, acknowledging the work that they have developed during the darkest days of confinement and the state of alarm, particularly the health sector workers, where we must include doctors and nurses to the cleaning staff of health establishments, as well as the work that has been carried out by other sectors essential for the functioning of society such as State Security Forces and Corps and all those who carry out their work in the supply chains of essential products such as food and fuel.

But I also want to take the opportunity that this virtual meeting gives me to acknowledge, and, as they say now, to value the work of all those who have made it possible that, during those days, nuclear power plants continued to play the role fundamental that nuclear energy has been playing in the Spanish electricity supply, where I include the operating personnel and the plant and engineering technical personnel to all those workers who have participated in the refuelings that have taken place during the alarm state.

In this regard, I also believe that the efforts made by the licensees of nuclear facilities to establish and implement contingency plans in order to comply with the limitations demanded by this situation while guaranteeing the safe operation of these facilities deserve special recognition.

In other words, using another term that has also become fashionable and that some of us studied, a long time ago, in the subject of resistance of materials, the "resilience" of the Spanish nuclear sector has been amply demonstrated.

Therefore, in this virtual meeting, I also want to dedicate a "virtual applause" to all the workers of the Spanish nuclear industry who, during the state of alarm that lasted between March 14 and June 1 were showing up while others were teleworking, one could say "huddling."

**JAVIER DIES.**

**Board Member. Nuclear Safety Council**

Board Member Dies as a Board Member of the Nuclear Safety Council (CSN) appreciates the invitation received from the SNE to address the attendees and to proceed to the closing of the SNE annual meeting, this time in a virtual session. He also stated that it would have been his wish to greet all the attendees in person, but this pan-

demic situation does not allow it, so he sent an individual greeting to each attendee.

In his capacity as Director of the Nuclear Safety Council, he dedicated the following presentation to explaining three topics that he considers to be of special importance and that include the activities underway in this organization: i) improvement projects being carried out by the CSN to try to be more effective in its management; ii) reference to evaluation projects approved by the CSN throughout this year; iii) projects currently under evaluation by the CSN and that will be resolved in the near future.

### CSN OPERATIONAL IMPROVEMENT PROJECTS

The first issue is the **management of human resources** available to the CSN. Last March, twenty-four new civil servants for the upper management of the nuclear safety and radiological protection technical division joined the CSN, which contributes to the renewal of CSN technicians, which is a priority objective both due to objective needs associated with the workload and as a result of the predicted retirement of staff. Continuing along this line associated with the needs of human resources, it is appropriate to mention that in the last public job offer, the CSN has obtained twenty-five new positions to join said organization in the coming year 2021. It has also been achieved that the public call for employment for two hundred government computer science positions includes the reservation of five government computer science corps positions for their incorporation to the CSN.

The second topic includes the project under development by the CSN called "**Systematic Approach to Training" (SAT)**. This project, as it is well known, has already been carried out in Nuclear Power Plants. As could not be otherwise, the CSN is embarking on this process. It is a project that involves an investment of €600,000 and which has recently been awarded to TECNATOM within the framework of a European tender with the launch meeting that has already taken place on September 7th. Its objectives include identifying and categorizing the skills necessary for each job position as well as identifying the current competencies of the personnel who occupy each job, and finally organizing the necessary training to fill the training gaps in order to complete the competencies currently not covered.

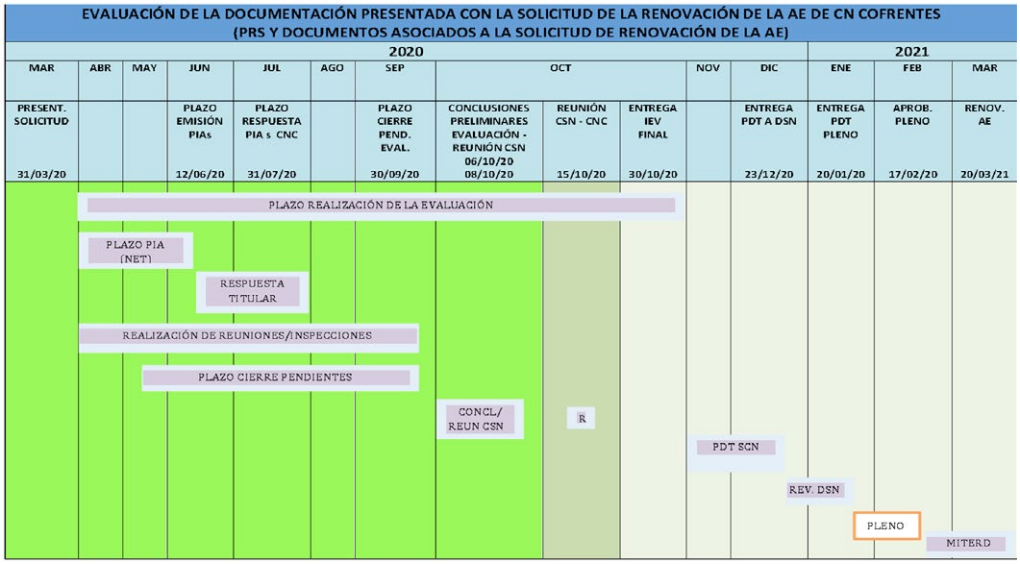
As a third issue, the CSN is tackling the **digital transformation** project that, with a budget of around two million euros, intends to make the CSN more digital and improve all types of applications, both internal management and project management. This project is also complemented by the incorporation of the five civil servant positions from the computer science corps mentioned above.

Welcoming ceremony at the CSN for the 24 new civil servants for the Upper Management of the Nuclear Safety and Radiological Protection Technical Division.

Almaraz I and II Nuclear Power Plants.

### PROJECTS EVALUATED AND APPROVED BY THE CSN IN THE COURSE OF THIS YEAR 2020

The first of these is the **renewal of the operating license for the Almaraz I and II NPPs** approved unanimously by the CSN on May 7th last year. This project has been an important milestone, especially in the confinement conditions due to COVID-19 during which it has been carried out. Since March, the full session has been meeting virtually in the exercise of its functions, not only for routine procedures but also for evaluations of this scope and relevance, such as operating authorization renewals. This evaluation has involved about 16,000 hours for technicians and that in this case also incorporated the transition to the National Fire Protection Association (NFPA-805) technical standard where probabilistic safety analysis (PSA) techniques are used. It is a matter of calculating the increase in the frequency of damage to the core, by fire areas, and visualizing whether or not that action represents a significant increase in core damage frequency, and thus priori-




Evaluation schedule for the renewal application of the operating license for the Cofrentes NPP.

tizing those actions that have a significant increase in core damage.

Along the same lines, on June 24th, the CSN unanimously approved the renewal of the operating license for the Vandellós II NPP.

## ONGOING PROJECTS

Taking advantage of the experience acquired in these two approved operating license reviews, the CSN is focused on the **renewal for the Cofrentes NPP operating authorization** in accordance with the schedule developed for the management of this evaluation process, with which at the beginning of 2021, the proposal for a technical opinion will be submitted to the full session for approval.

Finally, the renewal of the operating license for the Ascó I and Ascó II NPPs will be addressed. Already in this process, on July 17, 2019, the basic document for the periodic safety review was approved, with the expiration date of the current operating licenses for both units being October 2, 2021. As an important detail, these two plants will begin their long-term operation on August 13, 2023, for the Ascó I NPP, and on October 23, 2025, for the Ascó II NPP, which entails a specific study to address this life extension. To illustrate this process, the CSN has already issued twenty-six requests for additional information, with the final meeting with the licensee being scheduled for next March 2, 2021. Likewise, during the first quarter of 2021, an inspection of the Integrated Plan for the Evaluation and Management of Aging (PIEGE) is planned. All this in order to seek the renewal of the license prior to the expiration date of the operating license on October 2, 2021. To date, the Ascó NPP has identified 63 strengths, 93 improvement proposals, and 109 actions grouped into 11 lines of action. This work has been carried out in parallel with the adoption of the NFPA standard on fire protection. This topic has recently been selected by WENRA (Western European Nuclear Regulators Association) as the next Topical Peer Review, which denotes the relevance of the topic and the appropriate national positioning.

Relevant activities include everything associated with the **management of irradiated fuel**. The first point is the licensing of the individualized temporary storage (ITS) facility for the Cofrentes NPP, which in light of the exhaustion of the storage capacity in pools is urgently needed to ensure the continuity of operation. At the same time, the process for evaluating the design of the HI-STAR 150 dual-purpose container (storage and transport) that will house the spent fuel with the peculiarities of the fuel at Cofrentes and which, among things, addresses the application of the technical standard for the confinement enclosure in transport conditions, also in transport, the criteria for acceptance of exclusion of the moderator, treatment of fuel with a high degree of burnup, etc. The licensing schedule associated with the project differentiates between the schedule associated with the storage function and the schedule associated with the transport function. Along the same lines is the recently concluded licensing of HI-STORM 100 and HI-STAR 100 containers for use at the Ascó I and II NPPs, also for high burnup fuel and able to accommodate damaged fuel, allowing the optimization of spent fuel management.■

ITS Ascó NPP Fueling campaign.

# SOCIEDAD NUCLEAR ESPAÑOLA
## REUNIÓN VIRTUAL - 2020

## Sponsors

anav
ALMARAZ TRILLO
COFRENTES CENTRAL NUCLEAR
coapsa
DMIM
edp
EMPRESARIOS AGRUPADOS
endesa
enresa
enusa
EPRI ELECTRIC POWER RESEARCH INSTITUTE
ensa
Foro Nuclear – Foro de la Industria Nuclear Española
framatome
GDES
HITACHI
GRUPO EULEN
IBERDROLA
IDOM
INGECID – Ingeniería de Construcción, Investigación y Desarrollo de Proyectos
marSein
minsait – An Indra company
moncobra
Naturgy
orano – Giving nuclear energy its full value
RINGO VALVULAS
TAMOIN
tecnatom
Westinghouse

## Exhibitors

AHLBERG CAMERAS
alisys
amarA
GOBIERNO DE ESPAÑA – MINISTERIO DE CIENCIA E INNOVACIÓN – Ciemat – Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas
CLUSTER DE LA INDUSTRIA NUCLEAR DE CANTABRIA
EMPRESARIOS AGRUPADOS
endesa
enusa
ensa
enwesa
GRUPO EULEN
framatome
GDES
IBERDROLA
Naturgy
orano – Giving nuclear energy its full value
RINGO VALVULAS
SGS
tecnatom
Westinghouse

# WIN CONFERENCE

## APPLICATION OF RADIATION IN THE CONSERVATION OF CULTURAL HERITAGE


Women in Nuclear Spain (WiN) has two main objectives, to disseminate the reality of nuclear science and technology to society as a whole and to promote a network of professional women who develop their activity in the various applications of ionizing radiation. As part of our efforts to inform society, the "Application of Radiation in the Conservation of Cultural Heritage" conference was organized on the occasion of the Spanish Nuclear Society Virtual Meeting. The annual meeting should have been held in Granada, and this interesting and appropriate topic was chosen because of the great cultural heritage of the Andalusian city. Finally organized virtually, we did not want to leave out the knowledge of this subject. The conference featured two experts in the Conservation of Spanish cultural heritage, who each explained to us, each from their point of view, this complex work, which is approached from an interdisciplinary perspective, and they explained to us how the use of different techniques with radioisotopes and electromagnetic radiation enables research, conservation, and the restoration of the assets that make up our Cultural Heritage. It is another way of showing how the use of radiation has other beneficial applications for society other than medical and energy applications. The talk was moderated by **Susana Falcón**, President of WiN Spain.

The first speech, given by speaker **Rosa Becerril**, currently Director of the Cabinet for the General Secretariat of Culture (Ministry of Culture and Sport), has a degree in Geography and History, specializing in Art History and Ancient History, and a postgraduate degree in Museology, whose professional experience has taken her to a large number of museums, including the National Heritage, Reina Sofía, Sephardic Museum, Museum of America, Army Museum, National Museum of Maritime Archeology. She approached the different radioactive techniques in a theoretical way, explaining to us that knowledge of the asset is necessary for Conservation, and how the tools provided by radioactivity can be used in the field of historical heritage. She divided the speech into two sections, starting with all the techniques that use the disintegration of radioactive atoms, specifically their usefulness in the dating of cultural assets, explaining Carbon 14 techniques in a simple way (for charcoal, bones, wood, hair, wool, skin, seeds, shells), thermoluminescence (terracotta pottery, porcelain, lost wax bronze sculpture), Potassium-Argon ratio (volcanic rock), fission traces (volcanic crystals, pumice stones, obsidian, ceramics), and other relationships such as Rubidium-Strontium or Uranium-Lead. The second block dealt with radiation analysis of cultural assets for their conservation, radiography and gammagraphy as


non-destructive tests, and the rest of the analysis systems, emphasizing the utilities of these analyses: knowledge of the state of conservation, detection of previous restorations, knowledge of the creation technique and therefore of the author, school and time, the evolution of the work: sketch, priming, preparatory drawing, repaints, revisions, etc. She also explained to us how they give us information about the analysis of the materials: dating and location. The recognition of authorship: falsifications, confirmation of attributions. The next part on radiographs, one of the most interesting parts, made a distinction between painting (canvas, panel, metal), engravings and drawings, wood and bronze sculpture, ceramics, musical instruments, glyptics, and numismatics, furniture, textiles, weapons. She explained what is observed in the paintings: the weave of the canvas, the board, primers, gold background, preparatory drawing, modifications of the composition, pigments; what is observed in the sculpture: set materials, removable parts, cavities: reliquaries, conservation problems, repairs and restorations, additions; with bronze: internal imperfections, cracks, burrs, welds, additives; with stone: types of rocks, deposits, terracotta: clays and silicates, repairs and restorations, and finally in wood: covering layers, assemblages, deterioration, biological attack. She concluded the presentation with the great importance of these methods for knowledge, conservation, intervention, and complementation with other studies.

The second, much more practical talk, with many images and more artistic explanations, was given by **Miriam Bueso Manzanas**, a graduate in Prehistory and Archeology with a diploma in Conservation and Restoration of cultural assets, specializing in Archeology. She is part of the Research and Training Area of the Spanish Cultural Heritage Institute (IPCE), in the Physical Studies Section, Head of the Projects Service and Supervisor of the IPCE radioactive facility. Currently, she is the Co-Coordinator of the National Plan for Conservation Research. Ministry of Culture and Sports.

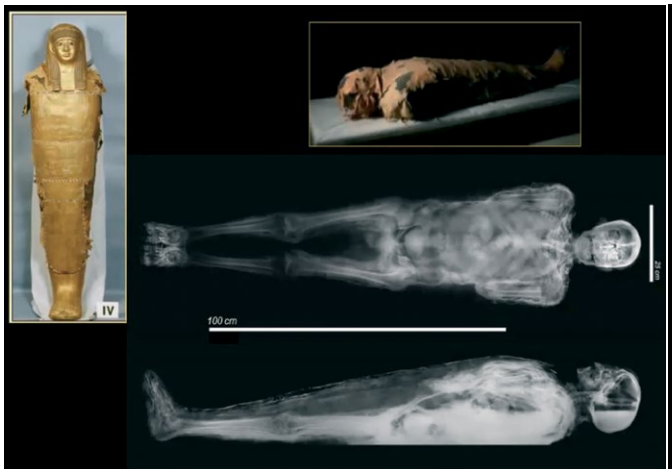
She explained to us that her department at the IPCE works with imaging examination techniques derived from exposure to electromagnetic radiation for the cultural property being studied (radiography, photography and infrared reflectography, ultraviolet photography, endoscopy, etc.). Its application today is very widespread since it generates unique graphic documentation itself, provides information on the state of a cultural asset at a specific moment of its material life, and allows for knowing first-hand aspects that are not visible in direct observation of the object, without the need to manipulate it or take any samples.

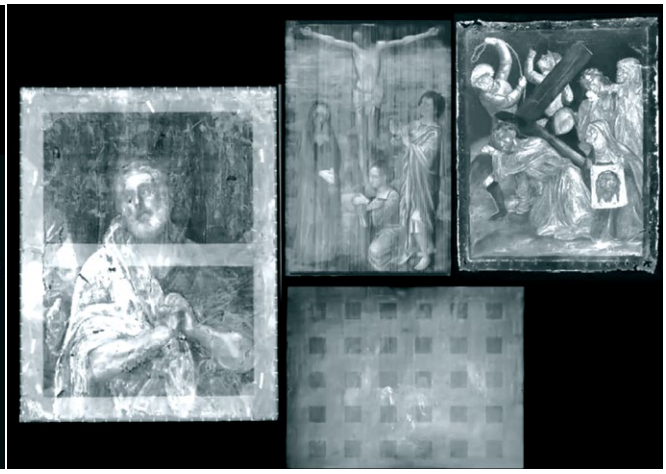
The speaker, with a magnificent presentation, with a multitude of graphic examples of all kinds, showed us how the comparative study of these images therefore provides essential information to address conservation and/or restoration interventions and provides valuable information for research studies of these cultural assets.

However, the special characteristics of some techniques such as radiography and gammagraphy and their mode of use force the facility to acquire the category of a radioactive facility and, for obvious safety reasons, require the Supervisor and Operator roles to validate and develop the work that is carried out in it, guaranteeing the derived safety requirements.

We were able to see through the presentation, which introduced us to the world of art, how the Institute of Cultural Heritage of Spain has a long history in this field, and, for an hour, it brought us closer to the working procedure with these techniques and the technological innovation surrounding them with practical examples of their application in a varied typology of cultural assets and formats.

After the conference ended, which had more than 100 spectators from various countries, an interesting question and answer session took place.■



# NUCLEAR YOUNG PEOPLE (JJNN)

## BACK TO THE FUTURE OF THE NUCLEAR INDUSTRY

In this edition, Nuclear Young People replaced its traditional Basic Courses on Nuclear Technology, directed to both communication professionals and the general public, with a virtual meeting that served as the closing of the convention.

Therefore, from Nuclear Young People, they would like to thank the Spanish Nuclear Society for the opportunity to close the first edition of the Virtual Meeting.

In connection with the organization of the next European Nuclear Young Generation Forum 2021, which will be held next September in Tarragona, Nuclear Young People organized a debate around the question "What will the nuclear industry be like in ten years?"

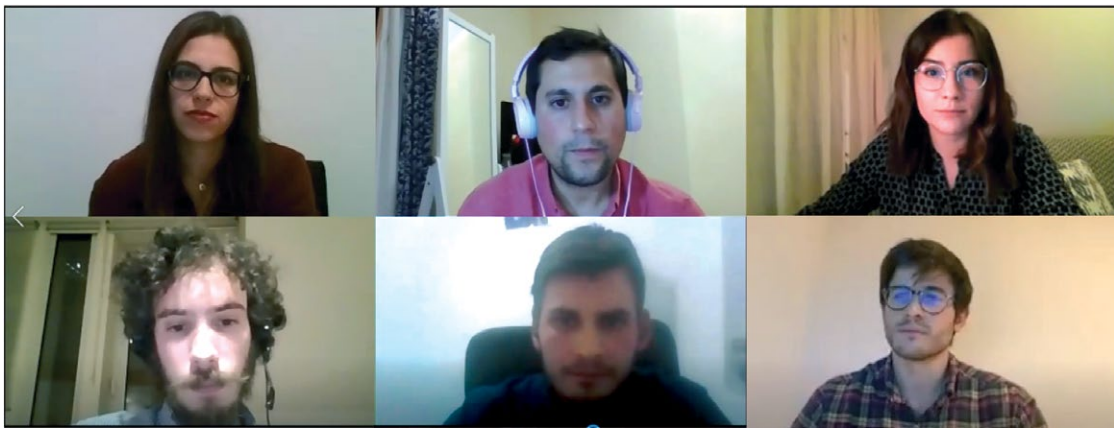
With an attendance of more than 60 spectators, the speakers spoke about what, in their opinion, will be the fundamental advances in the nuclear industry in the next decade:

Alba Valls explained the fundamentals of deep geological storage (DGS) for high activity waste and the technical and administrative challenges (in terms of licensing) that a project of this magnitude entails;

- Alejandro Carrasco presented the emerging technology for accident-tolerant fuels (ATF) and
- Samanta Estévez presented the planned roadmap for the deployment of modular reactors (SMR) in Europe in the next two decades;
- Finally, in line with the non-energy applications of SMRs, Roberto García initiated the debate on the role of the nuclear industry in the energy transition for the continent and the new European Green New Deal sought by the European Commission.


During the question-and-answer session, the audience was interested in the future sustainable management of spent nuclear fuel (both from the point of view of its recoverability in DGS and its potential use as an energy source in SMR and generation IV reactors), the next avenues of research in nuclear safety and its relationship with the implementation of ATFs, as well as the particularization of the information, presented at European level, for the situation in Spain.

Once again, Nuclear Young People would like to thank not only the Spanish Nuclear Society in general but also the Organizing and Technical Committees of the Virtual Meeting for the support and trust received and the opportunity to put the finishing touch on an event that, in every sense, can be considered a resounding success.



# AWARDS AND DISTINCTIONS

The president of the Spanish Nuclear Society, Javier Guerra, served as master of ceremonies at the SNE annual awards and recognitions ceremony that took place after the closing ceremony of the 2020 Virtual Meeting. The following are the words from both the presenters and the winners.

## "JUAN ALBERTO GONZÁLEZ GARRIDO 2020" NUCLEAR YOUNG PEOPLE AWARD TO

### EDUARDO GALLEGO

**Professor of Nuclear Engineering at the Polytechnic University of Madrid**

The president of Nuclear Young People, **Pablo García**, was in charge of presenting the award, stating that the close relationship between Nuclear Young People and Eduardo Gallego is not only limited to having been a professor for many of the members of said commission, but also to his predisposition to facilitate the activities of the same at the University, both at the public and private level, always lending himself to any collaboration.


Eduardo Gallego received the award feeling grateful, flattered, and hopeful. Grateful that this distinction is awarded to him for a job that he considers part of his obligation as a professor of Nuclear Engineering. Flattered because having this type of recognition for your work when you are already a certain age makes you feel very good. And hopeful because, in his opinion, nuclear energy is useful, necessary, and fulfills an important mission, and the fact that there are so many young people who sign up to study nuclear engineering makes him very hopeful and consider that all these years of work teaching were well spent. In short, "nuclear energy will be necessary as long as it is and will be usable, as long as it is safe."

## SPECIAL WIN SPAIN 2020 PRIZE TO

### MATILDE PELEGRÍ

**President of Grupo Senda**

The WiN Spain association, represented by its president, **Susana Falcón**, presented this award to Matilde Pelegrí for her great dedication to the association of which she has been President for the last five years. For her excellent work, professional and personal know-how, promoting and growing the association, highlighting her ability to unite and collect all the WiN legacy established in each of the previous Presidents, and to boost and promote a new stage adapted to the world of today. Among her achievements is her commitment to the Spanish chapter organizing the last WiN Global conference in Madrid, which was very successful, among other things, for leading, supporting, and reinforcing the team that carried it out. This success has made WiN Spain a role model in the WiN Global organization.


She also highlighted Matilde Pelegrí's dedication to WiN activities, both nationally and internationally, such as the establishment of joint activities with other associations such as the NEA, and for being a reference in her role in making the role of women in our sector visible through communication and outreach. In Falcón's words, "with this award, we want to value her role as an entrepreneur and an expert in communication related to our work and more technical visions within the sector, along with respect, cordiality, letting us do things to achieve a united and cohesive work team that has only enriched WiN Spain as a whole."

In her words of thanks, Pelegrí stated that it is always a joy to receive an award and even more so if it is in this year of so few joys.

"When in 2014 the colleagues from the WiN Spain Board of Directors decided to elect me as President, we set ourselves the challenge of renewal, getting the new generation of women in the sector to get involved, and to do so in an active way, and this came in 2016 during the WiN Global Conference when they proposed to us the possibility of organizing the next one (2019) in Spain. To do this, the main thing was to select a team to carry it out. That team, formed by Susana Falcón as the leader, María Luz Tejeda, Rosa González Gan-

dall, Patricia Cuadrado, Amparo Soler, and Idoia Hernando, was able to organize a conference with 300 attendees from 60 countries on 5 continents, with an excellent economic result that has positioned WiN Spain within WiN Global and the SNE, carrying out very important communication work with a lot of encouragement, effort, and very powerful volunteer service. This is undoubtedly the achievement that I feel very satisfied with.

After more than 30 years in the nuclear sector, for me, it is a great pride that the award in this year 2020 is that from WiN Spain. Thank you all very much and keep going because you are more needed than ever. "

## SNE GOLD MEDAL 2020 TO FRANCISCO LÓPEZ GARCÍA

This medal rewards a continuous and extraordinary work in support of the SNE by personally participating in its management bodies or promoting collaboration of the Society with the institution that the winner belongs to. And, also, a recognized work in support of the development of nuclear energy or the implementation of nuclear science and techniques or other special merits that make them worthy of recognition from the SNE. In the words of Javier Guerra: "The person chosen to receive the 2020 gold medal was unanimously chosen by the Board of Directors and is a person who embodies the values that we defend from the SNE and who has had a key task both for the Society itself and its objectives as well as for the entire Spanish nuclear sector. "

Francisco López García is an industrial engineer from the Comillas Pontifical University (ICAI) and holds a master's degree in Operations Management from the Instituto de Empresa. He has been closely linked, throughout his professional career, to the nuclear sector, performing many different functions that have allowed him to have a very complete vision of our industry. He has developed practically his entire career at IBERDROLA where he has been the General Director of Nuclear Generation since 2012. This company has supported the SNE and continues to do so in every possible way that a collective member can.

Francisco López was President of the SNE between 2013 and 2015, thus culminating many years of collaboration, support, and closeness with our Society and that will surely continue in the future.

The awardee picked up his medal stating that it was a great honor to receive it and that he did so with great emotion and enormous responsibility to continue the career of the great professionals who have preceded him in this distinction.

"I take this moment to thank all the people and institutions that have contributed to creating our excellent nuclear industry. And also, all the people who have allowed me to dedicate time to the SNE, especially the constant support of my family. "

Francisco López considers the SNE as "our home" due to its objective of disseminating the values and technology of nuclear generation in all its applications; for fostering the union of professionals in the sector, being a meeting point for the exchange of experiences and ideas, especially in its Annual Meetings. "In addition, the support and communication work of the SNE is vital to contribute to the excellence of nuclear energy. For me, the period in which I had the honor of presiding over the SNE was enormously enriching, in which we set a goal the support and development of two SNE commissions and that today we have seen that it has been achieved, which are Nuclear Young People (JJNN) and nuclear women (WIN). "

He ended his speech with an accurate reflection on nuclear generation, highlighting the excellence of its professionals and companies that have proven to be capable of overcoming any challenge so that, currently, thanks to nuclear energy, fundamental needs of society in general are solved, such as security of supply, decarbonization, sustainability of the electricity system, technological development, creation of highly qualified jobs, etc. However, the challenge ahead is enormous as we have to ensure that this technology continues to contribute in the future to meet the needs and objectives of sustainable development. To do this, he asserted, "we have to be bold, committed, and persistent."

Francisco López said goodbye by confirming his commitment to the SNE and its members and expressing his desire to continue contributing with the Society to achieve a bright future for the nuclear sector.

### "JOSÉ MARÍA OTERO NAVASQUÉS 2020" AWARD TO NUCLEAR YOUNG PEOPLE

This distinction, which rewards communication work in the nuclear field and special dissemination in the media of the peaceful use of nuclear energy has been awarded to Nuclear Young People which was created in 1996 as a new commission of the SNE and since its origins has aimed to promote the incorporation of young talent into our sector, something essential for our future and which is precisely one of the strategic objectives of the Spanish Nuclear Society, along with the dissemination of nuclear technology, and is in this area where Nuclear Young People has stood out in an exceptional way, giving a fresh image to the communication of our sector. With this award, we want to recognize this effort of many years that is now bearing fruit and that makes us look to the future with a youthful and contagious optimism.

**Pablo García**, as president of Nuclear Young People. collected the award stating that the true essence of Nuclear Young People is all those people who make the work of the commission possible.

"This award is for all those people who give talks at institutes, universities, who help us prepare content for social networks and publications in different media. And, ultimately, for all those people who always tell us 'yes' when we ask for your help.

This has been a tremendously complicated year for our team as another of Nuclear Young People's characteristics is its proximity and the possibility of offering a different point of view of the nuclear industry in dynamic environments and formats that, unfortunately, this year we have had to exchange for computer screens. However, we have found a very positive response from the public that has allowed us to do other new things. That is why we want to thank each of the people on the other side of the screens who listen to us and give us words of encouragement that help us continue and want to do better things.

And for the record, we are not going to relax after receiving this award. I want to say goodbye by announcing that in September 2021 we will organize the next European Nuclear Young People Congress in Tarragona and you are all invited to participate. Thank you very much."

### HONORABLE MENTION FROM THE SNE 2020 TO JULIO BLANCO ZURRO

This mention rewards the personal and continuous and special work of the candidate in support of the SNE, contributing to the fulfillment of its objectives and being part of the governing bodies or commissions.

In the words of the SNE President, "the person chosen this year for this award fits perfectly with this description for his very long work, for being a great professional and someone truly loved by all."

**Julio Blanco Zurro** is an industrial engineer with a specialty in Energy Techniques and was a researcher at the UPM for safety analysis projects for Spanish nuclear power plants, and since 1990, he has worked at the NATURGY GROUP in different positions and activities in the nuclear area. At present, he represents different responsibilities related to the Trillo and Almaraz power plants. He was a member of the SNE Board of Directors between 2005 and 2009 and Treasurer between 2009 and 2013.


Julio Blanco was unable to attend the event and connected virtually to thank the SNE for this Honorable Mention and wanted to send a message of encouragement to all members and their family and friends who are suffering from COVID-19, recalling the importance of taking care of our health and the health of all those who live and work with us.

"I am very excited about this recognition because of its significance. Because I have been part of this Society that I am proud to have belonged to for more than 30 years. I share this award with all the members of the SNE and I must especially thank the people who I have worked with on the Board of Directors where I was a member and Treasurer. And, particularly, to my Presidents: Maite Domínguez, Luis Yagüe, José Emeterio Gutiérrez Elso, and Lola Morales".■

# COMMERCIAL EXHIBITION Virtual

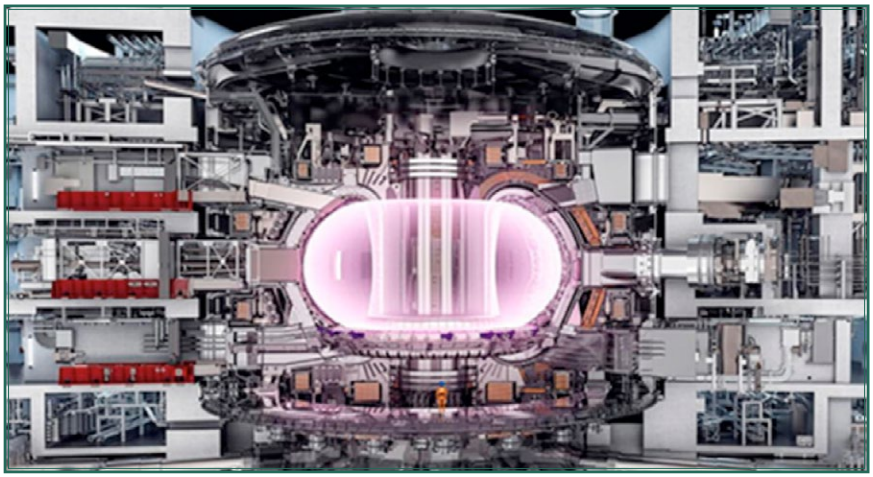

## EXHIBITORS COMPANIES

AHLBERG CAMERAS AB • ALISYS • AMARA • CIEMAT • CLUSTER DE LA INDUSTRIA NUCLEAR DE CANTABRIA • EMPRESARIOS AGRUPADOS • ENDESA • ENUSA INDUSTRIAS AVANZADAS • ENWESA • EQUIPOS NUCLEARES • FRAMATOME • GDES • IBERDROLA GENERACIÓN NUCLEAR • NATURGY INGENIERÍA NUCLEAR • ORANO • RINGO VÁLVULAS • SGS • TECNATOM • WESTINGHOUSE

# EMPRESARIOS AGRUPADOS

EMPRESARIOS AGRUPADOS

https://www.empresariosagrupados.es/




Once again, **EMPRESARIOS AGRUPADOS INTERNACIONAL (EAI)** took active part this year at the Annual Meeting of the Spanish Nuclear Society. The leading nuclear engineering firm presented its main works in providing complete engineering services for new nuclear power plant projects, support for plants in operation, decommissioning and radioactive waste management, research reactor projects and simulation.

Notable domestically are the firm's engineering and consultancy activities for the nuclear power plants in Spain. It is relevant to mention an innovation project developed between PwC España and EAI with Iberdrola for the Cofrentes NPP, a real digital twin example based on physics and stochastic models developed under our Ecosimpro tool and integrated in Powerbrain. Internationally, noteworthy achievements include EAI's recently awarded 10M€ contract for the preconceptual design of DEMO and DONES. In addition, the Consortium EAI-CEN Solutions has successfully passed the Final Design Review (FDR) of the service contract ref. IO / 13 / CT / 4300000822 'Design, manufacturing, qualification and installation of the -Nuclear Safety Control System (SCS-N) from ITER'.

As in other years, personnel from EAI played a relevant role at the Annual Meeting, with EA's participants and speakers as well as helping organize the Meeting and its committees. Of particular mention this year was the Technical Committee's work at coordinating the Annual Meeting with Patricia Cuadrado in designing the technical program of the meeting. Furthermore, EAI has presented 12 papers in the technical areas of "Engineering and Innovation", "Fusion" and "Design and behavior of SSC".

# ENDESA


https://www.endesa.com/es/nuestro-compromiso

https://youtu.be/nd_bPf7wgrE

https://www.endesa.com/es/nuestro-compromiso/nuestro-compromiso/objetivos-desarrollo-sostenible

ENDESA, as the leading power company of the Iberian System and the first nuclear operator in Spain, with 47% of the total capacity installed, has been present in the first virtual congress of the Spanish Nuclear Society, showing one more year its commitment to this entity and having a prominent role in its organization and development.

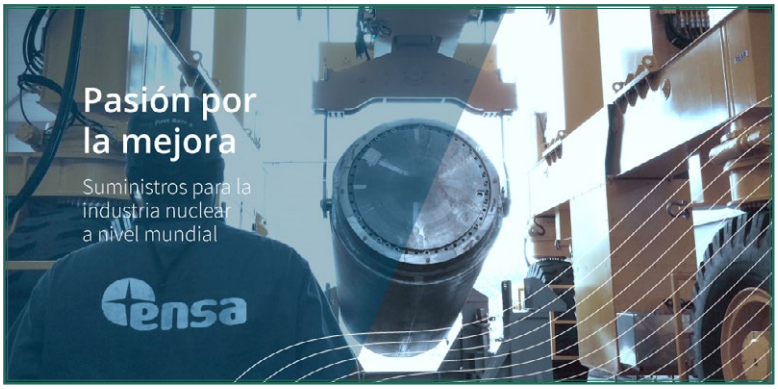
On the one hand, Gonzalo Carbó, General Manager of Nuclear Division in **ENDESA**, was in charge of moderating the plenary session entitled "The nuclear industry before COVID-19", which had representatives of the nuclear industry of the United States, France, China and Spain. **ENDESA**, strongly committed to mitigating the consequences of the COVID-19 crisis, did not want to miss the opportunity to reflect the important role that the nuclear industry has played during the worst months of the pandemic, being able to ensure the electricity supply, maintaining at all times the highest safety standards both in the operation and workers.

On the other hand, José García Laruelo, nuclear fuel responsible in **ENDESA**, was appointed chairman of the Steering Committee in which both Cristina Calvo Freijanes and Miguel Barreiro Bugallo also took part; in the same way, Eduardo Serra Sintes took part in the Technical Programme Committee. Its ability to adapt to external conditions in an agile and dynamic way have been the main point of these Committees, taking into account the Spanish Nuclear Society objectives with its partners and participants.

In addition, **ENDESA** has also participated in the exhibition thanks to its virtual stand which has focused on the social role of the company against the pandemic, the commitment of the company to lead the energy transition and the role of nuclear energy in this transition. **ENDESA** virtual stand highlighted **ENDESA**'s Public Responsibility Plan against COVID-19 as well as **ENDESA**'s Strategic Plan to achieve a 100% decarbonized economy by 2050, in line with European climate change targets.

Last but not least, **ENDESA** highlights the Spanish Nuclear Society capacity to quickly adapt its congress, being able to provide a quality event and maintaining the commitment acquired with its partners, despite the difficulties and consequences of the pandemic.

# EQUIPOS NUCLEARES S.A., S.M.E.



https://www.ensa.es

https://www.enwesa.com/es/company/history

**Equipos Nucleares S.A., S.M.E (ENSA)** y **ENWESA Operaciones S.A., S.M.E** participated in the 2020 Virtual Meeting of the Spanish Nuclear Society. Through a corporate stands of the group, ENSA and ENWESA showed their capacities within the nuclear sector given that their infrastructure, technology and human equipment are adequate for satisfying high quality of different areas like engineering, design, primary components inspections and the different services for the nuclear plants. Operational excellence, passion for improvement, progress of R+D and efficiency are present in all decisions and actions of the company. The group is expert in manufacturing nuclear large components in 90 nuclear plants with different designs in the whole world. Plant services related to maintenance during operation and outages, design and manufacture of fuel cask to storage and transport the fuel, spent fuel treatment, nuclear plants dismantling and their Advanced Technology Center are others strengths of the ENSA Group.


# GDES



www.gdes.com

https://gdes.com/corporate/es/analisis-predictivo-avanzado/

https://gdes.com/corporate/es/servicios-nucleares/

## GDES PLAYED AN ACTIVE ROLE IN THE SNE VIRTUAL MEETING

**GDES** participated in and supported the Virtual Meeting that the Spanish Nuclear Society organised in November as the annual meeting point for nuclear professionals. The format this year was different – 100% online – but the work dynamic and the participation levels were maintained in relation to previous years. The company and its staff joined more than 480 attendees who connected during the 4 days of the event and the 31 companies that made the organisation of the event possible.

**GDES** representatives participated in the Technical Sessions, sharing the most relevant projects and experiences of this past year with all our colleagues from the nuclear industry. As part of the programme of presentations, Alberto Mínguez, R&D Manager, gave a talk on the VIGIA system developed by **GDES** and its implementation at Cofrentes nuclear power plant. In another Technical Session, Antonio Martínez, O&M Support Services Director, presented a paper on the removal of fouling from the interior of the cooling towers of Cofrentes nuclear power plant.

Following Antonio Martínez, in the same session, Salvador Pineda, Project Manager, gave two consecutive presentations. In the first, he outlined our metallisation projects: multilayer metal alloy coatings applied to the interior of moisture separator reheaters (MSR) to remedy the deterioration caused by the effects of erosion and corrosion. In his second presentation, Salvador Pineda described **GDES**' involvement in the ITER project as the company responsible for the application of specific coatings in the building where the nuclear fusion reactor will be located, Tokamak, and its annex buildings, Diagnostic and Tritium.

**GDES** sponsored and co-organised the round table on "Digitalisation of processes, future challenges", within the framework of the Virtual Meeting and as a side event. It brought together the voices of innovation professionals from the nuclear sector.

Moderated by José Ignacio Roselló, head of Robotics and Instrumentation at **GDES**, the round table featured the views of Juan Atanasio Carrasco, head of Engineering at I&C CNAT, Luis López, head of Used Fuel and Innovation at Iberdrola Generación Nuclear, Paulo Santos, head of the Quality group at ANAV, and Alberto Conde, CEO of *xabet*, an expert in digital transformation. The high technological and digital standards of the nuclear industry were highlighted, as well as the willingness to continue along the path of monitoring, predicting and optimising processes through artificial intelligence; in addition, emphasis was placed on the importance of showing the profitability of these investments with a view to encouraging the development of these type of projects in nuclear power plants.

In addition, **GDES** sponsored the *Safety Minute*, a video presented by the QHSE Manager that gave a quick reminder of the new preventive measures to be followed in this pandemic situation. It reflected the **GDES** safety programme, involving awareness and dissemination actions, with which it aims to ensure safety in its operations, for its employees and for the environment in which it operates.

# GRUPO ENUSA


www.enusa.es

Twitter (@enusa_sa)

## THE ENUSA GROUP PARTICIPATES IN THE VIRTUAL MEETING OF THE SPANISH NUCLEAR SOCIETY

In a context of extraordinary social, economic and health difficulties due to the COVID-19 pandemic, the **ENUSA Group** wanted to renew its annual commitment to the nuclear sector by taking part in the Virtual Meeting of the Spanish Nuclear Society held in 2020. An annual event that serves as a meeting point for the Spanish nuclear industry to share experience and knowledge.

As every year, the presence at this congress for an organisation such as ours allows us to confirm our commitment to nuclear energy and the entire Spanish sector, at both industrial and scientific or institutional levels. This is a sector whose contribution to the economy and well-being of our country, as well as its fundamental contribution to the fight against climate change, are essential: throughout the year 2019, nuclear energy in Spain generated more than 21% of the total electricity, making it the leading source of electricity in our country. It is therefore a strategic element for the national economy, guaranteeing the electricity supply to industries and households, and a fundamental asset for the environment, guaranteeing the energy transition towards a $CO_2$-free generation model.

This year the Meeting of the Spanish Nuclear Society launched a virtual format, due to the restrictions imposed by the global health crisis. Between the 16th and 19th of November the different activities that took part in the congress were developed online in a website specifically designed for this purpose. **ENUSA**, together with the rest of the participating companies and sponsors, presented a virtual stand at the online exhibition which was used to find out about the activities that make up our business strategy and shape our business.

**ENUSA** took part in the more academic part of the meeting with 15 presentations, which formed part of the technical programme of the congress. The 23 people from **ENUSA** who participated as speakers presented some of the most recent advances in spent fuel, accident tolerant fuel (ATF) or decommissioning management, as well as other new developments in the field of nuclear engineering. Our specialists also presented different papers that deepened our commitment to corporate social responsibility and legal compliance, key elements of our corporate strategy that we wanted to be present, in a very active way, in the technical development of the congress.

Special recognition is deserved by the work of our colleague Javier Riverola, whose paper entitled *Use of neural networks to predict the critical heat flow in a reactor*, received the award for the best paper in the thermohydraulic and neutronic area. The article explores the use of neural networks to predict critical heat flow, which is fundamental for the safe operation of nuclear fuel. This paper is a good example of the high scientific and professional level demonstrated by all the interventions of the people who make up the **ENUSA** staff and who, year after year, share their know-how in the framework of this meeting.

Throughout the four days of the congress, the members of **ENUSA** who were able to attend had the opportunity to meet and exchange knowledge with other professionals in the field. As every edition, the annual meeting of the SNE becomes a core event of the activities of our sector in Spain, an event of which **ENUSA** wants to continue being an important part in 2021.

# IBERDROLA GENERACIÓN NUCLEAR

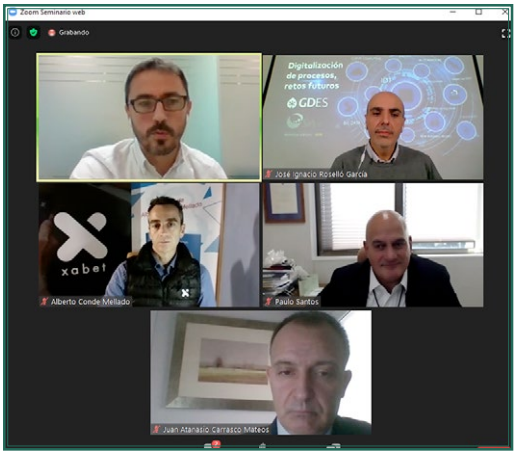
IBERDROLA
Generación Nuclear

www.cncofrentes.es


*Presentation by Rubén Mascarell and Juan José Molina, on "Spent Fuel Container Loading Equipment at Cofrentes NPP".*


*Javier Deltoro delivering his presentation on "Installation of new chiller in the Non-Essential Chilled Water System"*


*Carlos Gavilán presented the paper "Analysis of BWR thermo-hydraulic instabilities using the entropy in the recurrence period of the system's orbits".*




*Luis López, Head of Spent Fuel at Iberdrola Generación Nuclear, in his participation on Digitalization Session.*


*Nereida Sánchez, from Cofrentes NPP, in her presentation on "Current events in emergency management in CNC".*

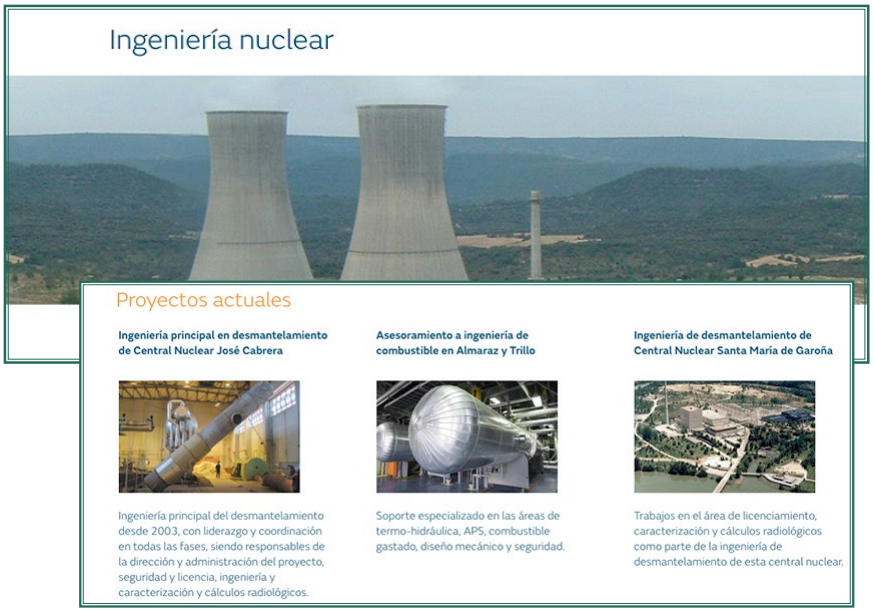
Despite the extraordinary situation, due to the COVID-19 pandemic, **IBERDROLA GENERACIÓN NUCLEAR** attended the SNE Annual Meeting as in all previous editions, although this time it was in virtual format. Like the rest of the exhibiting companies, it has set up a virtual stand through which to present the most important initiatives and actions that have been developed, particularly at the Cofrentes nuclear power plant, as well as at the rest of its investee nuclear power plants. This stand has been the most visited virtually by the congressmen.

The direct participation of Iberdrola technical staff and experts has been considerable. The staff of the Cofrentes nuclear power plant has made four presentations in different areas: *Current affairs in emergency management; Equipment loading of spent fuel containers; Installation of a new chiller machine in the Non-Essential Chilled Water System; and Analysis of thermo-hydraulic instabilities of BWR's using entropy in the period of recurrence of the orbits of the system.* In all cases, an attempt has been made to share information and operating experiences to improve actions in the nuclear field.

Presentations have been made about the construction of the ATI, at a time as delicate as the pandemic; the evaluation of the impact of the flexible operation in an operation cycle of CN Cofrentes; the impact on fire risk after the improvements to IS-30; or the optimization of the plant's operation until 2030.

Aware that the RA, in any of its formats, is the most important event in the nuclear sector in our country, and that its holding attracts congressmen from around the world, **IBERDROLA GENERACIÓN NUCLEAR** always tries to add value to this event, and share advances and experiences in the nuclear field. The digital format of the edition has allowed, through networking tools, a large participation of personnel through any PC or mobile device, favoring the dissemination of nuclear technology. It has been a great option to maintain interpersonal distance. There is no doubt that nuclear professionals have achieved our objectives and have demonstrated our ability to exchange experiences and transmit enthusiasm.

# NATURGY GENERACIÓN




**NATURGY GENERACIÓN** maintains its commitment to nuclear generation by participating, one more year, together with NATURGY INGENIERÍA NUCLEAR, in the Virtual Meeting of the Spanish Nuclear Society 2020.

Several **NATURGY** professionals have actively participated both in the presentation of (10) technical presentations from different thematic areas and in the virtual stand of our nuclear engineering showing more than 40 years of experience in the safe and efficient management of the complete cycle of nuclear power plants: design, construction, operation, and dismantling, have been reflected.

In addition, **NATURGY** has sponsored the monographic session "Nuclear energy: the future without $CO_2$" which had the participation of several international experts and collaborated, through their representation in Women In Nuclear, in the organization of the conference open to the public "Application of radiation in the preservation of cultural heritage" in which the various applications of electromagnetic radiation in research, conservation and restoration of our cultural heritage were exposed.

**NATURGY** has been the owner (100%) of the José Cabrera Nuclear Power Plant, Westinghouse PWR reactor, operating commercially for 38 years. NATURGY INGENIERÍA NUCLEAR, **NATURGY**'s engineering subsidiary, has been involved in all phases of the project, including the design, start-up, operation, definitive shutdown and currently in the dismantling of the plant.

This experience allows **NATURGY** to have a highly qualified team since 1991 and to develop large national and international projects in all areas of the nuclear sector.

At present, NATURGY INGENIERÍA NUCLEAR also provides highly specialized support to both Almaraz and Trillo, Nuclear Power Plants, as well as to the decommissioning, fuel and waste management departments at ENRESA.

The methodology and quality procedures employed, as well as the use of the most advanced engineering and modeling tools and practices, allow **NATURGY** to provide its clients with qualitative improvements in the safety, reliability or availability of processes and facilities, ensuring at all times strict compliance with existing regulations in the provision of the following services:

- Neutronic Calculations
- Thermohydraulic Calculations
- Severe accidents simulation
- Safety Probabilistic Analysis
- Support for Mechanical Design
- Monitoring of Fuel Manufacturing

https://www.naturgy.com/inicio

https://www.naturgy.com/conocenos/actividad_y_energias/electricidad

https://www.naturgy.com/generacion_convencional

- Nuclear Engineering
- Licensing
- Decommissioning and Dismantling
- Spent Fuel Management
- Radioactive Waste Management
- Human Factors Engineering
- Operation Support
- Radiation Protection

The specialists in Nuclear Technology of **NATURGY** have more than 20 years of experience and recognized expertise of all phases of development and in all key aspects of nuclear projects. Its nuclear division has a multidisciplinary and well experienced team of engineers experts capable of providing comprehensive services to nuclear power stations and other nuclear or radiological facilities, from the initial phase of feasibility study, through the supervision of construction, startup of the facilities, operation, maintenance and finally its final shutdown and decommissioning.

All this experience acquired over the years is available to its clients, both internal and external, through its wide range of services.

# RINGO VÁLVULAS

www.ringospain.com

## THE COMPANY

**RINGO VÁLVULAS**, a Company ASME III N&NPT Stamp holder, is a leader valve supplier in the Spanish Nuclear Industry having also a wide install base in 40 nuclear facilities located in more than 20 different countries all over the world. **RINGO VÁLVULAS** provides Engineered Solutions tailored to our customer needs for the most severe and critical services, where safety and reliability is a must. **RINGO VÁLVULAS** is a customer oriented company whose main aim is to offer the best solutions to our customers not only to fulfil their expectations but also to try to exceed them.

## NEW DEVELOPMENTS

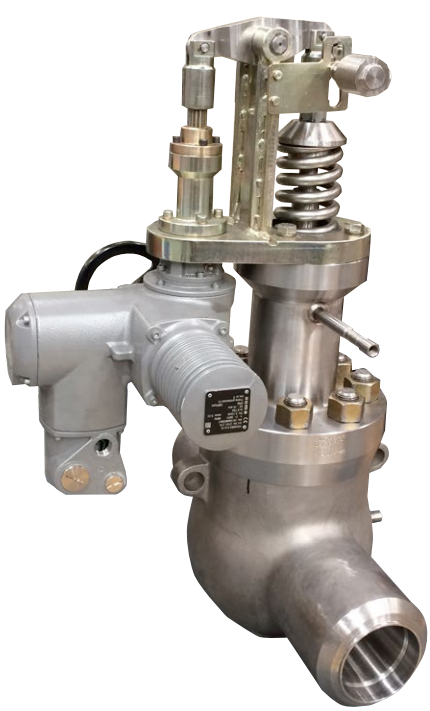
**RINGO VÁLVULAS** R&D Department counts on a multi-disciplinary team of engineers with extensive experience in the nuclear sector, developing, qualifying and validating new valve designs and complex solutions to the industry.

Within this context, **RINGO VÁLVULAS** has currently a contract for the supply of special valves: Electric Operated Bellow Sealed Globe Valves 4" 1750# with double seat for the Kursk-2 Nuclear Power Plant in Russia. These valves shall be installed in the primary circuit and have two main safety functions:

1. Isolation of the boric acid tanks from the nuclear island pipelines during the unit commissioning.
2. Boric acid supply from the tanks during the NPP emergency operation modes, including the one involving power failure.

Most relevant valve features are:

1. Under standard operating conditions, closing is executed by means of electric actuator, while opening is made by the spring.
2. Closure member is made with two discs and a leak-off tube between both of them to guarantee the strict closure tightness requirements. Furthermore valves have a bellow to assure that there is no any kind of emission to the environment.
3. Valve is inside the Nuclear Power Plant containment and has been designed to fulfill the strict weight and envelope limitations (height could not exceed 900 mm).

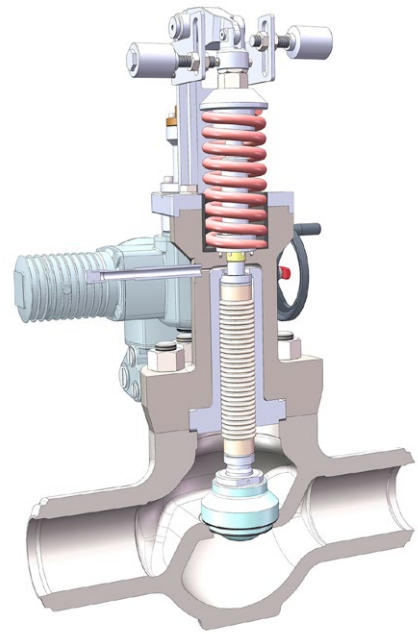


Before starting production of the serial valves and according to all the customer requirements, **RINGO VÁLVULAS** has proceed with a prototype to perform the qualification process Main activities carried out for design validation are:

- Hydrostatic Test of body, bellow and seat.
- Vacuum Test.
- Open/Close Functional Test. Determination of torque value for manual operation.
- Endurance Test (250 cycles).
- Seismic Test.
- Flow Capacity test (Cv).
- Noise Measuring.
- Electric Fail Position Test.
- Thermal Cycling.
- Dissasembly and components analysis.

## NUCLEAR SAFETY CULTURE

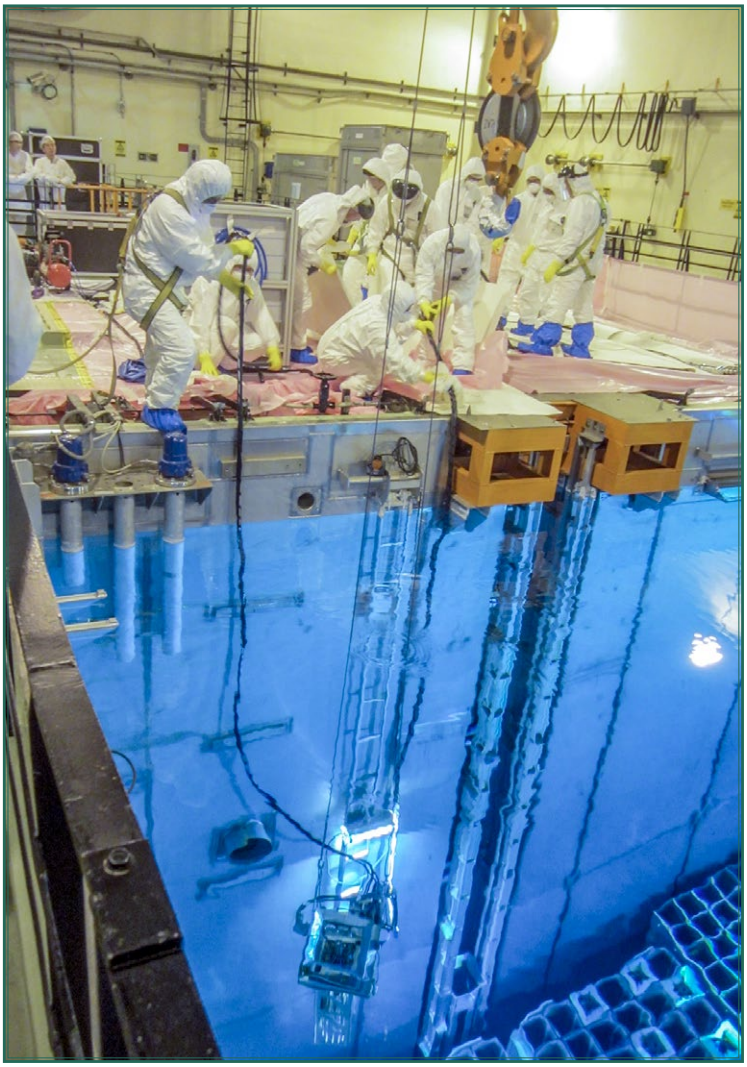
Development of this new design has been a great challenge to **RINGO VÁLVULAS** R&D Department, as this solution combines the difficulties of a shutdown valve with strict tightness requirement with the function of a safety valve; in spite of this challenging combination, it has been a relevant success. In this case, the design means an important milestone in the industry, as it is a new safety element added by Rosatom in their VVER plants design to increase the safety, after the lessons learnt from Fukushima accident in 2011.



This introduces a new passive safety system in case of reactor shutdown under power supply failure condition in the Nuclear Power Plant.

**RINGO VÁLVULAS** is very proud of its commitment to the Nuclear Industry: expecting to continue doing our part to make nuclear energy cleaner and safer.

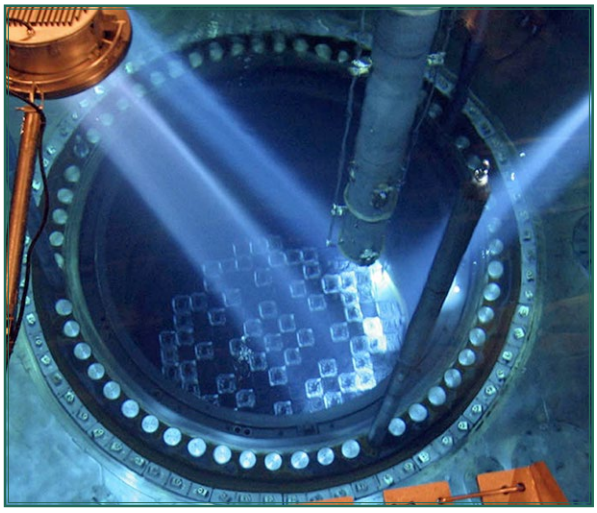
# TECNATOM



https://www.tecnatom.es/

https://www.youtube.com/watch?v=G_hB3Fere4E

https://www.youtube.com/watch?v=u6cj2mWb9QQ



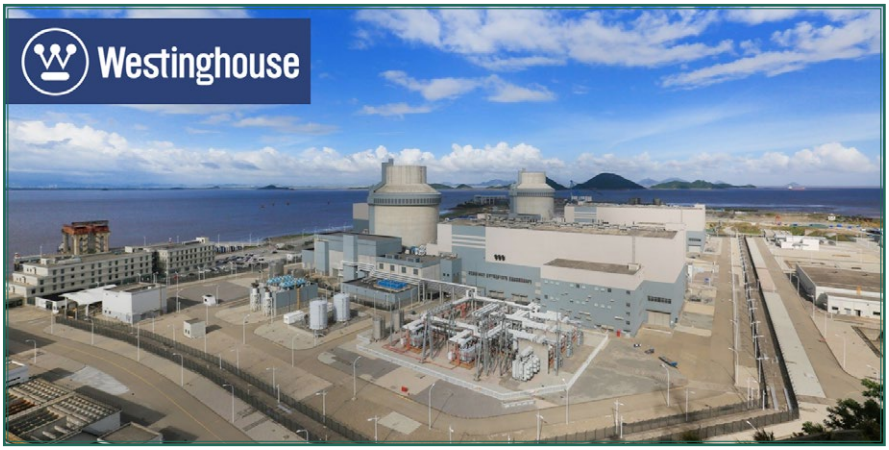
**TECNATOM**'s main activities are focussed on the management of assets, processes and people, the aim being to support safe and effective plant operation through the use of the latest technologies and digital processes.

The **TECNATOM** of today is a business group with subsidiaries in France, Brazil, China, the United Arab Emirates, Mexico and the United States that carries out activities in a variety of sectors, including the power generation, petrochemistry, railway and aerospace industries.

The company provides high-tech services and products that are generally designed and developed using in-house technology and tailored to the needs and requirements of the customer, in all cases in keeping with the state of the art as regards mechanical design, electronics, data processing and software.

**TECNATOM** undertakes projects in more than 40 countries across the world and its methodology and equipment have been validated and certified by clients and regulatory authorities at world level.

# WESTINGHOUSE




www.westinghousenuclear.com

**WESTINGHOUSE TECHNOLOGY SERVICES (W TS)** and **WESTINGHOUSE ELECTRIC SPAIN (WES)** have participated, as every year, in the Annual Meeting of the SNE, this year in its virtual arrangement. **WESTINGHOUSE** has been also involved in the meeting organization as a sponsor of the nuclear dissemination workshop with @ operadornuclear, and with a virtual stand in the trade exhibition displaying information related to its different business areas. Additionally, it has contributed to the technical sessions with several papers related to different projects implementation, products and services.

**WESTINGHOUSE** is the original NSSS equipment manufacturer for five (5) Spanish Nuclear Plants (out of 7 operating plants). **WESTINGHOUSE**'s presence in the Spanish Nuclear Market started with the supply of a turnkey project for the Jose Cabrera NPP in the mid-sixties and the opening of an office in Madrid in 1972 to provide equipment and services to the second and third generation of Nuclear Power Plants.

Since that time, **WESTINGHOUSE** has served the Spanish Utilities' needs either directly or throughout technical agreement with other Spanish companies.

Today **WTS** and **WES** continue to provide on a permanent basis engineering, operation services, field services and spare parts to the Spanish Nuclear fleet as well as participating in waste disposal and decommissioning projects not only in Spain but also in different European countries. At the international level, it is also worth to mention that **WES** is actively involved in the design and construction of the AP1000® plants at Vogtle Units 3 and 4 (Georgia, USA) and the Bohunice dismantling project (BBRs 440).

In addition to the headquarters office in Madrid, **WESTINGHOUSE** has another facility in Hospitalet, Tarragona that houses the Field Services group.

**WES** is a key part of the team involved in the design, manufacture, installation and construction of all AP1000 plants worldwide. The team established in Madrid, is a small piece of the **ONE WESTINGHOUSE** which has become an international group developing the AP1000 plant. In fact, this functional design model has been established at the Corporate level through the implementation of GOS (Global Operation Services) and the different BU's (Business Units). This active participation takes place from the Madrid and Cranberry offices, the factories around the world and the construction sites. The Spanish group takes part in the rotational assignments to provide technical support in those places where technical assistance is provided by **WESTINGHOUSE ELECTRIC COMPANY (WEC)**, as well as construction support at Vogtle by engineers fully dedicated from the Madrid Office.

Moreover, and based on the successful experience of **WES** in decommissioning plans; main engineering; site remediation; waste storage design: high, medium and low level; along with engineering support and vessel and internal segmentation capabilities, **WESTINGHOUSE** provides solutions for a wide range of Decommissioning, Dismantling, Remediation and waste Management (DDR&wM) projects. More than 30 years of national and international experience endorsed the new Environmental Services business unit being remarkable: El Cabril and Radiana waste repository design, Zorita and Barsebäck (Sweden) and Bohunice (Slovakia) internal and vessel segmentation.


GE Hitachi Nuclear Energy

# What's next.

At GE Hitachi Nuclear Energy, we work to solve the world's toughest problems. From the first nuclear reactor to power a commercial grid, to the world's safest reactor, the ESBWR – GE Hitachi has been powering the globe for more half a century. Since day one, we've worked with our customers on the things that matter to them ... power uprates, safely extending the life of their plants and reducing dose.

As the world leader in boiling water reactor technology, we are poised to meet tomorrow's energy demands. Always focused on the future, we continue to develop advanced technologies, including a fast reactor that could solve one of the world's most difficult challenges, used nuclear fuel.

**ge.com/nuclear**

HITACHI

EMPRESARIOS AGRUPADOS

# Engineering, Design and Services for Power Generation

In the nuclear field we offer our international experience in a wide range of services for the design, construction and operation support of nuclear power plants, including:

- Consulting
- Project Management
- Licensing Support
- Radiation Protection
- Equipment Procurement
- Quality Assurance and Document Management
- Operation and Maintenance Support
- Safety Assessments
- Probabilistic Safety Analysis (PSA)
- Design Modifications
- Software Development and Simulation
- Low-Level Radwaste Management
- Spent Fuel Storage Facilities
- Long-Term Operation (LTO)
- Decontamination and Dismantling
- Cybersecurity

Almaraz Nuclear Power Plant (Spain).

Angra Nuclear Power Plant (Brazil).

Cofrentes Nuclear Power Plant (Spain).

ITER (France).

Trillo Nuclear Power Plant (Spain).

Temelín Nuclear Power Plant (Czech Republic).

**EMPRESARIOS AGRUPADOS INTERNACIONAL, S.A.** Magallanes, 3 • 28015 Madrid, Spain • Phone: (+34) 91 309 80 00 - Fax: (+34) 91 591 26 55

www.empresariosagrupados.es