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SOCIEDAD NUCLEAR ESPAÑOLA

INTERVIEW:
Beatriz LIÉBANA & Patricia CUADRADO.
Presidents of the Organizing Commitee & Technical Committee of the 47th Annual Meeting of the SNE

Nuclear España
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47th ANNUAL MEETING OF THE SNE

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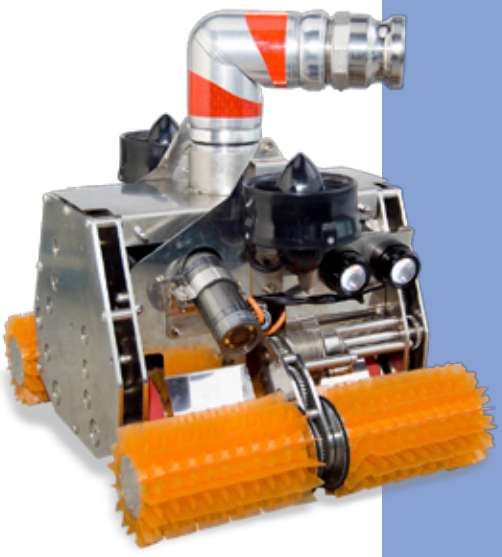

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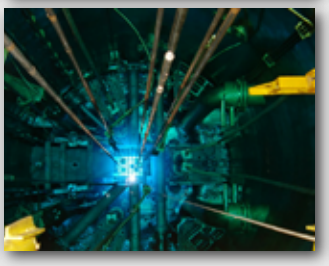

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EDITORIAL

YES, WE FIT IN WITH THE TIMES

The Spanish nuclear industry recently gathered at its annual meeting, an event organized by the Spanish Nuclear Society for 47 years that is proof of this sector's vitality. More than 600 participants; 300 presentations in technical fields such as fuel, engineering, maintenance, training, human factors or communication, to name but a few; such issues as long-term spent fuel storage or European taxonomy; technological deployment of companies in robotics, virtual reality and, above all, a new generation that is trained, enthusiastic and willing to show itself without complexes.

Yes, we fit in with the times. However, neither our perception nor the operational data of nuclear power plants in Spain (20.8% of total net electricity production last year came from these facilities, which also provide an availability factor of 88.41%) make us able to share this vision of the nuclear industry held by part of the leaders of this country and part of society.

We disagree with those who consider us a technology that should be left behind, and we do so on the grounds of total contribution to the grid, operating hours, price stability, and of course, safety and commitment to the operation of nuclear power plants in Spain. We can also add to our allegation the panorama that opens the window to the world and see that this technology, of the past for some, will be used in 2022 to continue building reactors in the world (57 under construction and 443 operating according to data from the World Nuclear Association) and to continue research into new designs.

We call once again for a reasoned, reasoned, and argued debate on the increasingly critical review of our energy future. As of today, we are tied to an agreement signed in 2019 that leads us to shut down the plants between 2027 and 2035, thereby losing 112 MW of installed power that in 2021 translated into the production of 259,850 GWh (21% of the total consumed in Spain).

Far from the image that some sectors want to project, the nuclear industry in Spain is a living and strong economic sector which, despite the situation in our country, has remained strong with significant international development and which is made up of a business fabric and nuclear professionals who feel part of the times we live in and those to come.

Beatriz LIÉBANA & Patricia CUADRADO

PRESIDENTS OF THE ORGANISING COMMITTEE AND THE TECHNICAL COMMITTEE OF THE 47th ANNUAL MEETING OF THE SNE

Texts: MATILDE PELEGRÍ Photos: Grupo SENDA

The 47th Annual Meeting of the Spanish Nuclear Society has been free of capacity limitations and prevention measures related to the pandemic suffered in the previous two years. In this way, Cartagena has once again become the meeting point for companies and professionals, willing to share professional experiences and personal encounters that we had to restrict so much.

For the first time, the Annual Meeting has taken place in this city of the Region of Murcia, where the history of its Roman remains is mixed with modernist buildings, to welcome visitors with open arms.

We learn from Beatriz Liébana, president of the Organising Committee, and Patricia Cuadrado, president of the Technical Committee, the most essential facts about the development of this 47th edition of the Annual Meeting.

CARTAGENA, AN ENVIRONMENT TO BE DISCOVERED

For the first time, Cartagena is the host city for the Spanish Nuclear Society Annual Meeting. What reasons led the SNE to choose this city as the venue for the Annual Meeting?

Beatriz Liébana. The first reason we chose Cartagena was its infrastructure, which met the requirements to host more than 600 congress participants. The Palacio de *El Batel* in Cartagena was a perfect venue for an event of this magnitude, as not every city has a palace like this. Cartagena also has close links with the Spanish nuclear sector that are perhaps not so well known. The Polytechnic University of Cartagena trains future engineers with the possibility of specialising in this field, as it has "nuclear engineering" subjects in the Civil and Mining Engineering degrees. In addition, Cartagena has a fundamental industrial fabric, with companies that provide services and equipment to our power plants, such as NAVANTIA. Many of the people working in our nuclear power stations come from Cartagena's combined cycle power stations.

Last but not least, it is a city with a spectacular historical, cultural, artistic and gastronomic environment, which deserves to be enjoyed and discovered by the congress participants.

What has been the response from regional and local authorities and institutions such as the University?

PROFESSIONAL PROFILE

Beatriz Liébana is an Industrial Engineer from the Polytechnic University of Madrid, specialising in Metallurgy.

All her professional life, more than 24 years, she has worked in the nuclear sector, both nationally and internationally. First at Iberdrola Ingeniería, and currently at Iberdrola Generación Nuclear as head of Technical Support within the Nuclear Technical Services.

From 2015 to 2019, she was a member of the SNE Board of Directors, and since 2020 she has been part of the Communication Commission.

BL. The reception from the city of Cartagena and its institutions could not have been better. Not only have they given us enormous support in providing us with spaces for the informative activities that we have carried out during the week in the city (such as the STEM workshops for secondary school students, the WiN conference, the mentoring aimed at girls, the introductory course on nuclear technology, etc.) but they have also allowed us, with their significant involvement, to have a high visibility and media impact not only at a local level but also throughout the Region of Murcia. The culmination of this institutional support was undoubtedly the presence at the closing session of the Annual Meeting of the President of the Region of Murcia and several regional and local authorities.

How did the media respond to the SNE's invitation to cover the congress?

BL. The response has been very positive, bearing in mind, as I said, that a fundamental factor in achieving this visibility and media interest is the involvement and support of the authorities, who are well aware of the media's good, as is primarily in the case of the mayoress of Cartagena and the president of the Region of Murcia.

The current energy crisis situation has also helped a lot, which has created a scenario in our country where there is much interest on the part of the public in learning more about nuclear energy and what it can bring to the country, and the media have logically echoed this. And finally, it was essential to carry out dissemination activities open to society and to the city of Cartagena, something that always attracts the attention of the local media.

What are the overall attendance figures?

BL. This year we had more than 660 attendees, which shows the broad interest of professionals in attending and participating in the Annual Meeting.

THE TECHNICAL CONTENT

The technical program is the backbone of the Annual Meetings. How many papers were presented, and which thematic areas generated the most interest among the congress participants?

Patricia Cuadrado. A total of 300 papers were presented in 35 Technical Sessions, with up to 8 in parallel. It is important to note that, in general, all the rooms for the technical sessions were packed.

Of particular interest this year was the Communication Session with Alfredo García, better known as @OperadorNuclear on social networks, who spoke about his personal experience in dissemination and the transformation experienced in more than a decade of presence on the different channels. Also noteworthy was the presentation given by Manuel Fernández Ordóñez, chosen as the best of the Communication session, which consisted of an original journey through the world of myths, in which he asked the attendees to participate in the deployment of communication as a critical asset of the nuclear industry, as we all communicate.

Where is the technical program evolving to?

PC. Every year we try to innovate. This year we again included the Nuclear Technology workshop, organised by Jóvenes Nucleares, which created a space for innovation by bringing together the most innovative technologies in the nuclear sector. These technologies were presented interactively and provided a dual opportunity: companies had a space to showcase their

products in detail, and attendees could interact with them and meet face-to-face with the experts who had created them.

The two workshop sessions focused on Virtual/Augmented Reality and Robotics, bringing together companies specialising in emerging technologies such as Artificial Intelligence.

The plenary sessions provide an opportunity to discuss current issues in the sector. What were the highlights of these sessions?

PC. With the recent inclusion of nuclear energy in the European Taxonomy this year, we decided to address this aspect in the first plenary session. We linked this topic with the second plenary session on spent fuel management, as this inclusion is subject to certain conditions, including the obligation for Member States to have detailed plans for a high-level radioactive waste disposal facility in operation by 2050.

How do you value the participation of international speakers in addressing current issues such as modular reactors or the European Taxonomy and nuclear energy?

PC. In the monographic session on advanced reactors, we invited four technology companies with very significant designs, who decided to commit to the development of this technology and showed us the current state of their plans, and how they have been overcoming milestones to ensure that this supposed solution will soon be on the market. Designs from Westinghouse (AP100, eVinci, Lead Fast Reactor), GE Hitachi (BWRX-300), Seaborg (Compact Molten Salt Reactor), and Holtec (SMR-160) were presented.

A MEETING FOCUSED ON SOCIETY

The interest in bringing nuclear science and technology closer to society is increasingly reflected in the Annual Meeting through the activities organised by Jóvenes Nucleares and WiN Spain. In addition, some of these initiatives also have a technological component for congress participants, such as the JJNN technology sessions, or the educational community, such as the Nuclear Forum course for teachers. What aspects of these initiatives stand out?

BL. It is important to recognise the great value of these activities, from the point of view of bringing the sector closer to the public entertainingly and excitingly, and also from the point of view of personal satisfaction at seeing how well received they are. Behind these activities, there is an immense amount of work on the part of Jóvenes Nucleares, WiN, the Organising Committee, and all those people who, altruistically, dedicate a great deal of free time to their preparation and organisation in order to make them a success.

Should this type of activity be encouraged at the annual meetings?

PC. Of course. In the first two days (Monday and Tuesday), multiple outreach activities are aimed at the city's society chosen to hold the Annual Meeting, while the remaining three days (Wednesday to Friday) are focused on the congress participants. Throughout these three days, the congress participants enjoy an intense Technical Programme, complemented by the collective participation of the attendees in social and cultural events in emblematic places of the city.

What relevance do activities such as STEM workshops have in this objective of communicating to society?

BL. Opening the SNE Annual Meeting to society is a positive aspect that local institutions highly value. It is also a distinctive

PROFESSIONAL PROFILE

Patricia Cuadrado holds a degree in Chemistry from the Universidad Autónoma de Madrid, specialising in Analytical Chemistry.

She works as Westinghouse's Principal Project Manager of the Lead Fast Reactor project.

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, being a member of the Board of Directors since 2017. She was chair of the Technical Committee of the WiN Global World Congress, held in Madrid in 2019.

Since December 2019, she has been Secretary General of WiN Spain.

feature that makes our Congress very different from many other scientific congresses. Teachers and students from educational centres appreciate it because it allows them to learn about scientific topics that are sometimes out of their reach outside the classroom. In addition, this year, we have had the magnificent facilities of both the Polytechnic University and Navantia, and the students, for example, have had the opportunity - which few have - to work in a real chemical laboratory or to visit and admire the design of the most innovative submarine. We have held six STEM workshops in parallel... quite a milestone and a challenge!

DATA

- Attendees (congress attendees + accompanying persons): **662**
- Number of papers: **276**
- Exhibitors: **24**
- Sponsors:: **29**
- Collaborating entities: **8**

BUSINESS PARTICIPATION

The trade exhibition at the 47th Annual Meeting is one of the main meeting points for companies and professionals. What has been the response from companies this year?

BL. It has been great, as always, and fundamental to the success of the Annual Meeting. The exhibiting and sponsoring companies' participation and involvement are essential to hold the Annual Meeting with almost 700 congress participants, consolidating it as the reference meeting point in Spain and Europe for professionals in the nuclear sector.

How has networking worked?

BL. One of the most attractive aspects of the Annual Meeting is precisely having this meeting point for professionals and companies in the nuclear sector, who have a space and three days available for exchanging information, lessons learned, initiating new collaborations, and promoting their products and services. In this sense, as every year, activities were carried out to encourage networking both inside and outside the Conference Centre, and spaces were made available inside the Conference Centre for companies that so wished to hold more formal meetings. After such a painful situation for all of us, as the pandemic, we needed to meet again and see each other's faces, reconnect in person, and strengthen human relations.

COMMUNICATION

The activities of the Annual Meeting are increasingly present in the host society. What role has communication played in this edition of Cartagena?

BL. We are communicating more and better; we have established this channel with society, which is now much more open to receiving and understanding our messages. It is essential to take care of the media, to keep them informed severely and rigorously, and to provide them with the answers they need and which are demanded by the public to whom they are addressed. In this sense, we have held two press conferences, one before the summer to announce the Annual Meeting and another just before it in the Cartagena City Hall itself, which has dramatically facilitated contact with the media and the dissemination of our activities and our messages.

SOCIAL RELATIONS

In addition to an essential level of technical content, the annual meetings are also a meeting point for professionals in the sector. What is your assessment of the social program?

BL. This year we took advantage of the great historical and cultural heritage that the city of Cartagena offers us to hold a cultural event that allowed us to get to know its heritage. Given that capacity was limited, the visits had to be divided into several groups. 90% of the congress participants were very positive about this activity, which also involves and facilitates meeting spaces at the end with a Spanish wine where, in a relaxed way, contacts between the congress participants continue outside the technical program.

What about the activities organised for accompanying persons?

BL. With the program designed for accompanying persons, we have tried to give a general overview of Cartagena's strong points: its historical heritage, gastronomy, and the sea. During the three days, a very complete but relaxed program has been carried out so that all these places and experiences can be enjoyed without haste, which has been very positively valued by the people who have participated in the program.

THE COMMITTEES

Leading the organisation of an event that has brought together more than 600 people, where more than 300 technical papers have been presented, is a challenging task. How has the work of the Organising (CORA) and Technical (CTRA) Committees developed?

BL. This year's CORA had many new members participating for the first time in the Annual Meeting organization. This mix of experience from previous years and fresh ideas has enriched everyone. For me, the motivation and the desire to do things well and enjoy preparing everything is essential in CORA, and we have achieved that with this CORA.

PC. We are very well coordinated, and the excellent support from CORA and the Board of Directors makes the organisation of this event very easy. Regarding the CTRA, everyone has been assigned one or more activities according to their specialty, and they are aware of the others to support us. The whole committee knows the sector very well, and I am fortunate to have a very dedicated and professional team.

How has the relationship with the Board been?

PC. Every year, they have been straightforward to deal with, and thanks to them, the organisation has succeeded.

LESSONS LEARNED

According to the survey results addressed to the attendees, most congress participants rated the 47th Annual Meeting between good and very good. Therefore, the standard it sets is difficult to surpass. However, there are always improvements to be made. What lessons are you consider most important to pass on to the following Committee?

PC. Regarding the Technical Programme, we need to promote the Poster session. We are already working on organizing this session for the 48th Annual Meeting, and we have excellent ideas.

Another point would be to avoid overlaps between the special sessions and the Nuclear Technology workshop so that congress participants can participate in both sessions.

And finally, in the parallel technical sessions, it is advisable to condense some thematic areas as some have too many papers and others too few. This way, all the speakers would have more time for their presentations and the final discussion with questions.

BL. For my part, it only remains for me to thank all the CORA and CTRA members of the 47th Annual Meeting for their effort and dedication and to encourage and wish all the Committees of the 48th Annual Meeting the best of luck. I am sure that the next Annual Meeting in Toledo will be a success, given the quality of the people they have at their disposal and the desire and effort they put into it.

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SOCIAL EVENTS

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CULTURAL EVENT

This year the cultural event consisted of a guided tour with two alternatives: The Roman Theatre of Cartagena with a visit to the site of the Forum Quarter and a route through the modernist buildings along the main streets of Cartagena.

COCKTAIL RECEPTION AND OFFICIAL DINNER

Cócktail sponsored by: coapsa IDOM

The official dinner of the 47th Annual Meeting was held at the *Aquario Celebrations* restaurant and was preceded by a cocktail party sponsored by COAPSA and IDOM. The Official Dinner is the most important social event of the SNE Annual Meeting, where congress participants and guests enjoyed Cartagena's gastronomic excellence and where the Society's distinctions were presented, as shown on the following pages.


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SNE ANNUAL AWARDS

During the official dinner, the SNE annual awards ceremony was held, with the participation of Héctor Dominguis, president of the SNE; Pedro Ortega, secretary general of the SNE; Francisco Suárez, president of Jóvenes Nucleares, and Susana Falcón, president of Women in Nuclear Spain.

FRANCISCO JAVIER GUERRA, SNE MEDAL 2022

The SNE 2022 Medal has been awarded, unanimously by the Board of Directors, to Francisco Javier Guerra, Director General of Tecnatom and former President of the Spanish Nuclear Society for 2019 - 2021.

This award is the Society's highest recognition. It acknowledges his work favouring the implementation of nuclear sciences and technologies in Spain and his support for the SNE.

"For me, it is a real honour to receive this distinction, which I must undoubtedly share with many people who accompanied me and were with me during these intense moments. It is a long list: the Board of Directors, the different commissions, the whole Nuclear Society, the members, the companies, etc. I am grateful to all of them.

And in the difficult times when we went through COVID-19, we certainly made the grade, and the proof is that this Society continues to move forward. A Society that I believe is essential, its role in the context in which we find ourselves, in which nuclear energy is once again recovering and in which public opinion is becoming more favourable, is the moment in which the SNE must continue to bring the sector together. We would not be able to call ourselves the nuclear sector if the SNE did not exist.

And on the other hand, we are a valuable source of opinion and professional opinion on the proper functioning of our nuclear plants and our energy source. Nuclear energy is essential in the energy mix that we need today and will need in the future.

And finally, I would like to thank my wife, Elena, for her unconditional and unwavering support and understanding throughout all these years.

And that is all. Thank you again, and we will continue to see each other".

Manuel Fernández Ordóñez, José Mª Otero Navascués 2022 award winner, next to Héctor Dominguis and Francisco Suárez.

MANUEL FERNÁNDEZ ORDÓÑEZ, JOSÉ MARÍA OTERO NAVASCUÉS AWARD

The José María Otero Navascués Prize has been awarded to Manuel Fernández Ordóñez, Business Development & Digital Marketing Director at Tecnatom, in recognition of his communication work in the field of nuclear energy, contributing to its knowledge and dissemination.

"It is an absolute honour to receive this award from my colleagues at the Spanish Nuclear Society.

When you get up in the morning and realise that you work in the best industry in the world, it is effortless to do what I do. I am often asked why I spread the word. And the truth is that I do it out of an exercise of responsibility. When our children look at us in a few years and tell us what we did to stop nuclear power plants from being shut down, we don't have to look at the ground and say that we didn't do anything. So the only thing I can promise you in gratitude for this award is that, at least, we will not stop fighting. Thank you once again.

Francisco Javier Guerra, with the SNE 2022 medal, together with Héctor Dominguis and Pedro Ortega.

FRANCISCO GARCÍA ACOSTA, HONOURABLE MENTION

In recognition of his valuable participation and longstanding collaboration with the Society and its aims. Francisco García has been treasurer of the SNE and a member of the Technical Committee of the Annual Meeting on different occasions.

"It is an honour for me to receive this distinction.

I feel very grateful and proud to belong to this Spanish Nuclear Society. We are great professionals and better people who, in a self-interested way, try to disseminate and promote our energy.

Today, on receiving this honourable mention, I feel very fortunate and privi-

Francisco García Acosta, SNE 2022 Honourable Mention, with Héctor Dominguis and Pedro Ortega.

leged. I have met and shared many moments with extraordinary professionals, and I have always found many friends in each of our SNE commissions. Since starting my professional career in 1990, I have formed a wonderful family with Silvia, Carmen, and Laura.

I have many good memories. There are so many that it would be better not to go on talking to cut the speech short. But talking about the Technical Committee of the Annual Meeting, the Organising Committee, the Board of Directors, and so many other projects where I have tried to do my bit, fills me with satisfaction and pride. I hope to continue to count on your friendship from now on.

And finally, I would like to have a very special remembrance for all those who have left us and are no longer with us. We would be no one if we did not rest in the memory of those who had gone before us and taught us so much. Wherever you are, receive a big hug from me; my deepest thanks to all of you who have made me so happy over the years.

A thousand thanks for being part of my life and rewarding me by being here".

MIGUEL SÁNCHEZ LÓPEZ, SNE DIPLOMA

Awarded to Miguel Sánchez López, Head of Licensing and Safety at Iberdrola and former Chairman of the Editorial Committee of the Journal, in recognition of his work for the development of nuclear energy and his contribution to the aims of the Society.

Miguel Sánchez López, SNE 2022 Diploma, and Héctor Dominguis and Pedro Ortega.

"I would like to express my deep gratitude to the Spanish Nuclear Society for this diploma of honour.

The truth is that for me to belong to the SNE and have been able to give the best of myself over the years, especially in the journal committee, has been nothing but a great opportunity. The Nuclear Society has undoubtedly given me much more than I could have given it. I am grateful for the confidence that the Society has placed in me to help fulfill its mission of disseminating nuclear science and technology, both within the industry to professionals and outside it to the general public.

This is an exceptional year; it is the 40th anniversary of the journal Nuclear España. And the magazine Nuclear España is like our power plants; it is approximately the same age, and we can say that it will be in operation in the long term, just like the power plants. But that is not the only analogy; many other things are similar between the two. For example, the magazine has undergone a significant overhaul recently, just like the power plants. It is led by a great team, as are our head offices. It is an international benchmark, not only among Spanish-language publications but also in any other language. And above all, it has a great future ahead of it".

GONZALO JIMÉNEZ VARAS, "JUAN ALBERTO GONZÁLEZ GARRIDO" JÓVENES NUCLEARES AWARD

Awarded to Gonzalo Jiménez, contract doctorate professor at the Polytechnic University of Madrid, for his constant support to the institution over the last few years.

"I hope you are having a great time in Cartagena. Unfortunately, I could not attend the SNE Annual Meeting this year, but I wanted to record this short video to thank you for the award, which has made me very happy for several reasons. The first is because it comes from Jóvenes Nucleares (JJNN), an association with which I have collaborated for many years; at first as part of them and now as a retired member of JJNN, I try to help as much as I can. I am also very excited because if I have been nominated for this award, it means that I have been able to share activities and time with the people of JJNN, and that is always something to be grateful for and something that you take with you, something that means a lot to me.

Gonzalo Jiménez thanked the "Juan Alberto González Garrido" Nuclear Youth Award by means of a video, as he could not attend the 47th Annual Meeting of the SNE.

And finally, this award also means a lot to me because it is named after my friend Juan Alberto, who was unjustly killed in the Paris attacks in 2015. And it is to him that I would like to dedicate this award and, to do so, I am going to read a short poem that I composed in his day, and I hope you like it:

"He was that hand always outstretched
that asked nothing for help.
It was that torch that, in this dark cave,
illuminated and warmed as it passed.
One cursed Friday, someone decided
to extinguish that light,
but they didn't succeed because that
light is now here,
it lives in us.

A big hug, and I'll see you".

ALFREDO GARCIA, WOMEN IN NUCLEAR SPAIN AWARD

Women in Nuclear (WiN) Spain has awarded its annual prize to Alfredo García (@Operador Nuclear) for disseminating nuclear energy and his continuous support for the organisation's initiatives.

"It is with great pleasure that I receive this award from WiN Spain, an organisation of women involved in nuclear energy, with peaceful and constructive uses of nuclear energy for society, which has been disseminating and promoting the use of nuclear energy and new vocations among women for more than 26 years.

When I began collaborating with WiN Spain a few years ago, I felt very integrated into an organisation that sought to add rather than divide. What has emerged from this collaboration have been informative threads, associations, collaborations, and publications that have enriched us all.

Therefore, I would like to express my utmost gratitude; it has made me very happy to collaborate with WiN Spain; it is an absolute honour and really, thank you very much from the heart, Cherenkov Blue".

Alfredo García, WiN Spain 2022 award winner, with Susana Falcón and Héctor Dominguis.

CLOSING COCKTAIL

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COMPLEMENTARY ACTIVITIES

STEM PROGRAMS

To promote STEM (Science, Technology, Engineering, and Mathematics) education among younger students, the SNE held the STEM Programme as part of the 47th Annual Meeting. An open and free event aimed at students of Secondary Schools (IES) in their last two years.

The SNE wants to add value to its Annual Meeting by informing and training ESO students in technical and scientific concepts related to science and technology in general and nuclear energy in particular.

This programme consisted of two itineraries at the Polytechnic University of Cartagena and the NAVANTIA facilities, with different workshops.

CARTAGENA POLYTECHNIC UNIVERSITY

This itinerary included three workshops that included chemical experiments with accurate laboratory material, as well as the presence of a real science magician:

1. Sustainable chemistry (ENDESA)
2. Magic to spread science (FORO NUCLEAR)
3. DiY Polymers (WIN SPAIN)

The Spanish Nuclear Society Annual Meeting concluded on Friday, 30 September, coinciding with the celebration of the European Researchers' Night. The Polytechnic University of Cartagena organised several activities during that day as part of its Mediterranean Researchers' Night Goes to School (MEDNIGHT GTS) project, developed together

Collaborating entities :

with the universities of Murcia, Valencia, Alicante, Jaume I of Castellón, Politécnica of Valencia and Miguel Hernández of Elche, the scientific foundation Fundación Séneca, the Institute of Health and Biomedical Research of Alicante (ISABIAL) and the communication and strategy agency (ATAMA). MEDNIGHT GTS is a project associated with the European Union's European Researchers' Night initiative, funded by the Marie Skłodowska-Curie Actions, with call identifier: HORIZON-MSCA-2022-CITIZENS-01 (MSCA and Citizens 2022).

NAVANTIA

This itinerary also included three workshops and an exterior visit to the facility. The workshops were:

1. DiY Holograms (NUCLEAR YOUTH)
2. Scape Box: "Mission El Cabril" (ENRESA)
3. Nuclear 360 (IBERDROLA)

PHOTO COMPETITION

SOCIEDAD NUCLEAR ESPAÑOLA

framatome

BEST PHOTOGRAPHS GENERAL CATEGORY

First Prize:
SALT - Iván Sánchez Hernández

Second Prize:
THE PLEASURE OF FLYING
Manuel Muñoz García

Third Prize:
STORM OVER DUNAS
Pedro Ortega Pascual

BEST PHOTOGRAPHS ENERGY CATEGORY

First Prize:
DUGARADAR - Rabel Leonardo Maes

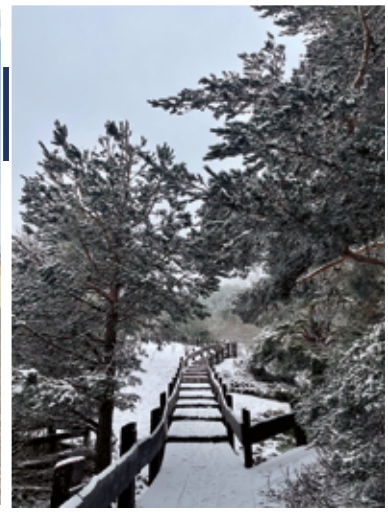
Second Prize:
SIMULACRO UME_ASCÓ
Roberto Bueno Hernández

Third Prize:
14 TRAMS - Josep Miquel Biarnés Sanz

BEST PHOTOGRAPHS POPULAR JURY

First Prize:
SUMMER STORMS - Roberto del Sol Marcos

Second Prize:
THE ROAD
Francisco Javier Hernáez Delgado



Third Prize:
TOWARD WINTER
Iván Sánchez Fernández

ALMARAZ TRILLO

Una alternativa limpia, segura y competitiva

En continuo proceso de mejora, actualización y modernización

OPENING SESSION

HÉCTOR DOMINGUIS, PRESIDENT OF THE SPANISH NUCLEAR SOCIETY

"Europe and the world are firmly committed to nuclear power generation as a sustainable, independent, and competitive energy source. Meanwhile, in Spain, the government continues publicly reiterating its commitment to close nuclear power plants in 10 years".

HÉCTOR DOMINGUIS

"More and more voices are calling for the role of nuclear energy in the energy mix; business associations, academics, civil society, etc.".

The whole of Spain is concerned about the future of energy, and our message must reach further and more precise".

JUAN PEDRO SOLANO, VICE CHANCELLOR OF THE POLYTECHNIC UNIVERSITY OF CARTAGENA

He explained the university's lines of research in the nuclear field: analysis of accidents in ITER, protection against natural radiation, and the construction of new generation nuclear power plants to combat climate change.

He highlights the role of UPCT researchers in the nuclear world. With particular emphasis on nuclear safety projects and others related to nuclear fusion through ITER.

"Research and transfer of knowledge and technology will enable the future of nuclear energy."

"Researchers play a crucial role in nuclear safety.

JUAN PEDRO SOLANO

MIGUEL ÁNGEL CERDÁN, IBERDROLA'S INSTITUTIONAL DELEGATE IN THE REGION OF MURCIA

The delegate of Iberdrola in the Region of Murcia thanked the company for choosing Cartagena as the venue for our annual meeting and explained the work that Iberdrola is doing in the re-

MIGUEL ÁNGEL CERDÁN

gion in the direction of decarbonisation of the energy sector.

IGNACIO DEL PINO, DIRECTOR OF NAVANTIA'S ENGINE FACTORY IN CARTAGENA

"NAVANTIA has a strong relationship with the nuclear sector, building and training operators of large nuclear power plant components."

NOELIA ARROYO, MAYORESS OF CARTAGENA

"In Cartagena, we are making a strong commitment to tourism in the region within Murcia, which includes congress tourism, so this meeting is fundamental for us. We are very grateful that you have chosen us".

"Citizens are asking for guaranteed energy independence. It does not make sense to give up a clean and secure method of energy generation".

"We need a debate that allows us to make decisions based on scientific evidence, the situation of our families, and the interest of Spain.

"We are a city that has grown based on one of Europe's most important industrial centres. This is the future, and we continue to be committed to growth that gives a leading role to our industry and supports the university to train future professionals".

Cartagena has grown thanks to the energy sector. I believe that the future and

NOELIA ARROYO

the sector's growth, hand in hand with the Polytechnic University, has marked and will mark the city".

The current crisis has brought energy to the centre of political debate and concern for citizens.

An honest debate is needed on ways to produce energy, away from demagogy and populism, based on science and in the interest of business, families, and the country.

INAUGURAL CONFERENCE

ISAAC PERAL, THE DREAM OF INNOVATION

DIEGO QUEVEDO CARMONA
NAVAL ENSIGN AND SUBMARINE SPECIALIST

Diego Quevedo Carmona has developed his professional career in the Spanish Navy; he is a retired naval ensign and specialist in submarines. He has collaborated with many magazines and media, written books, and given lectures all over Spain. He has also had the opportunity to cultivate another of his great passions, research, and dissemination of the history of the Navy and naval subjects. He is also a great collector of objects related to the life and work of Isaac Peral, having recently donated more than 200 pieces related to his figure to the City Council of Cartagena for an exhibition that will open its doors soon in the house museum of the inventor from Cartagena.

"First of all, I would like to place on record what a tremendous honour it is for me to have been chosen to welcome you to this 47th Congress of the Spanish Nuclear Society, which begins today in this three-thousand-year-old city, "*to which the Carthaginians gave their name, closed to all winds and concealed, to whose clear and singular renown all ports are prostrated, the sea bathes, the sun discovers, and man has sailed*," which welcomes you to this recently built Conference Centre.

These words that I have just quoted came from the fertile pen of the immortal Miguel de Cervantes more than four centuries ago, in 1614, the year in which he visited this city, being reflected in his work *Viaje al Parnaso* and immortalised in this ancient tile panel (Photo 1) that you may have seen nearby, and which welcomes all those who arrive in this city, especially by sea, as it is almost the first thing they encounter when they set foot on land.

As I said, they say that this city, which is going to welcome you during these days, is "*closed to all winds*", which is due to the orography of the terrain, to which I modestly want to add the expression "and open to the future that all new technology implies," which is what I consider to be represented in the work that you all carry out.

Since ancient times, it is known that man has always had the desire to achieve two challenges that made it impossible for him to achieve his human condition, such as being able to fly like the birds or swim like a fish, and consequently, to try to manufacture devices that would lead him to explore the airspace or the deep sea.

Concerning this last objective, and after multiple attempts by many pioneers going back centuries, some of whom paid the price of progress with their own lives, I will talk to you in the next few minutes about a character born in the mid-19th century precisely in this city that welcomes you today, and whose studies gave the definitive solution to one of those dreams long

Photo 1.

desired by man, that of the then called "*art of navigating underwater.*"

As you will have deduced, I am referring to Isaac Peral y Caballero, a Navy lieutenant (Photo 2), a true innovator in the era in which he lived and, dare I say it, a pioneer almost 140 years ago of what is known today in the business world as "R&D."

Photo 2.

Photo 3.

In the words of the President of the Organising Committee herself, the intention for this 47th Congress is that it should be marked by "*optimism and the desire to look to the future with enthusiasm*", which is by chance and precisely the same ideal that almost a century and a half ago guided the conduct and actions of this character, because thanks to his perseverance not only in the study but also in the subsequent application of the new technologies of the time, the Congress will be marked by "optimism and the desire to look to the future with enthusiasm", which is by chance and exactly the same ideal that guided the conduct and actions of this character almost a century and a half ago, self-believing in what he was doing, with an unquestionable blind faith in success, when practically the only "guarantee" he had was confidence in his own possibilities and in his innovative spirit, strong not only in the face of unjustified criticism, but he also had to suffer scorn and even humiliation that rained down on him from almost all sides.

Despite all this, being strong in the face of discouragement, perseverance, effort, and many other qualities, he managed to design and build in Spain and, more importantly, for Spain, the first torpedo boat submarine in history.

You can see it in Photo 3, and its launching on Saturday, 8 September 1888, at the Cadiz Arsenal of La Carraca, in San Fernando, to which the image corresponds, was the most extraordinary event not only at the naval level but also at technological and in-

Photo 4.

dustrial level in the backward - why not say it - Spain of the last quarter of the 19th century, An event that undoubtedly aroused unusual expectation and in which great hopes were placed, as can be seen in the design of the fans that were given to the ladies who attended the launching event (Photo 4).

An invention which, had it not been unjustly vilified, I dare say could even have changed the course of history if ten years later, with the modernisations that Peral had already planned to introduce and with several units in service, whose construction he had also contemplated, it had been used to defend our last overseas colonies, as Admiral Georges Dewey himself (photo 5), the man in charge of the blockade by the American fleet, acknowledged before the United States Congress after the unequal war of 1898, when he took the stand and said, "G*entlemen, I recognise that if Spain had had several of the submarines invented by the Spanish officer Peral, I would not have been able to maintain the blockade for even 24 hours....* ".

Isaac Peral, in order to bring his torpedo submarine project to fruition two lustrums before those historical events, had to struggle from the outset with many elements in a Spain

Photo 5. Admiral Georges Dewey.

where technology was conspicuous by its absence, even though the industrial revolution of the 19th century had already brought many advances to much of Europe and, of course, to the United States. But it was not only the lack of technology that he had to contend with; as the saying goes, "*nobody is a prophet in his land*". He also had to fight against other elements, as we shall see.

Even so, despite all the difficulties, Peral managed to make his submarine the first in the world to be powered entirely by electric motors, powered by more than 600 batteries, and which even had a garland of filament bulbs for the interior lighting of the ship, which had been marketed by Thomas Edison only a few years earlier, in 1880, and which shortly afterward, as he would do with other components, Peral would modify by fitting them with a potentiometer so that, through a variable resistor, more or less current would pass through. So they would therefore give more or less light. In other words, he introduced a very novel "innovation" in something that had just been commercialised (Photo 6).

This submarine was also the first steel-hulled vessel to be built in a state arsenal at a time; moreover, when the electric welding we know today did not exist, but rather the plates were joined together using "rivets" (Photos 7 and 8).

In other words, the lack of experience of the workers - who were under his supervision throughout the construction process - in using this new system of shipbuilding was another added problem that also had to be solved, which was the starting point for the great leap from having ships "with wooden sails" to having them with steel hulls and steel hulls, to having them with steel hulls and "non-wind" propulsion in the same way that the Parisian Eiffel Tower was built, which was only half finished when the submarine was launched, or the London bridge over the River Thames, which is also contemporary with the submarine.

Peral had to travel to these cities, among others, to obtain what did not exist in Spain, as he had to go to France to acquire the optical components, to England to buy the steel for the hull, as well as the whole propulsion system, the shafts, and propellers, and to arrange for the motors to be wound; to Belgium to buy the batteries and various measuring devices such as pressure gauges, ammeters, voltmeters, multiple components for the electrical installation, etc.; and to Germany to do the same. Or to Germany to do the same with the torpedoes and, in general, with the entire weapons system involved in their use, valves, pipes, compressed air bottles, etc.

Photo 7. The engraving represents the construction of the Eiffel Tower, based on heating roblons.

Photo 8. Interior of the submarine Peral where the sheet metal riveting can be seen.

Peral had to make a long journey across half of Europe to acquire what he needed and which the Spanish industry at the time refused him simply because it did not exist. However, the effort was undoubtedly worthwhile because he was finally able to assemble everything that until then had only been in his mind and in his plans to fulfil his dream of seeing his submarine become a reality (Photo 9).

This circumstance and the mere fact that envy made its appearance even from the first moment Peral presented his project to the government made him a character worthy of praise more than anything else for his perseverance in achieving the objectives he had set himself, which were none other than to provide his country with an invisible and deadly weapon.

And I say his country because he was denied further support when he was here. The government, barely two years after the launch, decided to cancel the project definitively and leave it abandoned, to the sad cry of "*let others invent it*" even after that, Peral rejected offers from foreign shipyards, some of which went so far as to offer him the chance to work on it, Some of them even offered him a signed blank cheque so that Peral could put up the amount he considered convenient, an offer that he would reject with the phrase "*I am sorry, but I cannot sell you anything, because the invention*

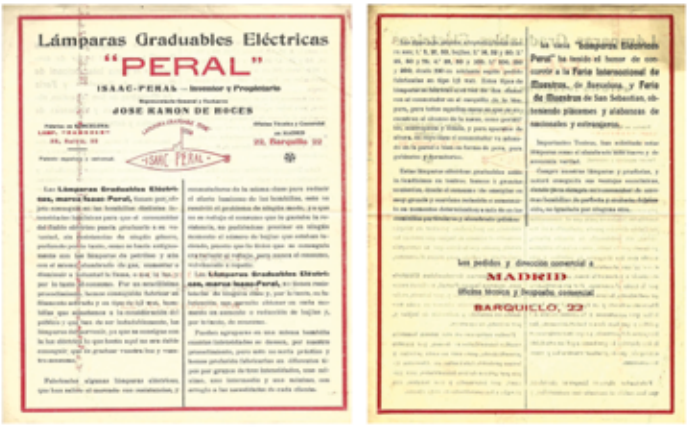

Lámparas Graduables Eléctricas
"PERAL"
ISAAC PERAL — Inventor y Propietario
JOSE RAMON DE ROCES
MADRID
BARQUILLO, 22

Photo 6. Advertisement for "Peral" brand electric dimmable lamps.

Photo 9. Submarine Peral, afloat in the Cadiz arsenal.

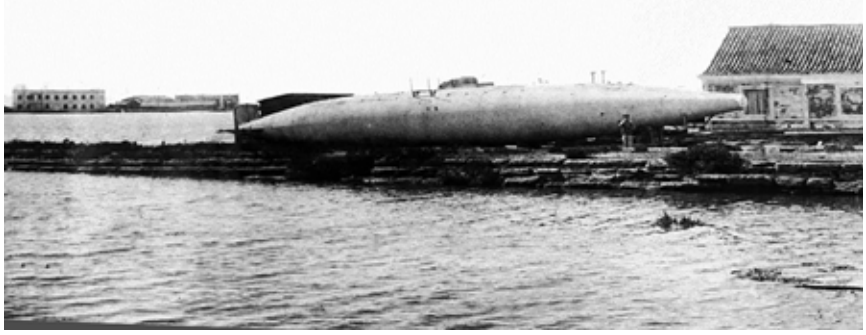


Photo 10. Submarine Peral, abandoned in the Cadiz arsenal, in the same place where it had been launched only two years earlier.

no longer belongs to me, I have given it to my country.... . " (Photo 10).

There is no need to explain. But to his misfortune, and going back a little in time, I will tell you that his ordeal began even at the very moment of conceiving the submarine because a few years earlier, Jules Verne (Photo 11) had written his book *20. 000 Leagues Under the Sea*, and in it appeared the figure of an imaginary submarine, the *Nautilus*, and this was precisely the reason for the first blunder of the government of the time, for when Peral came to present the project, at that very moment there were already politicians of great importance such as the President of the Council of Ministers himself, Antonio Cánovas del Castillo, who came to say that "*Peral is a quixote, who must have lost his mind reading Verne... "Although this would not be the only contempt, as envy soon made its appearance, followed by many others, including the application to him of a saying of the time that I believe has not lost its validity, which stated that "when a nail sticks its head out, there is always someone ready to give it a hammer blow and leave it flush with the others...*".

Of course, as is usually the case with all the geniuses of the world, there were also defenders of his project, with the circumstance - which I do not know whether to describe as sad or curious - that all the Peralophobes belonged to the political class. At the same time, all the Peralists were people of proven culture, including two people who would become Nobel Prize winners, José Echegaray and Santiago Ramón y Cajal, who were born only a year before Peral. Both would defend the submarine project in Spain and abroad, although to no avail.

The fact is that this man of science, possessed of a privileged mind, truly ahead of his time, had to overcome a thousand and one setbacks. However, with the great virtue that as often as he was made to fall, he got up again, something that indicates the spirit of self-improvement of someone who, like some of you, I have no doubt, at least at some point in your lives, has had to live through such a circumstance.

In this sense, a phrase attributed to Peral himself, which should serve as an example for anyone, was that "*it doesn't matter how many times you fall; what is important is that the number of times you get up is not less than the number of times you fall...*".

After two long years of fighting "against the elements", as the Invincible Armada had done some time before, Peral, embittered by so many disappointments and disappointments, finally decided to ask to be discharged from the Navy, which was granted without hesitation (you know the saying that "the enemy who flees, He was granted it without hesitation (you know the saying that "t*he enemy who flees, the silver bridge*") to devote himself to exploiting in civilian life the extensive knowledge he possessed in new technologies, as everything to do with electricity was considered, something that was then still in its "infancy"

Photo 11. Jules Verne (1828-1905) "Whatever one person can imagine, others can make it come true...". Plan of the Nautilus, Jules Verne's imaginary submarine.


INSTALACIONES PARTICULARES
DE
LUZ Y MOTORES ELÉCTRICOS.
TRANSPORTES DE FUERZA.
TRACCIÓN ELÉCTRICA
PARA
TRANVÍAS Y EMBARCACIONES.
ACUMULADORES ELÉCTRICOS
TELEFONÍA, TELEGRAFÍA
ELECTROLISIS, GALVANOPLASTIA
Y
toda clase de aplicaciones
DE LA
ELECTRICIDAD.

Centro Industrial y de Consultas Electro Técnicas
Proyectos, Estudios y Construcción de Estaciones Centrales
Director gerente - Isaac Peral
Calle de Rafael Calvo, nº 1, Hotel.
Teléfono 2087
Madrid de de 189

Photo 12.

and which the government had denied him by aborting the development of the first torpedo submarine in history, Despite the fact that he had managed to demonstrate that the invention not only worked, but that it did so almost perfectly, because what many considered electrical energy to be "a distant future", Peral was convinced that it was "a real present", with an infinite number of applications in everyday life, He therefore decided to leave the Navy and settle in Madrid, first in a hotel room in Calle Rafael Calvo, and had a standard letter printed up with a list of jobs he was offering to do for his hypothetical clients, as shown in photo 12, on his letterhead.

This would take place in January 1891, when he settled in Madrid. In a short time, thanks to his effort and tenacity, he would once again begin to reap the fruits of his labour, expanding rapidly and founding, also in Madrid, the Centro de Consultas Electrotécnicas Peral, which would be the starting point of his new business activity.

Everything related to electricity in the last two decades of the 19th century expanded worldwide. Our character continued to be on the "crest of the wave" of the emerging technologies of the time. Again thanks to his tenacity, Spain had another novelty that it lacked, such as the first battery factory in our country, which would be built in Calle Mazarredo, in premises that have survived the passage of time and are currently the headquarters of Google Spain, where a plaque was placed to remind passers-by of the building's origins.

Not content with that, it continued to expand throughout Spain, building several "electricity factories" (approximately twenty), as they used to be called, even sowing the seeds of some that have survived to the present day, such as Electro Peral Zaragozana, founded in 1893, and which later, after several mergers, became the current Endesa that we all know.

But very shortly afterwards, at the height of the effervescence of his talent and his spirit, not only an innovator of new techniques but also an enthusiastic entrepreneur, with a grand vision of the future and a tireless fighter, Peral died of cancer in the early age of 43, losing Spain one of its most distinguished and promising figures, His main obsession was to try to study and apply new technologies, as was undoubtedly everything derived from electrical energy, which in the last third of the 19th century was comparable, in my opinion, and of course with time, to today's nuclear energy, of which you are one of the most important representatives.

To conclude, and by way of a summary of what Isaac Peral contributed to progress, we could list the following points in particular:

- His submarine was the first steel-hulled vessel to be built in a state arsenal, with the challenge of using new and unknown technologies.
- He arranged for the rivet heads to face the inside of the submarine to make the hull more hydrodynamic.
- It was the first submarine from which a torpedo was fired while submerged.
- It was the first ship to sail submerged entirely, emerging at the place and time scheduled by the Technical Board.
- It was the first submarine to be propelled only by electricity, with two 30 hp, 500-volt Inmisch motors, something extraordinary for the time.
- It was the first to use an optical tower with a system for determining the distance to the target utilizing a graduated scale.
- It had a system of ballast bailing and water transfer (regulation and levelling) using pumps so that it could always maintain horizontality (trimming), currently in use on all submarines.
- It had a stale air regeneration system, also in use today.
- It had a system based on chemical compounds to prevent the glass of the optical tower from fogging due to condensation.
- It had compressed air bottles for firing the torpedoes, as is the case today.
- The torpedo tube could be reloaded at sea, with torpedoes in reserve, just as today.
- It had a nautical needle and depth rudders, which could be regulated at will.
- It had various pressure gauges to keep track of height, pressure, etc., at all times.
- He modified the acids and lead plates of the batteries, patenting them, the current ones having very similar characteristics.
- He designed and adapted a system of electromagnets to the batteries that activated a spring that stopped the charge when the battery was at 100%.
- He set up a system that intercommunicated the 613 batteries on board so that if one of them short-circuited, it could be isolated from the rest.

Peral, in short, was an example of perseverance, vision, persistence, and commitment to innovation, despite the disadvantage that in those years, very few people were dedicated to the study of electricity as a new form of energy, being little more or less what today would have been known as a freelance.

In this sense, you are playing history in Peral's favour because if only because of the large number of congress members who have gathered here, his specific weight in using and exploiting nuclear energy is undoubtedly destined to be necessary.

Let's hope I am right.

MONOGRAPHIC SESSION

MODULAR REACTORS, THE FUTURE IS ALREDY HERE

In this monographic session, we brought together representatives of four different nuclear technologies who shared with us the potential of the SMRs (Small Modular Reactors) they develop. Each of the speakers emphasised the particularities of these technologies and the role they can play in today's energy landscape.

Zachary McDaniel from Westinghouse presents the 5MWe eVinciTM Microreactor and its specific innovative design capabilities, as it is a solid-state pocket reactor, which allows cooling without moving parts, which is added to the fact that it is a transportable, modular, and compact design. All this minimises construction costs, and the reactor can operate in less than 30 days. It does not generate radioactive waste on-site, is highly autonomous, and is easy to operate. This means that its range of possible applications and uses is innumerable,

ZACHARY McDANIEL

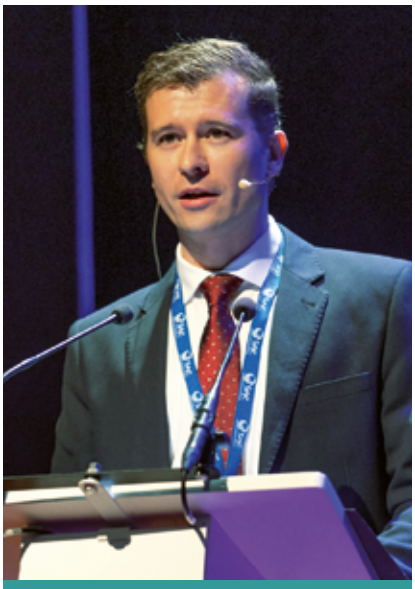
WESTINGHOUSE'S DIRECTOR OF COOPERATION AND GRANT RELATIONS

FEDERICO PUENTE-ESPEL

SEABORG GLOBAL STRATEGIC PROJECT MANAGER

its detailed design will be completed in 2025, and its commercial development is expected to begin before the end of this decade.

Going up in power, **Federico Puente-Espel** from SEABORG gives us a brief introduction to the young and enterprising company and its reactor model based on molten salts that present remarkable stability up to temperatures well above the operation, modular technology that is incorporated in large displacement vessels, being able to embark from 2 to 8 reactors for lengths of 100 to 300 meters producing an electrical power of 200 MW (2 x CMSR) up to 800 MWe (8 x CMSR). SEABORG proposes operating cycles of 12 years without refuelling and aims to rethink the nuclear energy model by presenting a modular and self-transportable reactor capable of supplying energy wherever needed.



RAFAEL MARÍN

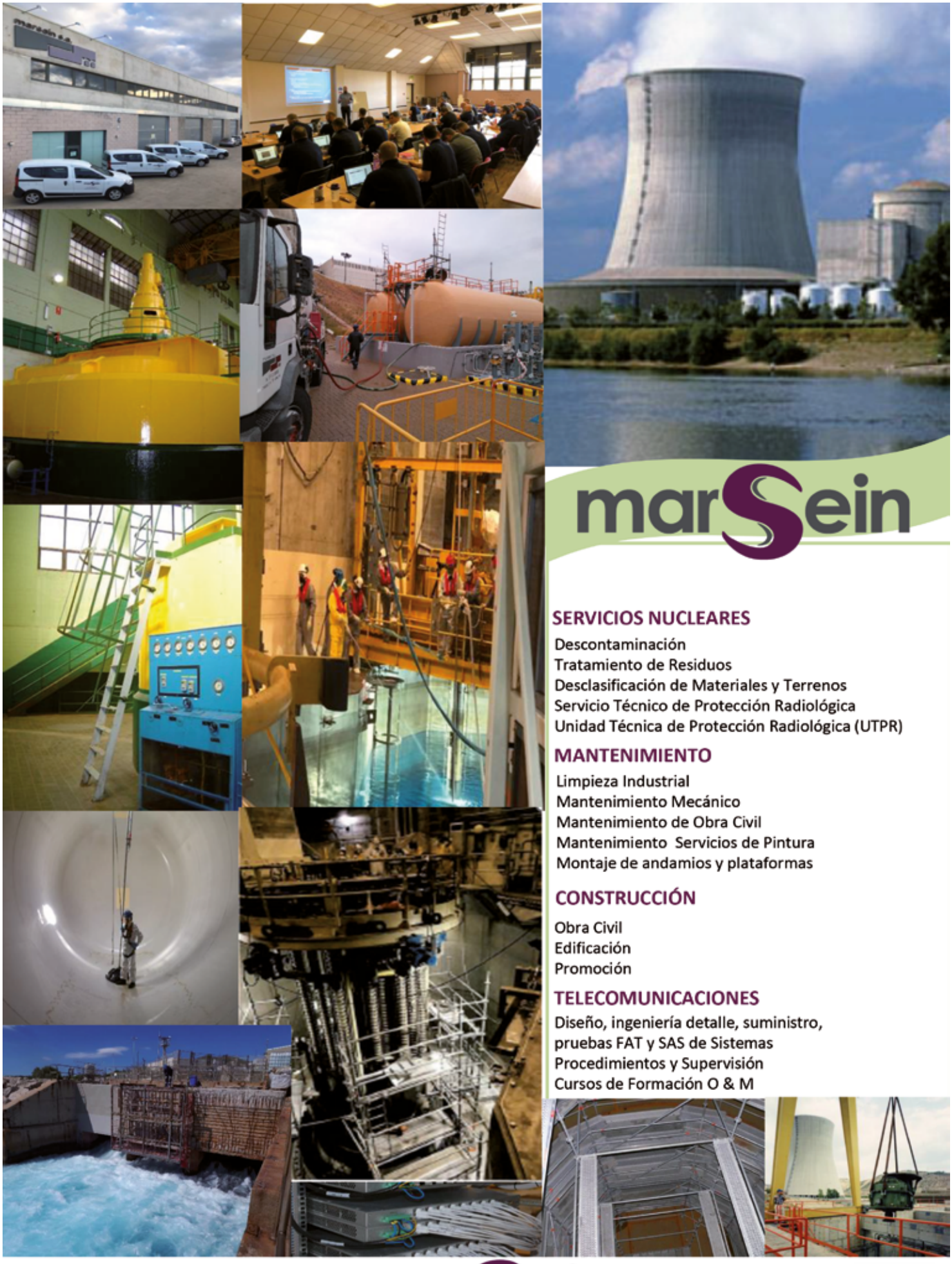
DIRECTOR OF HOLTEC INTERNATIONAL INTERNATIONAL PROGRAMMES

RICARDO MORENO

GE-HITACHI BUSINESS VP FOR EUROPE

Rafael Marín of HOLTEC International presented the programme and design of its modular reactor, the SMR-160, with proven PWR technology and a passive safety design that develops a unit power of 160 MW, the modularity of the reactor allows it to be scaled up to suit site-specific demand. Its small footprint makes it easy to build on previously licensed sites, which could simplify the licensing process and the reactor's low power output. HOLTEC's vision is to produce nuclear energy cleanly and safely for a diverse and large number of applications essential for progress in today's and tomorrow's world.

To close the session, **Ricardo Moreno** of GE HITACHI presented his SMR, the BWRX-300, the tenth generation of BWR reactors, this time of 300 MW, cooled by natural circulation and simplifying design, the built volume is reduced by more than 50% over the volume built for an ESBWR, systems or components that are not contemplated in the current design have been eliminated or simplified. The modular construction techniques ensure simplicity and efficiency in plant works and load-following capability to meet energy demands. The first GEH BWRX will operate by 2028 in Clarington, Ontario..



marSein

SERVICIOS NUCLEARES

Descontaminación
Tratamiento de Residuos
Desclasificación de Materiales y Terrenos
Servicio Técnico de Protección Radiológica
Unidad Técnica de Protección Radiológica (UTPR)

MANTENIMIENTO

Limpieza Industrial
Mantenimiento Mecánico
Mantenimiento de Obra Civil
Mantenimiento Servicios de Pintura
Montaje de andamios y plataformas

CONSTRUCCIÓN

Obra Civil
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PLENARY SESSION I

IS NUCLEAR ENERGY GREEN?

The period from December 2021 to June 2022 has undoubtedly been one of the most talked-about periods for nuclear energy in recent decades. On the one hand, the combination of the post-covid-19 inflationary bubble and the energy impact of the Ukraine war has highlighted the fundamental role of nuclear energy in containing electricity prices and as a guarantor of supply in a situation of global conflict during the energy transition. At the same time, a slower process that began in 2019 with the presentation of the European Green Deal continues in the background to align the different countries of the European Union on energy issues to achieve climate neutrality - net zero or zero net GHG emissions - by 2050.

In this process, a classification of economic activities was established by Regulation 2020/852, better known as the "green" taxonomy, in which nuclear energy was finally included as a transitional energy through a complementary delegated act (DCA) in July 2022, which entered into force on 1 January 2023. Professionals in the sector have experienced these events through press reports with generalist and sometimes diffuse definitions, and that is why, from the Technical Committee of the 47th Annual Meeting, we have held a session to disseminate information on the famous green taxonomy of the European Union, with profiles that master the subject to perfection. To organise this plenary session, we have counted on **Berta Picamal**, legal and international relations director of nucleareurope; **Manuel Martín**, deputy head of unit of the EURATOM Coordination Unit of the Joint Research Centre (JRC) of the European Commission; and **Antonio L. Bañón**, legal director in public law for the law firm Squire Patton Boggs. This session was moderated by **Gonzalo Carbó**, nuclear general manager of ENDESA (ENEL Group).

Gonzalo Carbó introduced the European Commission's sustainable finance agenda to channel private investments towards environmentally sustainable activities, considering environmental, social, and governance considerations. Two tools are essential to carry out this mission: the green taxonomy, as a system for classifying

GONZALO CARBÓ

NUCLEAR GENERAL MANAGER OF ENDESA (ENEL GROUP)

MANUEL MARTÍN

DEPUTY HEAD OF UNIT OF THE EURATOM COORDINATION UNIT OF THE JOINT RESEARCH CENTRE (JRC) OF THE EUROPEAN COMMISSION

economic activities according to their degree of sustainability, and green bonds, as a financing instrument. Under the current proposal for a European green bond standard, only activities aligned with the EU's green taxonomy would be financed.

Gonzalo highlighted the conditions necessary to include economic activity in this taxonomy: firstly, it must contribute substantially to at least one of the objectives defined in the taxonomy. In the case of nuclear energy, it effectively contributes to the objectives of climate change adaptation and mitigation. Second, it must not cause significant harm (Do Not Significant Hurt or DNHS) to one of the other objectives. Thirdly, it must provide social safeguards (equality, inclusiveness, labour relations, etc.) and satisfy the European Commission's screening. He concluded that neither gas-fired nor nuclear power generation could be classified within this taxonomy.

The first rapporteur, Manuel Martín, detailed the process of technical assessment of nuclear energy against the "no significant harm" criterion set out in EU Regulation 2020/852, i.e., the taxonomy itself. The Commission initially delegated this task to the Sustainable Finance Technical Expert Group. However, this group could not determine whether or not nuclear energy met the DNHS condition, even if it contributed substantially to climate change adaptation and mitigation objectives. To this end, the Commission commissioned the Joint Research Centre (JRC) to conduct this technical analysis in 2021.

A group of 16 experts drafted a two-part report on the review and analysis of the environmental impacts of the entire nuclear power cycle, compared to the effects of other technologies already included in the taxonomy, and state of the art on the DNHS condition with a focus on radioactive waste management. After analysing different indicators such as GHG emissions and other air pollutants, acidification and eutrophication potential, ecotoxicity, land use, water use, and thermal pollution, among others, no scientific evidence could be found that nuclear energy causes more significant damage to health or the environment than other electricity production technologies already included in the taxonomy. Manuel points out that, in addition, there is scientific consensus that deep geological disposal is now a suitable solution to isolate such waste from the biosphere for the necessary timescales. The technologies are available, and repositories will be built when the political conditions and public acceptance are favourable.

This report received two subsequent evaluations by the expert group on radiation protection and waste management and by the Scientific Committee on Health, Environment, and Emerging Risks. A generally favorable opinion was obtained for the first group, except for one vote. Regarding the second group, a general agreement was also reached. However, they suggested further studies on the existing regulatory framework or the uncertainty of radioactive waste disposal in the long term, among others. Manuel ended his speech by stating that the DCA approved by the Commission in February 2022 already includes nuclear energy and that as it was accepted by the European Parliament or the European Council, it entered into force on 1 January 2023.

This was followed by Berta Picamal, who briefly summarised the political process and focused on the in-depth analysis of the previous DCA. This DCA classifies nuclear energy as a transitional technology by specifying the following activities: activities related to Long Term Operation (LTO) and construction and operation of new facilities whose construction permits have been issued before 2045. Berta detailed the criteria for selecting sustainable activities in the nuclear field, for example, that the Member State has operational disposal facilities for low and intermediate-level waste or has a detailed strategy to bring into operation a disposal facility for high-level waste before 2050. Berta indicated that these requirements may pose a problem for countries such as Poland, which will only need disposal after 2050, or small nations that could consider shared storage. Another exciting selection criterion is the application of Accident Tolerant Fuel (ATF) from 2025 onwards.

Berta also pointed out that the operation and maintenance of existing nuclear reactors are not explicitly included in the EQSD. However, the text itself refers to the NACE codes on the nomenclature of economic activities of operation and maintenance; these activities are therefore included. Investments outside the EU have not been included in the EUSD. Berta Picamal's intervention ended by notifying the publication of the EQSD in the Official Journal of the EU on 15 July 2022 and by communicating two essential pieces of news: that the Commission will establish guidelines to help Member States interpret the EQSD and that legal challenges before the Court of Justice of the European Un-

BERTA PICAMAL

LEGAL AND INTERNATIONAL RELATIONS DIRECTOR OF NUCLEAREUROPE

ANTONIO LUIS BAÑÓN

LEGAL DIRECTOR IN PUBLIC LAW FOR THE LAW FIRM SQUIRE PATTON BOGGS

ion (CJEU) have started, led by Austria and Greenpeace.

The last speaker of the session was Antonio L. Bañón, who proceeded to interpret the regulatory context in which the taxonomy is developed. This legislative context is defined by the EU regulation: the taxonomy regulation itself (Regulation 202/852) as a general framework, the delegated act (Delegated Regulation 2021/2139) with the criteria for mitigation and adaptation to climate change, and those as mentioned above complementary delegated act (Delegated Regulation 2022/1214). At the national non-legislative level, the Nuclear and Radioactive Installations Regulation (RINR) and the current Integrated National Energy and Climate Plan (PNIEC) approved in 2021 provides for the closure agreed with the companies that own four nuclear reactors between 2021 and 2030, and the remaining ones before 2035, are in force. The PNIEC defines the national energy policy and reflects Spain's contribution to achieving the objectives of the European Green Pact. Antonio indicated that the European regulation is mandatory and directly applicable to all Member States, so it has implications in the national regulatory context. Identifying alternatives and opportunities offered by the European regulatory framework will be critical for the sector in the context of the national energy strategy to undertake significant investments for the continued operation of the Spanish nuclear fleet. In this regulatory context, it should be borne in mind that the aforementioned technical selection criteria will be subject to a periodic review every three years, that the PNIEC must be revised before June 2023, and that the 7th General Radioactive Waste Plan (7th GRWP), which defines the radioactive waste management strategy, is still awaiting final approval.

Antonio raised legal alternatives in this regulatory context since extending the operating time of certain existing nuclear facilities contributes to the decarbonisation of the energy system in the short and medium term. This pretext invites us to consider the revision of operating permits for a possible extension of the operation of the nuclear fleet since the long-term process is contemplated by the European regulatory context in RD 2022/1214. It is entirely feasible for several reasons: the PNIEC itself does not rule out a scenario of extending the service life of nuclear facilities, the 7th GRWP still needs to have a final version, and the sectoral regulations make it feasible by applying the RINR. Antonio closed his speech by encouraging him to contribute to the objectives of the European Green Pact by relying on the regulatory framework that came into force in 2023 to achieve the climate objectives efficiently.

Ultimately, the speakers and the moderator detailed the keys to understand the European green taxonomy, which promotes private sector investment in activities classified as sustainable, including the long-term operation of the nuclear fleet, backed by an intensive literature review and scientific consensus. The selection criteria for nuclear power emphasise a sector at the technological forefront and the long-term management of irradiated fuel. The economic horizon for carrying out the necessary investments for long-term operation is favourable due to the regulatory context that comes into force in 2023, with the revision of the PNIEC and the final approval of the 7th GRWP still pending, so, despite the existing uncertainties, the latest developments regarding the European green taxonomy invite us to look to the future with a certain degree of optimism.

PLENARY SESSION II

EUROPE, A PIONEER IN FINAL SPENT FUEL MANAGEMENT

The second plenary session of the Annual Meeting focused on the issue of the final management of spent nuclear fuel and high-level waste. This is a fundamental issue, but one that is now technically solved by employing proven technologies that guarantee the protection of people and the environment.

A consensus has been established among the international scientific community that the safest and most sustainable way to manage these wastes in the long term is to dispose of them deep within stable geological formations, which have been proven to be undisturbed for millions of years. Such a facility, known as deep geological disposal (DGS), is the most technically mature and safe solution for the final stage of managing this waste.

The first AGP in the world was built in Finland. Very advanced projects can be found in Sweden, France, Canada, and Switzerland. Several other countries are at different stages of research or development of such a facility.

The inclusion of nuclear energy as a transitional energy in the EU's taxonomy of sustainable economic activities is subject to certain conditionalities, including the obligation for Member States to have detailed plans for a high-level radioactive waste disposal facility in operation by 2050, which underlines the importance of HLW at EU level.

Among the challenges to be overcome, many of them of a technical nature is achieving a social consensus that will allow such a project to be developed in the long term with the necessary peace of mind and security.

The session was moderated by **Álvaro Rodríguez Beceiro**, technical director of ENRESA. Álvaro Beceiro began the session with a brief presentation to contextualize the attendees. He then introduced the three speakers, to whom he gave way without delay.

The first speaker was **Daniel Delort**, head of the International Relations department of ANDRA, the French national agency for radioactive waste management. Delort explained the principles and pillars on which the management model used in his country is based. He went into more detail on the explanation of the National Radioactive Materials and Waste Management Plan, specifically on the main strategic lines of the fifth Plan (2022-2026), which is currently in force. After listing all the stakeholders involved in the process of commenting on the Plan, the speaker went on to describe ANDRA's most relevant data and to specify the types of radioactive waste covered by French regulations and the solutions available to ANDRA for each of them. For superficial-level waste, there are two facilities in operation. In contrast, for high-level, intermediate-level, and long-lived waste, the Cigéo deep geological disposal facility is planned and

ÁLVARO RODRÍGUEZ

TECHNICAL DIRECTOR OF ENRESA

DANIEL DELORT

HEAD OF THE INTERNATIONAL RELATIONS DEPARTMENT OF ANDRA

ERIK MÖLLER

SENIOR CONSULTANT AT SKB INTERNATIONAL

is at an advanced stage of design and licensing.

Among the most outstanding features of Cigéo is that it is designed to operate for 120 years and to be reversible for at least 100 years. The principle of reversibility means that, through periodic re-evaluations, there is sufficient flexibility to decide to continue the project as planned, modify it or even return to an earlier stage if necessary. The development of this project started in 1991, and over the past 30 years, there have been numerous interactions with parliament and society at large.

The latest milestone in the licensing process for this facility is the declaration of public utility, approved by the Prime Minister in July 2022, which paves the way for the necessary expropriations and urban planning modifications. The construction licence for non-nuclear facilities, which the local government grants, is expected to be obtained soon, and the application for the construction licence for nuclear facilities, which is likely to take between 3 and 5 years to process, is expected to be submitted to the regulatory body by the end of 2022.

Among ANDRA's plans for the future is its reorganisation, which will allow it to address the shift from the design phase of the Cigéo to the construction phase, starting in 2025, and the operation phase, beginning in the second half of the 2030s or the first half of the 2040s.

The second presentation was given by **Erik Möller**, senior consultant at SKB International, who explained the context and historical development of nuclear energy in Sweden. Regarding plans for managing radioactive waste, the responsibility for radioactive waste management initially rested with the state. This began to change in 1976, with a new government determined to shift blame to the generators. In this context, SKB, a company set up by the nuclear power plant operators to deal with the second part of the fuel cycle and radioactive waste, was born.

SKB has used the research, development, and demonstration programmes it has been publishing since 1984 until the latest available in 2019, a total of 13 plans, to communicate with stakeholders and adapt to the results of experiences made in nuclear waste management and storage methods.

SKB's material resources for spent fuel management include the m/s Sigrid transport vessel and the Clab centralised temporary wet storage facility. This underground facility has been operational since 1985. Its licensed capacity of 8000 tHM is close to exhaustion, but an extension to 11 000 tHM is in the process of being licensed. It is also planned to construct a cooled spent fuel encapsulation facility at Clab to complement the future disposal facility.

A short-lived radioactive waste disposal facility, SFR, has been in operation in Sweden since 1988. It is planned to double its current capacity of 60 000 m^3 to accommodate waste

from the decommissioning of nuclear power plants.

In addition to the construction and capacity expansion projects mentioned above, there are projects for constructing a spent fuel disposal facility and a storage facility for long-lived low and intermediate-level waste (LILW).

After explaining from a technical point of view the envisaged method of final disposal of spent nuclear fuel, based on three protective barriers called KBS-3, Möller described the historical process of site selection for the corresponding facility. The study of alternatives began in 1977, and the decision on location in Forsmark was taken in 2009. In 2022, the Swedish government approved the licence application for the AGP, pending only the conclusion of a territorial and environmental court and the regulatory body. As soon as the licensing process, which started in 2011, is completed, the construction phase will begin. After about ten years of construction, the operation period will extend over 40 to 50 years, ending with nearly ten years of closure and decommissioning.

The presentation concluded with a few words about SKB International, SKB's subsidiary, dedicated to providing advice on waste management programmes and implementation of waste storage facilities to foreign entities wishing to take advantage of the knowledge developed in Sweden in this field.

Clemens Bolli, the regional engagement specialist at the Swiss Federal Office for Energy, concluded the round of speakers. The first part of his presentation explained the historical context of nuclear energy in Switzerland

CLEMENS BOLLI

REGIONAL ENGAGEMENT SPECIALIST AT THE SWISS FEDERAL OFFICE FOR ENERGY

and the site selection process for deep geological disposal. Responsibilities in this area are divided between three entities: the Swiss Federal Energy Office is in charge of designing national energy policy and legislation and leads the site selection procedure; ENSI is the regulatory body; and Nagra, the cooperative in cost of implementing waste management policies. Nagra was established in 1972, just three years after Beznau, the country's first nuclear power plant, became operational.

Nagra presented a Deep Geological Storage Sector Plan in 2008. The site selection process it describes consists of several stages. Stage 1 (2008-2011) focused on identifying suitable regions using geological and safety criteria. As a result, six candidate regions for hosting such a facility were identified. In Stage 2 (2011-2018), at least one area in each region was identified and investigated, leaving only three selected regions. In the ongoing Stage 3 (2018 until approximately 2029), the investigation of sites is deepened. In 2022, Nagra proposed an area (called Northern Storage) for the combined storage of low and intermediate-level waste and high-level waste, for which it expects to apply for a licence in 2024. Final approval would be obtained in 2030, and high-level waste storage would begin in 2060.

The second part of the presentation focused on the involvement of stakeholders and society as a whole in the site selection process. In Switzerland, this participation is channelled through regional partnership conferences involving municipal authorities, regional planning and urban planning agencies, other bodies, and civil society representatives. Their organisation consists of a plenary assembly, a board of directors, an administrative office, and various working groups, such as infrastructure or security. To illustrate how these conferences work, the speaker presented two examples of participation: one, the shaping of surface infrastructures, and the other, the working group on regional development. Between 2013 and 2021, 1099 regional participation meetings were held, the cost of which was spread between 2011 and 2022, amounting to CHF 28.06 million, taking into account the charge of the Swiss Federal Office for Energy staff.

In the third part of the intervention, the present challenges of this complex process were presented: the determination of compensation payments to the affected communities and the increase in real estate prices in these communities due to speculation.

As lessons learned that could be exported to Spain, Bolli highlighted the following:

Regarding the site selection process, a comprehensive and well-designed regulatory framework is indispensable.

Concerning the involvement of society, that intimate knowledge between stakeholders should be promoted, and an atmosphere of mutual trust should be created.

And in terms of remaining challenges, it is essential to structure the problems correctly and try to solve them step by step by providing evidence-based arguments.

CLOSING SESSION

EMILIO MÍNGUEZ, VICE-PRESIDENT OF THE SPANISH NUCLEAR SOCIETY

President of the Region of Murcia, Mr. Fernando López Miras; Regional Minister for Enterprise, Employment, Universities, and Spokesperson of the Government of the Region of Murcia, María del Valle Miguélez; Mayoress of Cartagena, Noelia Arroyo and President of the Nuclear Safety Council (Juan Carlos Lentijo).

This week the 47th Annual Meeting of the SNE took place in this magical and historic city of Cartagena, which has perfectly preserved jewels of the different civilisations that have contributed to the fact that this city, originally Carthago Nova, was and is a welcoming city: Phoenicians, Carthaginians, Romans, Byzantines, Visigoths, Muslims and Christians, who have contributed to its history over the centuries.

Throughout the week, a multitude of activities has been carried out, in which the SNE, at the initiative of WIN and Jóvenes Nucleares (JJNN) in collaboration with local entities such as Navantia and the Polytechnic University of Cartagena (UPC), to give added value to the Meeting aimed at local society for greater awareness of the advantages and opportunities of nuclear science and technology.

Thus, as has become customary in recent years, the following events have taken place:

- STEM workshops with UPC, Navantia, Endesa, Foro Nuclear, Enresa, and Iberdrola.
- WIN/ NEA mentoring workshops.
- Course for teachers of the Nuclear Forum.
- WIN lecture by Professor Carolina Ahnert on the evolution of nuclear propulsion.
- Course for journalists at the University of Murcia.
- Introductory Course on Nuclear Science and Technology.
- Two Nuclear Technology sessions on robots, virtual and augmented reality, and new technologies.

Science is the cane. Thanks to all of you who participated in these activities and the sponsoring companies. Thanks to WIN and JJNN, and the local entities mentioned above.

EMILIO MÍNGUEZ

The 47th Annual Meeting kicked off with a press conference at the Cartagena City Hall with the participation of the Councillor for Tourism and Coastal Affairs of the Cartagena City Council, Cristina Pérez; the President of the Organising Committee of the 47th Annual Meeting (CORA); Beatriz Liébana; and our President, Hector Dominguis.

Authorities attending the Closing Session. From left to right: Beatriz Liébana, President of the Organising Committee of the 47th Annual Meeting; Juan Carlos Lentijo, President of the Nuclear Safety Council; Noelia Arroyo, Mayor of Cartagena; Fernando López Miras, President of the Region of Murcia; Héctor Dominguis, President of the SNE; María del Valle Miguélez, Regional Minister for Enterprise, Employment, Universities, and Spokesperson of the Region of Murcia; Javier Dies and Elvira Romera, Councillors of the Nuclear Safety Council.

The welcome from the Mayor of Cartagena and the facilities for the organisation of the events have been excellent. In this respect, the Opening Session was attended by the Mayoress of Cartagena, the President of the SNE, the delegate of Iberdrola in the Region of Murcia, the Vice-Rector of the Polytechnic University of Cartagena, the Director of the Technology Centre of Navantia Seanergies, and the President of CORA.

The general message of the participants at this opening was that given the energy crisis situation, it is impossible to address a sustainable energy transition without nuclear energy, as it fulfils important parameters: it ensures energy independence, is cheap, and has the lowest carbon emissions.

For the first time, we had the presence of ENS President Leon Cizelj, representing over 10,000 members from all European Nuclear Societies, of which the ENS was a founding Society.

Diego Quevedo's keynote lecture on Isaac Peral, the dream of innovation, followed. One more of the greatly misunderstood geniuses who, if his developments had been followed, the course of history would have been different, as has happened with many other geniuses and will continue to happen, unfortunately. When people stand out for their contribution to the development of science and technology, they are often not recognised in the way they deserve.

Thanks to all the exhibitors for supporting the SNE again this year. Their presence and efforts provide evidence of their work and constant support for the sector and professionals.

This year, the Board of Directors has made a great effort to make society aware of what we are losing if we continue to be the only country in Europe that has not yet decided on continuing to keep the seven nuclear power plants in operation, given the energy crisis we are experiencing. This message is based exclusively on scientific and technical criteria from our position as professionals.

This year we continue to see an increase in the number of presentations covering all topics, which is evidence of the sector's growing activity in R&D&I and, above all, in the company's long operational experience and global expansion. By the way, there has been excellent attendance and participation in all the sessions.

I want to highlight a technical session that the Board of Directors initiated last year. We presented the activities of the SNE commissions. These are the lifeblood of the Society; we are what we are because of all those who work in these commissions. Many members participate in them, and the Board of Directors would like to thank them for their efforts. Some of them are celebrating their 40th anniversary this year, such as the Programmes Commission and also the Journal, which, for such a significant anniversary, has prepared a complete archive of the 412 issues published, which can be accessed from the digital portal of the journal NUCLEAR ESPAÑA (www.revistanuclear.es).

With a monographic session on the future of small modular reactors (SMRs) and the two plenary sessions: one on taxonomy and the other on spent fuel management, we have covered this triangle of topics of maximum activity with top-class speakers and moderators.

We can say that this 47th Annual Meeting is one of the best attended in recent years:

- No. of attendees: 662
- No. of sponsoring companies: 29
- Number of collaborating companies: 8
- No. of exhibitors: 24
- No. of technical and poster sessions: 38 technical sessions and one poster session
- No. of papers: 276

I want to notice the social programme: opening cocktail, cultural visits, official dinner, closing cocktail, thanks to the sponsors, and the facilities of the City Council of Cartagena and the Government of the Region of Murcia.

I would also like to congratulate the SNE, WIN, and JJNN winners. It is al-

ways challenging to choose, but the winners always deserve it, even if there could be many more.

As usual, we will announce the winners of the technical and poster sessions and the photo contest sponsored by FRAMATOME. These prizes will be awarded at the 2023 Assembly.

Finally, given the global energy situation, we have a great new opportunity to contribute to energy development, with the experience of our sector, which never stops innovating, and which is always at the forefront, with a young generation that is highly prepared and has a lot to contribute, which we must support because they are taking over with a great professional and social responsibility.

It is possible to retain an entire knowledge asset when the Spanish nuclear industry has dedicated many resources over many years, has a recognised prestige in the international field, and must continue to have a presence in the energy mix.

A well-deserved applause to Beatriz Liébana and all the members of the Organising Committee, and Patricia Cuadrado and the members of the Technical Committee for the excellent work carried out over many months to make this Meeting a success.

I would also like to congratulate the commissions that have provided their support and activities to the annual meeting and the SNE General Secretariat, IBERDROLA, as host company; all the sponsors and collaborators and the companies that have attended the exhibition and allowed their professionals to attend.

To reiterate our thanks to the Government of the Region of Murcia, the Mayor's Office of Cartagena, and the Polytechnic University of Cartagena for all the facilities and support during the preparation process and during the holding of the Annual Meeting on these days. Thank you on behalf of the Board of Directors and all the members.

I want to thank the President of the Region of Murcia and the President of the CSN for their presence at this closing session.

We will remember this meeting.

Finally, I would like to announce that the 48th Annual Meeting will be hosted by NATURGY and will take place in another city that has been emblematic for its conjunction of cultures since before the Roman conquest in 143 B.C. It is considered an Imperial City and is known for being the city of three cultures: Toledo. It is regarded as an Imperial City and is known for being the city of three cultures: Toledo. Let us hope that this city can be the talisman so that 2023 will be the year in which nuclear energy continues to remain operational for more years in a mix free of carbon emissions and a stable regulatory and fiscal framework.

We are looking forward to seeing you, but don't forget that the SNE is more than the Annual Meeting.

JUAN CARLOS LENTIJO, PRESIDENT OF THE NUCLEAR SAFETY COUNCIL

On behalf of the Nuclear Safety Council Plenary, I would like to thank you for the invitation to this closing ceremony of the SNE Annual Meeting. It is a pleasure for me to join you in the historic city of Cartagena.

This meeting, now in its 47th year, is a classic in the sector, even more so after the pandemic, we have experienced. But, precisely for this reason, we appreciate that it provides a magnificent meeting point to reconnect and celebrate normality.

The history of nuclear energy is relatively short, just over half a century, during which time it has reached a high degree of maturity in its various applications.

It has been a long road to get here since the Greek Democritus of Abdera gave us the first definition of the atom in the 5th century B.C. And we had to wait until 1896 for Henri Becquerel to discover nuclear energy almost by chance. And we had to wait until 1896 for Henri Becquerel to find nuclear energy almost by chance. That was the beginning.

Little could Becquerel have imagined that, just a few decades later, the first nuclear power stations would be built, capable of producing electricity using this type of energy.

And so we have come to the present day, where we live in an increasingly complex and interdependent world. This, of course, also affects us as professionals in the sector.

Who would have thought on 24 February that Russia would invade Ukraine?

This execrable act of war in which we are still immersed has only altered the world's rhythm, turning economic, energy, and geopolitical forecasts upside down and forcing all governments and institutions to react and adapt to this new reality. And unfortunately, the safety situation of several nuclear power plants in Ukraine is highly delicate, if not profound, due to their use as targets of war, with the subsequent radiological risks for people and the environment on the European continent. This unprecedented event calls for our strongest condemnation as nuclear safety professionals.

JUAN CARLOS LENTIJO

The body over which I have the honour to preside, the Nuclear Safety Council, has existed for 42 years. Our priority has always been nuclear safety and the radiation protection of workers, the public, and the environment during that time.

Safety comes first and foremost. That is our role as a regulatory body, and the nuclear industry works with us to achieve that goal from its responsibility in the different stages of the life cycle of the installations. It is our common task.

At the CSN, we work to fulfil our mission. As you are well aware, in recent years, the Council has issued favourable reports for the renewal of the operating permits of the Almaraz and Vandellós plants in 2020, and of Ascó and Cofrentes in 2021, in addition to the commissioning of the individualised temporary storage facility (ITS) for the latter plant. In total, we have thoroughly reviewed the activities of six reactors.

And as future milestones, in 2023, we will initiate the evaluation of the request

for renewal of the Trillo operating permit; the licensing of the casks required for the emptying of pools and the total ITAs of the plants; as well as the licensing of the requests relating to the decommissioning of the Santa María de Garoña plant, and the monitoring of the implementation of the Spent Fuel Management Plan (SFMP), which the CSN reported at the beginning of this year.

We are entering a new and challenging phase for us as a regulator: the coexistence of nuclear power plants in long-term operation (LTO) and actions aimed at the cessation of operation and decommissioning of other plants.

During this week, in addition to the workshops aimed at young secondary school students, as part of STEM training, or the mentoring workshops, nuclear technology sessions have been held, covering topics such as the final management of spent fuel or small modular reactors (SMRs), in addition to the technical sessions and posters with the figures detailed by Emilio Mínguez.

This is what fills this type of congress with content and interest and what society demands of us: to face the future by anticipating the challenges of the future. Because preparing for the future is the best guarantee of doing things well. Progress, be in no doubt, has a lot to do with preparation, research, and hard work. Thus, this meeting has undoubtedly been an excellent forum to continue preparing ourselves for these new scenarios, which are increasingly complex and demanding from the perspective of nuclear safety.

Because since we are in Cartagena, to borrow a quote from Isaac Peral, I fully agree with him when he said: "My hopes are born of my conviction based on scientific reasons."

The Spanish Nuclear Society is a fundamental agent in our country for promoting knowledge of nuclear science and technology. In this respect, your work is commendable.

You know that "the best prophet of the future is the past." Well, given the past of the Spanish Nuclear Society, a splendid future awaits it.

To conclude, I congratulate you on this new edition of your annual meeting. Thank you very much, and congratulations on your work this week in Cartagena. See you in Toledo next year.

FERNANDO LÓPEZ MIRAS, PRESIDENT OF THE REGION OF MURCIA

Dear Mayoress of Cartagena, thank you for welcoming us again with the affection you do in this unique place, of course, in this Mediterranean powerhouse. President of the Spanish Nuclear Society; Minister of Enterprise, Industry, and Spokesperson; President of the Nuclear Safety Council and Vice-President of the Spanish Nuclear Society; Congress participants.

First of all, I would like to thank you for being in the Region of Murcia and for choosing this region to hold the 47th annual meeting of the Spanish Nuclear Society. I imagine that you have already seen, and if not, you will see in the hours to come, that this is the best land in the world and our tourist, energy, and cultural capital. There is no better place to host this international congress, which has brought together the leading professional experts and researchers in this energy field.

It falls to me to close this meeting before you, and I thank you. And since all those who have spoken before me have said a lot and said it well, I will be brief and summarise my speech. It can all be summed up in one idea: that, at a time of particular difficulties such as the present, the value of energy and its influence on practically all the activities that characterise an advanced civilisation is obvious. Hence, we cannot afford to discard any form of energy production, much less stigmatise those that are cleaner and help combat climate change, such as nuclear energy. We are at a challenging moment at the international level that has given energy sources a decisive role as a political, economic, and diplomatic instrument; something that, just a year ago, many had not even considered, but which those of you who have mastered this field were very clear about. Combining the green transition promoted by the European Union and tackling the global energy crisis is a challenge at all levels that all those in power must seriously consider. Politically, decisions have to be taken. This is not always easy, but you have to prioritise and focus.

It is necessary to determine when establishing a viable energy policy optimises the resources available to us and makes us as less dependent as possible on foreign suppliers and markets

FERNANDO LÓPEZ MIRAS

while simultaneously being sustainable and self-sufficient. And it is impossible to say this, which is the responsibility that every government should have, without advocating the continued operation of nuclear power plants. We must find a way to afford to get rid of this source of energy production in the current context. On the other hand, industrially speaking, it is clear that the energy cost reduces these companies' competitiveness, and we, therefore, need to promote an industrial policy and a coherent and effective energy policy.

And in the social sphere, households cannot bear the rising price of energy, electricity, gas, or fuel. It is, therefore, an obligation to provide an affordable and sustainable alternative from an economic and environmental point of view. And, in this scenario, no one is unaware, or should be ignorant, that nuclear energy has regained an important role. The European Union's proposal to consider nuclear energy and gas as sources of electricity generation with low carbon emissions and for which there is no technologically or economically viable alternative - I insist because this is perhaps the crux of the matter - could not have been better.

The Government of the Region of Murcia advocates an energy policy in Spain that values nuclear energy for what it is worth, even more so now. We cannot renounce energy sources that for decades have allowed society to develop and which, today, with the latest technological innovations, are highly secure, as is the case with nuclear energy; an

option which, of course, is more than evident, would reduce dependence on gas and other fossil fuels and which is also contributing to the reduction of the carbon footprint and, therefore, to the fight against climate change, which is now so essential or should be so crucial for some ministries.

At this point, I would like to mention, as has been done during this congress, the small modular reactors that are breaking the myths and stigmas of nuclear energy and which are indeed being presented as a reliable, safe, and competitive source of energy in terms of both time and cost. As I have said, all this and much more was discussed at this meeting, which was a great success, for which I congratulate all the organisers, especially IBERDROLA, which hosted the event.

I would also like to highlight the different activities for the dissemination of science and technology that have been carried out these days. Because it is necessary to educate and it is required to transmit, and only through knowledge will we be able to achieve the goals we set for ourselves. Only through knowledge can we get rid of the prejudices that some institutions, administrations, or sectors want to implant about nuclear energy, and only through understanding, starting with the youngest people, can we establish the productive system that we will need, not only for the future but for the present. And that is what I want.

Of course, I give this meeting the importance it deserves, which is very important because of the time it is taking place, because of what has been said here, and above all, because whoever has spoken about it, I believe that one of the most critical issues of the event that you organise every year and which this year has taken place in Cartagena, is to transmit the importance of nuclear energy and safety to young people and society. This is a fundamental task you must not abandon and implement, as you have done in Cartagena with the STEM sessions for students in the third and fourth years of ESO. They have again allowed these young people to delve into technical and scientific concepts related to science and technology in general and nuclear energy in particular. And each young person has seen that nuclear energy is safe and clean energy that respects the environment, as it has no emissions. Furthermore, these young people have been aware of how at a time of international uncertainty marked precisely by the energy war and its costs, they have been able to bring this knowledge to their families. They will have a different perspective from the one that some political or institutional sectors are trying to transmit. Therefore, what you have done is certainly important for society.

The preponderant role of the Spanish Nuclear Society's Young Nuclear Commission in the meeting of the Spanish Nuclear Society is also noteworthy. This is particularly important. As I said, young people have seen how vital nuclear energy is in such a sensitive area as health and the technologies applied to it. And so we can see how diagnostic tests, treatments, radiotherapy, and the production of radiopharmaceuticals through the Health Service are essential.

I would therefore like to thank the SNE for choosing our region, and specifically the city of Cartagena, to hold its 47th Annual Meeting. I sincerely hope that you have enjoyed these days in the city with the most history, the most varied and tasty gastronomy, the best port, the most cutting-edge and avant-garde industry, with a three-thousand-year-old past, with an admirable present and with a bright future. And, of course, I invite you to come back and share with us the greatness of this region of opportunities. I wish you all the best of luck this year because, without a doubt, this country will do well if you do well. And your annual meeting will also be a success in a year in Toledo. You will not be able to enjoy the Mediterranean; you will not be able to enjoy the excellent gastronomy of Cartagena. You will not be able to enjoy more than 3000 hours of sunshine a year in this land. But they will have it easier because nobody said that getting to Paradise was easy. Thank you very much.

WORKSHOP

NUCLEAR TECHNOLOGY

Coordinated by Alejandro Carrasco (ENUSA & JJNN/CTRA) & Laura Martín Huete (IDOM & JJNN).
Participating companies: ALISYS, ANAV, AZISA, BOOST4PRO, ENUSA, FRAMATOME, GE HITACHI, IBERDROLA, INETEC, INNOMERICS, SIALI, TECNATOM & WESTINGHOUSE

The Nuclear Technology workshop created an innovation space on the first floor of the Palacio de Congresos El Batel, bringing together in one place the most innovative technologies in the nuclear sector. Moreover, interactively presenting these technologies provided a double opportunity: the companies had a space to show their products in detail, and the attendees could interact with them and meet the experts who had created them face-to-face.

This year, the two workshop sessions focused on virtual/augmented reality and robotics, bringing together companies specialising in emerging technologies such as artificial intelligence. Jóvenes Nucleares and the Technical Committee of the Annual Meeting sought to create an innovative and interactive space in which a congress participant interested in learning about the technologies that will shape our sector in the years to come could interact with them with their own hands.

ALYSIS presented the Boston Dynamics Spot robot for the second consecutive year, the world's most advanced quadruped robot with mobility, of which they are official distributors in Spain. This year the robot learned new skills, such as transporting objects.




ANAV showed an innovative immersive virtual reality model of the Vandellós II NPP containment with virtual reality glasses. The attendees could take a virtual tour of the plant, viewing realistic 360º images. The sensation of walking around inside the plant was a unique experience for many congress attendees.

AZISA: This Asturian company exhibited two drone models, a crawler-type robot for nuclear applications and other miniature robots. The company has already used these little technological marvels in Spanish nuclear power plants for remote inspection and intervention tasks.

BOOST4PRO presented several virtual reality equipment-oriented post-Fukushima training procedures. These techniques can reduce costs, leading to higher-quality training.

ENUSA presented an augmented reality application for equipment at its Juzbado Fuel Factory, allowing virtual maintenance to be carried out by remote assistance, which saves time and travel and increases the interventions' quality. It was one of the most mature Augmented Reality applications presented at the workshop.

FRAMATOME presented two robots designed for nuclear applications: a version of Boston Dynamics' Spot robot with a programmable autonomous operation option and a crawler robot piloted by hand gestures with augmented reality glasses. Seeing Spot's demonstration of autonomy and piloting a robot with hand gestures but without a controller was very enriching.

GE HITACHI let us go inside the SMR BWR X-300 reactor using virtual reality glasses. The attendees could explore the different parts of this reactor in an immersive way, living the experience of being inside a BWR-type SMR in the first person.

IBERDROLA demonstrated an augmented reality application for remote monitoring of activities using Microsoft's Hololens device. Integrated with Teams and Remote Assist applications, it offers an environment that reduces costs, increases ease of communication and access to paperless documentation, and allows activities to be recorded for later reference.

INETEC brought from Zagreb virtual reality goggles where you could see demonstrations of its robotic equipment for inspection, repair, and maintenance, used by nuclear power plants worldwide.

Innomerics presented its component, reverse engineering capabilities, as a company certified by the Supplier Evaluation Group (GES) for nuclear safety-related work.

SIALI: This Cantabrian artificial intelligence start-up presented its product Inspector Safe, an object recognition system that uses artificial vision to identify people and PPE in real-time. It also gave other AI applications that could be the future of the nuclear industry in the coming years, such as automated intelligent quality controls.

Tecnatom demonstrated several lines of digitalisation, including proof of concept and commercial solutions. It showed a computer vision application with two artificial intelligence models for detecting accidents or blackouts and checking the correct use of PPE. On the other hand, it showed Digital Worker solutions with Tablets: TecOS PROCEED to digitally execute nuclear power plant operation and maintenance procedures, and TecOS VIEW as an interactive P&ID solution.

And finally, Westinghouse presented two projects related to its WorkLife business line, aimed at digitalizing fieldwork. They explained the success story of the implementation of TecOS PROCEED, TECNATOM's computerised procedures solution, at its Waltz Mill Service Centre in the USA and its radiological management platform: an application designed to enable operators to manage the productivity and safety of crews in containment more efficiently..

TECHNICAL SESSIONS

SESSION 1 SIMULATION WITH NUMERICAL CODES + 3D (I)

Alberto Escrivá from the UPV as president and **Amparo Soler** from NFQ as coordinator.

The prominent speakers came from the UPM, CIEMAT, and Empresarios Agrupados. Eight papers were presented in the simulation field with numerical codes, one of which was eligible for the best TFM award.

The first two were related to containment simulation using the GOTHIC code. The first one presented the updates to the containment model of the Almaraz nuclear power plant, and the next one explained how to optimise the models by applying a priori geometric simplifications.

The subsequent two presentations dealt with the spray system in containment and its modelling with GOTHIC. The third presentation showed the validation of the performance of this system using the experiments carried out in the PANDA installation. The fourth presentation showed the implementation of this system in a generic PWR-W containment, using the PANDA installation as a reference.

New pool scrubbing correlations based on old reliable data were presented in the fifth presentation. Calculating decontamination factors requires reliable data, and not all experiments are suitable for this validation.

In the following presentation, the development of a containment model in an openFOAM CFD environment was presented, showing the geometric adaptations necessary to carry out the meshing, indicating that a process of refinement/simplification of the geometry is required before meshing.

The seventh presentation compared the TRACE and RELAP codes, intending to reach the capabilities of both principles to simulate the natural convection occurring in the SIRIO experimental facility.

Alberto Escrivá
PRESIDENT

Amparo Soler
COORDINATOR

The last presentation was dedicated to coordinating 3D environments in collaborative nuclear projects. In these projects, it is essential to implement coordination models that allow access to the joint design of all the facilities. The software to be used must be selected appropriately.

The high number of papers and their high technical level indicate the excellent health of thermal-hydraulic simulation in the country and allow us to be optimistic at this time of generational change.

It should be noted that the speakers kept to the time available for each presentation so that those attending this session, around 20, had time to ask various questions and discuss different aspects related to the work presented, which contributed to enriching this session and clarifying aspects that there was not enough time to go into in depth in the presentations given.

SESSION 2 WASTE MANAGEMENT (I)

The first presentation, "*Characterisation by X-ray diffraction of the oxidation of nuclear fuel analogues during temporary dry storage*", was given by **Luis Gutiérrez-Nebot** (CIEMAT). The presentation described the development of in situ oxidation measurements by X-ray diffraction (XRD), considering that the existing nuclear safety regulations require the integrity of the fuel rod to be ensured.

The second paper, "*Reaction kinetics of alkaline activated cement for the storage of nuclear grade spent resins*", was presented by **María Criado** (CSIC). The paper develops the management of spent ion exchange resins through their immobilisation in Portland cement (PC) matrices.

The third paper, "*1D Reactive Transport Model for Spent Fuel Alteration: Integration of processes with different time scales*", was presented by **Olga Riba** (ANPHOS 21 Consulting). The paper addressed the challenge of considering kinetic processes with time scales integrating the complete water radiolysis scheme, the complete system chemistry, and the corrosion kinetics of the GC and the iron (Fe) of the steel cask.

Ricardo Moreno
PRESIDENT

Gregorio Socorro
COORDINATOR

The fourth paper, entitled "*Influence of isocarinic acid (ISA) on the sorption of ^{238}Pu, ^{152}Eu, and ^{60}Co on cement, portlan-*

dite, and ettringite", was presented by **Manuel Mingarro Sáinz-Ezquerra** (CIEMAT). The paper showed the influence of ISA concentration on the sorption capacity of ^{238}Pu, ^{152}Eu, and ^{60}Co on two commercial CEM I and CEM IV commercial cement.

The fifth presentation, entitled "*Process of declassification of timber from the El Cabril Disposal Facility*," was given by **Lucía Sevilla Horrillo** (ENRESA). The exhibit focused on the initial steps of the project to declassify timber temporarily stored at the El Cabril Storage Centre. The objective is to maximise the recycling and disposal of the reusable materials generated and the minimisation of the radioactive waste generated.

The sixth presentation, entitled "*Radioactive waste management at the Ascó nuclear power plant. Indicator 2.0*", was presented by **Luis Vega Cosio** (ANAV). The paper presented the new two-dimensional monitoring indicator that combines: cubic metres of radioactive waste produced with cubic metres that have been conditioned in the same period.

The seventh paper, entitled "*Waste optimisation in the decommissioning project of the J. Cabrera NPP*," was presented by **Enrique Van-Baumberghen** (MARSEIN). The report suggested that the plans and lines of action achieve an optimum waste reduction sent to the El Cabril Disposal Facility, both low, medium, and meager. The priority objective is to comply with the line set by ENRESA as regards responsible service, classification, and control of materials.

The eighth presentation, entitled "*New strategies and solutions for volume optimisation and efficiency in ENRESA's radioactive waste management*," was delivered by **Diego Espejo Hernando** (ENRESA) and addressed the need for ENRESA to define actions and new solutions for volume optimisation in the conditioning of radioactive wastes and minimisation of their generation for disposal at the El Cabril Disposal Facility.

The ninth presentation, entitled "*The generation of materials in the J. Cabrera NPP decommissioning project*," was given by **Enrique Van-Baumberghen** (MARSEIN). The lecture presented the final results of the materials generated (in cubic metres and tonnes) broken down by categories of materials and buildings.

SESSION 3 DISMANTLING (I)

Eight papers were presented covering different technical aspects related to decommissioning.

This session was chaired by **José Campos** (ENRESA) and coordinated by **Miriam Lloret** (ENUSA) with the support of **Domingo García Cárdenas** (GE-HITACHI).

The session was well attended by many people who took part in the question and answer sessions with the speakers, which demonstrates the interest in issues related to the decommissioning of facilities.

The first presentation was given by **Diego Santoro** (GDES), who presented the work carried out by GDES since 2020 in the decommissioning of two reactors in Barsebäck (Sweden), and more specifically, those related to the primary recirculation system in this nuclear plant.

Secondly, **Alejandro Soria** (ENUSA) spoke to present the progress made in developing and testing a drone applied to the radiological characterisation and release of nuclear sites.

Subsequently, **Tomás Recio** (TECNATOM) presented an update on the safety assessment based on field tests in the LD-Safe project for laser cutting vessels and internals.

Marcos Sánchez (GE-Hitachi) gave an update on decommissioning and dismantling projects around the world.

The fifth presentation was given by **Carlos Martos** (WESTINGHOUSE), showing the work and results obtained concerning the scale factors and type isotopes of the turbine building at Sta. Mª de Garoña NPP.

José Campos
PRESIDENT

Miriam Lloret
COORDINATOR

The following presentation was given by **Enrique Benavides**, who presented the analysis carried out on the isolation of the spent fuel pool and its systems to accelerate the decommissioning process of nuclear power plants.

José Luis Revilla gave the seventh presentation (CSN), entitled "*Advance preparation for decommissioning. The CSN instruction IS-45*".

Finally, and closing the session, **Hugo Mejía** (CYCLIFE ENGINEERING) presented the process used in the design of the dismantling scenario with the title "*The performing Integrator Model engineering process in the design of dismantling scenario*".

SESSION 4 QUALITY, REGULATION, ORGANISATION AND HRF (I)

Seventeen people attended, and six exciting papers on various topics were presented.

Firstly, **Fernando González**, from TECNATOM, commented on the actions being carried out in the development of nuclear leadership, among which the creation of the Safety Leadership Academy, for which a collaboration agreement has been signed with the WANO centre in London, stands out. He presented the results of the first activities carried out or planned for this Academy in different contexts, such as Spain, Brazil, France, and Romania.

Secondly, **Francisco Javier de la Morena**, from TECNATOM, presented the paper "*Hermes: a planning tool for the unified management of access to the different Spanish nuclear power plants*". The tool presented, developed entirely by TECNATOM and tested over the last two years, facilitates the process of access by external workers to the nuclear power plants, unifying, centralising, and improving this administrative task.

María Asunción Gálvez, from CENTRALES NUCLEARES ALMARAZ-TRILLO, gave a presentation on "*Awareness of counterfeit and fraudulent items. Definition of counterfeit and fraudulent elements and examples in the nuclear industry. Current situation and influencing factors*", which was complemented by the following paper, presented by Robert Ventura from ANAV, on "*Awareness raising for the detection and control of counterfeit and fraudulent items*". Both presentations highlighted the activities carried out in the Nuclear Forum's Supplier Evaluation Group (SEG). The productions aimed to raise awareness and warn about the potential risk of introducing counterfeit and fraudulent components through procurement processes in all industries and the importance of this in the nuclear sector. It was pointed out that for years several measures have been established, taking as a starting point references from international organisations of recognised prestige, to prevent, detect these elements and avoid their installation in nuclear power plants. It also recalled the need for nuclear power plants and their first and second-tier suppliers to remain focused on this problem.

The fifth presentation, "*Conducting a materiality analysis and implementing the Sustainable Development Goals (SDGs) in the ENUSA Group*", was given by **Nuria Valenciano** from ENUSA. The materiality analysis was presented as one of the essential tools for companies' sustainability management. It allows prioritising the issues with the most significant impact and relevance for a company and its stakeholders. This enables strategic decisions to be focused and targeted, taking into account stakeholder expectations and serving as a basis for sustainability reporting.

Pilar Almeida
PRESIDENT

Ana Belén Sáez
COORDINATOR

Finally, **Juan Antonio Muñoz**, from NUCLEONOVA, presented the paper "*The quality of the future in the nuclear industry. The challenge of the ISO 19443 standard*", in which he explained how quality has been evolving, adapting to the industrial reality, establishing a new approach but maintaining safety standards. ISO 19443 incorporates the ISO 9001 standard with the nuclear sector's specific characteristics: high safety culture in all activities and risk-based thinking. It establishes guidelines for suppliers to provide good product and service quality levels, considering customer expectations and compliance with standards and legislation by structuring quality levels throughout the supply chain.

SESSION 5 ENGINEERING AND INNOVATION (I)

The Session contained seven papers with various topics, but a common factor related to electronic or instrumentation and control engineering.

Harold Yepes, from the Polytechnic University of Valencia, gave a presentation on neutrino detectors and their use as an emerging technology applied to nuclear safeguards.

Luis Alejandro Torres, from the Universidad Politécnica de Madrid, had a presentation on the operational modal analysis of neutron noise signals for the mechanical characterisation of the core in KWU reactors.

Óscar Uribes, from IBERDROLA, spoke about predictive analysis of equipment behaviour through online monitoring.

Ana Isabel Novillo, from EMPRESARIOS AGRUPADOS, presented a paper on the qualified life extension of the Almaraz Nuclear Power Plant's electrical, instrumentation, and control components.

Lenin Cevallos-Rovalino, from the Salesian Polytechnic University of Ecuador, presented the comprehensive thermal neutron source (FANT) characterization technique with two americium/beryllium sources.

Javier Garrido
PRESIDENT

Stella Zamudio
COORDINATOR

Jorge Biaggini from WESTINGHOUSE explained how the digital transformation of engineering is being tackled in his company.

Finally, **Alejandro Carrasco**, from ENUSA, dealt with the Neutronet project on automatic learning to optimize recharge schemes.

SESSION 6 TRAINING (I)

In this session, six papers were presented, which could be grouped into knowledge management, training for plant personnel, and nuclear training. Around 30 people attended.

The first paper, entitled "*The Equivalency of Theoretical and Monte Carlo Approaches in Neutron Transport: the case of simplified slowing-down*" presented by **Abdulrahman Al-Awad** (UPC), dealt with a simplified comparison between two models that describe the process of neutron moderation with different methodologies. The Monte Carlo model and an analytical formula help students understand how the process works more efficiently.

The second presentation, "*Innovative strategies in nuclear emergency training*" by **Fernando Garrote** (TECNATOM), showed an online training project for the Emergency Response Organisations (ERO's) of the ANAV nuclear power plants. It is being developed by a multidisciplinary team of emergency experts, specialised instructors, organisational and human factors consultants, and experts in developing audiovisual and computer content. The topics include theoretical and practical content arranged using different didactic techniques: artificial intelligence, Vyond, 3D images, animated summaries, and gamification, allowing the student to participate actively in the training process.

The following presentation by **Alejandro Mora**, entitled "*Just-in-time training to prepare the operating crews for modifications to the design,*" shows that the TECNATOM Training School at Cofrentes NPP carries out a series of training actions, including Just-in-Time training on the simulator for the manoeuvres required for start-up and coupling by the personnel who will carry out them in the control room. Cofrentes carries out a series of training actions, including Just-in-Time training on the simulator, the manoeuvres required for start-up and docking by the personnel who will carry them out in the control room, and the adaptation of ongoing training on the simulator, including the new configuration and transients, allowing all the operators to become familiar with the recent behaviour of the plant.

The presentation "*Knowledge management in the European project PREDIS (Pre-disposal management of radioactive waste)*" by **Alba Valls** (AMPHOS21) presented the different activities carried out (seminars, grants, and documents) to improve knowledge transfer to future generations, preserve existing knowledge generated in the project and organising information. All were developed jointly with the technical task teams and in cooperation with the knowledge management team of the EURAD project (European Joint Programme on Radioactive Waste Management).

Susana Falcón
PRESIDENT

Pedro Díaz
COORDINATOR

Agustín Miguel Salguero, fire protection training technician of the EULEN group at Almaraz NPP, presented the paper "*Awareness and training as the basis of fire protection,*" the aim of which is to promote training processes as a tool to raise awareness and train all workers at nuclear facilities on their involvement in fire protection.

And finally, **Lluís Batet** (UPC), "*European Master in Nuclear Energy (EMINE) preparedness for "EIT label" renewal,*" explained that EMINE, an international educational initiative offered by InnoEnergy in the framework of the European Institute of Innovation and Technology (EIT), is accredited with the "EIT label," the EIT's Quality Assurance and Learning Improvement mechanism, and is applying for renewal. To fit into the EIT Knowledge Triangle paradigm, EMINE broadens the scope of classical nuclear engineering education by offering leadership, innovation, and entrepreneurial skills training.

SESSION 7 NUCLEAR SAFETY, LICENSING AND HPS (I)

The session began with a presentation by **Tomás Villar** (IBERDROLA) on the full-scope PSA at Almaraz NPP, who, by including the probabilistic analyses of fires and floods carried out at power, the same type of analysis in other modes of operation, presented a paper analysing the particularities and differences between function at power and different modes, presenting the characteristics of some specific scenarios and the most representative modes of operation in terms of risk.

Next, **Héctor Hernández** (ANAV) shares with us the lessons learned on the analysis of deviations from CSN IS-30, in particular, on the methodology followed to support alternative compliances to those required in specific articles of the instruction, justifying that the level of safety and risk provided by the current design is adequate.

César Queral
PRESIDENT

Javier Gutiérrez
COORDINATOR

Sergio Courtin (UPM) went on to remind us that behind an accident, a series of improvement strategies are established, which sometimes have a name and surname (FLEX), and he analyses and quantifies the impact they have when incorporated into the PSA of a generic, standardised model (3-loop, PWR-WEC).

Patricia González Ayestarán (ANAV) then presented something that we have always missed, the constitution of a specific committee, with the participation of the CSN and the sector, to define the definition of the licensing bases, their treatment in the official operating documents (DOE) and their maintenance.

Back to the PSAs, **Álvaro Fernández Romero** (WESTINGHOUSE) shows us the process of defining and concentrating the Plant Operational States (PSAs) in groups that have been carried out for the Level 1 PSA of Fires in other operating modes (OM) of Vandellós II NPP, in such a way that a simplified quantification of its Core Damage Frequency (CDF) has been carried out without reducing the scope of the PSAs studied.

To conclude the session, **Maritza Rodríguez** (Polytechnic School of the University of São Paulo) presented a series of examples of the limitations encountered by Brazil's specialists in applying PSA to Brazilian nuclear power plants, both in construction and operation.

SESSION 8 ESC DESIGN AND PERFORMANCE

Six oral presentations were made at the session.

In the first presentation, **Maria Plaza**, from EMPRESARIOS AGRUPADOS INTERNACIONAL, presented the usefulness of the HTRI Xchanger Suite software tool for determining design margins in shell and tube heat exchangers to cope with conditions different from those of their design, making it possible to establish an admissible number of plugged tubes. This is particularly useful for exchangers with many years of service and uncertain design margins.

The presentation by **Jacobo Archilla** from IBERDROLA - finally the winner of the session - dealt with how nuclear power plants provide inertia to the electricity transmission system, damping grid transients related to frequency variations. In particular, he explained the excellent response of Cofrentes NPP during the frequency transient of 24 June 2021 induced by a significant disturbance in the French electricity transmission system that caused load shedding in the transmission system of the Iberian Peninsula.

Virginia Madrazo, from ENSA, presented the methodology developed for validating ENUN spent fuel transport casks, using evaluation procedures based on fracture mechanics that consider the presence of cracks and the stress state of the component using Failure Diagrams.

Two of the presentations dealt with aspects relating to equipment obsolescence. **David Flórez**, from TECNATOM, analysed the growth of a crack in Class 1 components over 60 years of operation by Appendix L of ASME XI, assessing the effects of thermo-mechanical fatigue of components and confirming their acceptability for continued service. On the other hand, Lucas Rodríguez, from Westinghouse Electric Spain, presented the case study of the take-off of the polar cranes of several Spanish nuclear power plants designed and installed several decades ago according to current standards, verifying that the relative displacements between the wheels and the runway rails are within the expected margins.

Olga Asuar
PRESIDENT

Leandro Sánchez
COORDINATOR

In the last presentation, **Juan José Jaimot**, from ANAV, explained the treatment of minor and direct design modifications in ANAV for small design interventions whose design and implementation would not be feasible or practical following the usual standards.

SESSION 9 SIMULATION WITH NUMERICAL CODES + 3D (II)

The session was attended by approximately 20 congress participants, practically unchanged throughout the session. After briefly introducing the session and explaining the guidelines given by the organisers regarding the duration of papers and questions, the session proceeded without interruption or deviation from the schedule. The following summarizes the most critical aspects of the five papers presented and their subsequent discussions.

The first presented by the **Defence University Centre** provided an illustration of the capabilities of simulating hydrogen combustion accidents using Large Eddy Simulation with detailed chemistry. Their results showed excellent accuracy in both flame acceleration and deflagration-detonation transition. Local refinement of the mesh and numerical tabulation of the chemical calculations showed the capabilities of these approximations both in the actual combustion scenarios during severe accidents in fission power plants (ENACEFF facility, CNRS-Orleans) and in the ITER reactor vessel during LOVA sequences. Despite the excellent results, these models must practically apply to large-scale scenarios.

The second paper, presented by the University of Cantabria, showed the basis and approximations of the modelling of fire propagation in cable trays. The FLASH-CAT model used was compared against several experiments, and some limitations were found, such as the assumed unlimited oxygen supply or the low variability in the cable typology. A modification of the model has allowed the validation of the model against data from the PRISME-2 Programme and the laboratories of the GIDAI Group at the University of Cantabria. The results showed reasonable agreement on variables such as the heat released by the cable trays.

The last three presentations of the session all dealt with the thermal analysis of spent nuclear fuel casks utilizing computational thermofluid dynamics simulations. The first of these, carried out by ENUSA INDUSTRIAS AVANZADAS, focused on the HISTORM-100S cask and its modelling using the STAR-CCM+ code. Through a detailed description of the fuel element, the authors defended the possibility of making realistic calculations that reduce the uncertainties associated with less complex approaches. During the presentation, several applications of the model were shown, ranging from its thermal footprint on temporary storage slabs, thermal load regionalisation, and even transients in off-nominal conditions. At the end of the presentation, some attendees showed interest in the approach but questioned the accuracy gained over other methods used in container simulation.

The last two, carried out by NATURGY NUCLEAR ENGINEERING, used different approaches to solve the problem.

Luis E. Herranz
PRESIDENT

Alberto Escrivá
COORDINATOR

The first one focused on the resolution of the fluid dynamic field employing classical resolution techniques and compared its results with those obtained experimentally in the framework of the ESCP (Extended Storage Collaboration Program) project coordinated by EPRI (Electric Power Research Institute). In the first of these, the role that natural gas convection could play in the axial thermal profile of the container was discussed. In the second, the accuracy of keeping the clearance between internal components of the system constant over the entire container height was questioned. The second, based on the fundamentally conductive characteristics of the TN32 container, proposed to approach the resolution of the system using mechanical ANSYS and to assume the scarce influence of the gas circulation inside the container.

SESSION 10 FUEL (I)

The importance of the safe and reliable operation of nuclear fuel for the proper functioning of a nuclear reactor is well known.

It is also known that irradiated fuel pools have occupied all their positions in recent years. Given that definitive fuel storage has yet to be resolved, it has been necessary to develop solutions that generally focus on the use of irradiated fuel casks placed in the Individualised Temporary Stores (ITS) built at the sites of each of the different plants. In this way, operators can meet their fuel pool requirements.

In this session, three presentations on managing irradiated fuel were heard.

Firstly, **Jesús Fernández Movellán**, from ANAV, told us about the design and licensing project to increase the capacity of the current ATI at Ascó by two containers per slab, which is two slabs of 16 containers each.

This project has now been completed and has the relevant authorisations from the CSN and will be completed in the first half of 2022, with the movement of all the casks to their new positions. This action provides Ascó with a margin of 18 additional months of storage capacity until the start-up of the new ATI-100.

Roberto Plaza, from IDOM Consulting, Engineering, and Architecture, then showed us a computer tool that automatically allows us to consult the fuel inventory of the power plant

Mariano Rodríguez
PRESIDENT

Raquel Ochoa
COORDINATOR

and its characteristics and also to quickly obtain isotopic calculations and source terms for these elements through the ORIGEN code, either for part or all of the fuel inventory, representing them graphically and allowing the consultation of the multitude of results obtained to be very dynamic and straightforward.

Finally, **Miguel Ángel Rodríguez** from Naturgy presented the software tool they developed together with Nexus5 and with the collaboration of CNAT to facilitate and optimise the loading of fuel assemblies into containers according to differ-

ent parameters, such as burn-up, cooling time, defectology, etc. This tool allows the necessary information to be extracted directly from the fuel for the reports required for the loading plans and also allows specific data to be retrieved from the fuel loaded in these casks in such a way as to respond accurately to possible questions from the CSN or ENRESA itself.

SESSION 11 FUSION (I)

The session developed dynamically, thanks to the collaboration of all the speakers. The first speaker, **Jesús Poley Sanjuá**n, a doctoral student at the École Polytechnique Fédérale de Lausanne, presented his Master's thesis, "Feasibility study of a thermal ion loss detector in a magnetic confinement fusion device," with which he obtained his Master's degree in Nuclear Physics from the University of Seville.

Next, **Jon Azkurreta Fuentes**, PhD student at the University of the Basque Country (UPV/EHU), presented the paper "*Development of an inverse permeation model for the calculation of hydrogen transport parameters*". Inverse permeation makes it possible to measure hydrogen isotope transport parameters at low pressures, favoring the characterisation of the surface regime of materials of interest for fusion.

María Urrestizala de Andrés, also a PhD student at the UPV/EHU, continued with the topic of hydrogen isotope migration in fusion reactor systems. Her work on the relationship of the transport parameters for the different isotopes in structural materials illustrated the discrepancies between these relationships and the mass root ratio.

Professor **Igor Peñalva Bengoa**, from the UPV/EHU, explained to the audience the characteristics of the experimental absorption-desorption facility of the Fusion Materials Laboratory of the university, which, after being repaired, is now fully operational and will make it possible to measure the solubility of hydrogen and deuterium in the eutectic lead-lithium alloy. The results of the experiments will be helpful in the design of tritium regenerative envelopes.

Dr. **Ronny Rives Sanz**, the researcher at the Universitat

Lluis Batet
PRESIDENT

Carlos Iturregui
COORDINATOR

Politècnica de Catalunya, acting on behalf of the authors of the following paper, detailed the various research activities carried out by the seven partners of the FusionCAT project, led by the Barcelona Supercomputing Center and financed 50% by the Generalitat de Catalunya with ERDF funds.

Finally, Dr. Rives presented his paper on the problem of helium formed in the tritium regenerative envelope of a future fusion reactor. The formation of helium bubbles, practically insoluble in lead-lithium, would impact the main design parameters. Together with several Spanish and foreign institutions, an experimental facility is proposed to measure the solubility and demonstrate the principle of helium cavitation.

The session concluded after a question and answer session from the audience, which could have been extended into an exciting debate had there been enough time.

SESSION 12 RADIATION AND ENVIRONMENTAL PROTECTION (I)

Julián Garrido (ENUSA) presented the state of development of the analytical techniques for internal dosimetry that the ENUSA Bioassay Laboratory will use with Juzbado workers. Specifically: high-resolution ICP-MS spectrometry and alpha spectrometry. The information provided by ICP-MS will significantly help determine the isotope ratios of 235U characteristic of each enrichment since its high sensitivity is very high.

On the other hand, their parallel use allows us to quantify values in ppt-ppq concentrations of the different isotopes in mass and to analyse the activity of the various isotopes.

In this way, the Enusa bioassay laboratory will be able to perform routine analyses on workers in the sector and, in addition, have methods with short response times to be able to report results in the event of an emergency.

José Luis Cormenzana (EMPRESARIOS AGRUPADOS) presented the study of alternatives defining the design of the

Óscar González
PRESIDENT

Elisa Gil
COORDINATOR

ATI-100 for Almaraz NPP based on the different spent fuel storage systems available on the market and the possible locations of the ATI-100 on the site. An essential part of this study was

the modelling with MAVRIC of the different disposal systems and the performance of radiological calculations to determine the minimum distance from the ATI-100 to the property fence to meet the controlled area dose limit (250 μSv/year established in IS-29) and to select the possible locations for the new facility.

The analysis considers realistic models of metal casks and welded capsules inside concrete shielding modules and different designs of the ATI-100 with sufficient capacity to discharge spent fuel pools and particular operational and decommissioning waste.

Radiological calculations identified the pros and cons of different storage options and potential locations for the ATI-100.

Borja Bravo (TECNATOM) presented the state of progress of the MEYER project, an R&D proposal promoted by the PEPRI Platform for the development of research in radiological protection, which will be carried out under an agreement between CSN, Ciemat, and Tecnatom, with the participation of the hospitals of La Fe in Valencia and Santa Creu and San Pau in Barcelona, as well as the universities of the Basque Country, Valencia, and the Balearic Islands. Its main objective is national training for the measurement of ^{131}I in the thyroid by means of the calibration of different equipment for measuring the population exposed in the event of a nuclear accident, thus allowing for the rapid screening of potentially contaminated individuals, identifying those who might require medical surveillance and dosimetric monitoring.

SESSION 13 ENGINEERING AND INNOVATION (II)

Four papers were presented.

The first two presentations, given by **Belén Díaz de la Cruz** and **Álvaro Iniesta López** of EMPRESARIOS AGRUPADOS AIE, focused on electrical penetrations in the containment buildings of nuclear power plants. These elements allow the passage of pipes and cables connecting power supplies and consumers inside and outside the building. These elements must be qualified to maintain the containment pressure boundary in regular operation and in the event of an accident. Throughout both presentations, the main design criteria were reviewed, both on the electrical side and for maintaining the containment inside the containment. As a main conclusion, it was stressed that the penetration protection design requires a methodology adapted to the different cases present, depending on the type of penetration, voltage levels, and electrical configuration to be protected.

The third presentation was given by **Cristina Muñoz-Serrano**, from IBERDROLA GENERACIÓN NUCLEAR, and dealt with the Reduced Pass Tensioning and Unlatched Latching strategies in the area of improvements to the Refuelling Plant Reliability Plan at the Cofrentes nuclear power plant. Reduced Pass Tensioning optimizes vessel bolts' stressing/stressing approach in the uncapping/capping processes. The Unlatched Latching strategy reduces the number of bolts that hold the lid to the top guide flange. It was highlighted that with

Luis López
PRESIDENT

Francisco González
COORDINATOR

these strategies, a reduction in the critical path is achieved and a significant saving in dosage.

The fourth and final presentation on alternatives to sulphur hexafluoride (SF6) in medium-voltage electricity distribution was given by **Carlos Enrique Peralta** from SCHNEIDER ELECTRIC SPAIN. In this case, he showed the benefits of eliminating SF6, a greenhouse gas in the switching devices of the substations of electricity grids in Europe, and its replacement by purified air, highlighting the impact they have on compliance with emission reduction targets in the medium and long term.

SESSION 14 MAINTENANCE, INSPECTION AND TESTING (I)

Five papers were presented at the session.

The first of these was presented by EMPRESARIOS AGRUPADOS and dealt with the methodology for the structural inspection of the cooling tower for discharges from the Arrocampo reservoir. To ensure that the discharge temperature from the Arrocampo reservoir to the Torrejón reservoir does not exceed the maximum value of 30º C established by the Tagus Hydrographic Confederation, the TEVA project (Arrocampo Spill Cooling Tower) was carried out between 2010 and 2011 in the area surrounding the Almaraz nuclear power plant. The TEVA tower is one of the richest and most varied elements in terms of the coexistence of structural typologies arranged on the same construction.

In the second presentation, GE HITACHI presented virtual reality developments for training applications in nuclear services, which allow training and qualification of personnel in tasks and simulate real refuelling challenges, allowing on-the-job training in a risk-free environment. Following the good results obtained in fuel movement, it has developed a new virtual reality environment for training in reactor vessel

lid stress relieving in BWR plants, including the disassembly of the vessel.

TECNATOM's presentation followed this, which aimed to explain the success stories of predictive monitoring (ACM) and the benefits of its integration into maintenance strategies. Predictive or condition-based monitoring (ACM) systems train machine learning models to subsequently carry out online tracking in search of abnormalities that anticipate future failures in components. This early search allows the action to be taken before production is affected. Actual cases of success in thermal power plants were presented, which can be transferred to the BOP of nuclear power plants, explaining the work methodology, the flow of communications with plant personnel, as well as the measurement of the economic return provided by the service to justify its value due to its precise impact on the results.

GUTOR ELECTRONIC then discussed the process for the qualification of digitally controlled battery chargers, inverters, and UPS systems used in nuclear applications. Battery chargers, inverters, and UPS are vital systems to ensure the safe operation of the nuclear reactor. While analogue UPS technology was typical when many reactors were built, the latest generation UPS systems are digitally controlled. Therefore, many concerns about achieving digital system qualification have accompanied the refurbishment or replacement of older UPS systems. This presentation aimed to show the successful methodology used to ensure a transition from analogue to digital technology for safety systems in nuclear power reactors, focusing not only on the product but also on the qualification activities necessary to achieve safety status.

The presentation that closed the session was on a case study that the company IDOM used for the cost-effectiveness of reliability-centered maintenance (RCM) and applied to a specific component (or group of elements), intending to analyse the impact of alternative maintenance strategies compared to the existing ones, using a reliability-centered maintenance methodology. This approach is based on the concept of Failure Mode and Effects Analysis (FMEA) and Cost Benefit Analysis of Maintenance (CBAM) so that the management of where, how, and why a failure may occur is optimised, avoiding its occurrence and defining a cost-effective method of prevention and execution. This method provides evidence and information on unnecessary preventive maintenance tasks and the opportunity to adopt more efficient predictive maintenance strategies to optimise inspection, diagnostics, testing, and lubrication tasks.

Jordi Sabartés
PRESIDENT

Víctor Mulero
COORDINATOR

Finally, around 20 people attended the session, and there were interesting questions for all the speakers. It should be noted that all the speakers kept to the time allotted to them. The session ended with thanks and recognition to all the speakers for their excellent work.

SESSION 15 NUCLEAR SAFETY, LICENSING AND HPS (II)

In this technical session, four excellent papers were presented on different topics, which could be defined globally as papers focused on analyzing different types of risk and, consequently, on nuclear safety.

The first of the presentations focused on the risk of fire and assessing the core damage frequency (level 1 PSA) in modes other than power operation in the case of Vandellós II NPP, thus covering the requirements of CSN IS-25.

Next, changing the facility affected and the type of risk associated with the analysis, the analysis and calculation model used to obtain the internal flooding protection manual files (those originating in failures of piping, tanks, or any component that might contain a sufficient volume of water to be considered a risk) was presented at the Almaraz and Trillo nuclear power plants.

The third presentation showed us an improvement in the safety margins, identified during the activities of the periodic safety review of ANAV's plants, associated with the execution of a regular test of one of the automatisms related to the low and high-pressure safety injection systems, achieving an improvement in the reliability of the channel and a reduction in the risk of the installation.

Rafael Martín
PRESIDENT

Juan Antonio Muñoz
COORDINATOR

The session was permeated with a good atmosphere of nuclear safety, fire analysis, flood analysis, improvements in safety margins, and, finally, a presentation on the validation of local actions that help to mitigate the consequences of a possible accident, contemplated in the PSA of Cofrentes NPP.

The session was very well attended. In addition, the small number of presentations, their subject matter, and the quality of the speakers allowed for interesting debates that enriched the session.

SESSION 16 OPERATION

The day-to-day running of a nuclear power plant consists of its operating processes, and the Operation Session of the SNE Annual Meeting summarises the main developments on the national and international scene. This year, 2022, was particularly interesting for the wide variety of topics covered, presenting more digital topics (digital twins and digitisation of procedures) and more technical issues (improvements in start-up and instrumentation). The presentations were as follows:

"*Two-channel continuous current decay of the excore nuclear instrumentation*" - **Jordi Estrampes Blanch** - ANAV

At Ascó 2, for several cycles, a continuous decrease in the value of the currents of two of the four channels of the Power Range has been observed. This does not correspond to the importance of the other two channels or the power distribution shown in the flow maps.

This paper has presented the historical evolution of the flows, hypothesised possible causes, and described the process followed to find the cause of the diminished extent (boron accumulation) and to mitigate it.

"*The electrical digital twin. Essential tool for the nuclear power plant*" - **Carlos Molina Gabriel y Galán** - SCHNEIDER ELECTRIC

This presentation aimed to introduce the concept of the electrical digital twin through the ETAP RT tool, showing its life cycle made up of four fundamental phases: design, simulation, operation, and analysis. The tool helps by providing security, naturally, to all the actors involved in the management of the plant to have an updated, synchronised, and validated knowledge of the electricity system.

"Improvements in the monitoring of reactivity insertion during start-ups at Cofrentes NPP"- **Juan José Molina** and **Yolanda Tofiño** - IBERDROLA

Luis Paniagua
PRESIDENT

Agustín Miguel Salguero
COORDINATOR

On 11/09/2021, with Cycle 23 in operation and reactor start-up after shutdown, the Reactor Protection System was automatically triggered by a high-scale signal from the intermediate power range neutron instrumentation, IRM.

Among the measures adopted, a reactivity insertion map (RIM) has been created, specific to each start-up, which serves as a roadmap of the reactivity insertion that will occur in each extraction movement. These maps indicate where high reactivity insertion with high neutron activity will occur.

WINNING SPEECH - "*Digitalisation of nuclear power plant operating procedures. Implementation strategy*" - **Mateo Ramos Ramos** - TECNATOM

One of the areas where there is the most room for digitisation is operating procedures.

These systems are starting to be implemented in several nuclear power plants for control room operation and local work. The presentation analysed the implementation strategy for a successful project based on previous experience, presenting a pilot case at the Westinghouse Waltz Mill plant.

SESSION 17 SIMULATION WITH NUMERICAL CODES + 3D (III)

The session started promptly at 9:00 and ran until 11:15 with the presentation of 10 papers.

Attendees and speakers were informed at the beginning of the session of the order and format of the session, as well as the rules applicable to the scoring and selection of the best thematic paper.

The order and content of the presentations during the session were as follows:

- (17-02) - **Arturo Vivancos**. The Polytechnic University of Valencia. "*Coupling between transport and burning codes: methodological analysis and results.*"
- (17-01) - **Arturo Vivancos**. The Polytechnic University of Valencia. "*Automation and optimisation of burning codes. Application to a fuel element*".
- (17-03) - **Cristian Garrido Tamm**. IDOM. "*Development and verification of the idom shielding optimization tool (ISOT)*."
- (17-04) **Francisco Álvarez Velarde**. CIEMAT. "*Validation of evolcode with experimental data from the Gösgen Nuclear Power Plant.*"

Carlos Gomez Rodríguez
PRESIDENT

Andrés Felipe
COORDINATOR

- (17-05) **Francisco Álvarez Velarde**. CIEMAT. "*Impact of the model in the simulation of a lead-cooled fast reactor.*"

- (17-06) **Gema María Muñoz Serrano**. EEAA. "*Sensitivity analysis of different parameters of nuclear fuel in the photon and neutron source term with the triton (scale) code*.
- (17-08) **David Martínez**. Ascó NPP. "*Two-phase calculation in suction lines of the loading pumps of Ascó NPP.*"
- (17-09) **Araceli Domínguez Bugarin**. UPM. "*Validation of the passive autocatalytic recombiner simulation Code Parupm using Reko-3 experimental data*".
- (17-11) **Gabriel Pedroche**. E-lite. "*UNED: a 360º neutron model of the ITER tokamak*".
- (17-10) **Santiago López García**. UPM. "*Study of high-order harmonic amplification with angular momentum in Krypton plasmas.*"

At the speakers' request, the presentations' order was slightly modified, and some of the previously announced speakers were also changed (replaced).

The session went smoothly in developing the presentations, with a short question and answer session after each. The time used by the speakers was reasonably adjusted to the 12 minutes established (10 minutes for the presentation and 2 minutes for questions) and was followed with great interest by the attendees, with a lively debate following the different displays. Attendance at the presentations varied, with an estimated average of around 30 attendees.

The equipment and facilities were adequate, and the technical level of the session was high, with all speakers meeting the quality requirements and expectations of the content of the papers presented.

The time for questions and discussion needed to be increased, given the variety of topics and the high technical level of the presentations. As an observation, 2-hour sessions should not exceed eight exhibitions in future editions.

SESSION 18 FUEL (II)

The session included eight oral presentations on fuel design, operational behaviour, and final management after irradiation.

There was good participation throughout the session, which generated much debate with the audience, who wanted to deepen some issues with technical questions addressed to the speakers. It is worth highlighting the excellent time management by the speakers, as the session finished within the scheduled time.

The presentations covered the following topics:

- "*ML techniques for modelling the effect of consumable poisons on the neutron source of fuel*": establishes a correlation between neutron emission from irradiated fuel, its burnup, enrichment, and the number of consumable neutron poisons in the design using ML techniques. The poison effect is relevant, especially at low burn-up levels. It was presented by **Alfonso Barbas**.
- "*PCI Pod Failure Assessment Methodology for Operational Flexibility*": studies the impact of fuel operating flexibility on the probability of failure of a PWR fuel rod due to PCI. It develops a methodology where a loss of pellet reconditioning is simulated in the FRAPCON code in scenarios with power down and power up. It was presented by **Carlos Aguado**.
- "*Analysis of Cycle Optimisation Strategies at Almaraz NPP*": a study of cycle optimisation at the Almaraz cores up to end of life, identifying refuelling schemes that maximise the cost-benefit for the plant. The analysis establishes that the best strategies foresee an increase in uranium enrichment. **Laura Encinas** presented it.
- "*Evaluation of isotopic composition measurements of BWR fuel by laser ablation*": an experimental technique, based on laser ablation, that measures the isotopes produced in irradiated fuel is validated. The importance of checking the experimental results obtained employing neutron code calculations is emphasised, especially when discrepancies are detected. **Marta Berrios** presented it.
- "*Bending test on pre-hydrated nuclear fuel cladding: analyses the mechanical behaviour of pre-hydrated unirradiated ZIRLO cladding under cask drop accident conditions by means of three-point bending tests. Due to the hydrides'* circumferential orientation, the sample's mechanical properties are not affected by hydrogen. **Miguel Cristóbal** presented it.
- "*Strengthening the initial thermo-mechanicalcharacterisation of spent fuel facing dry storage*": compares the FRAPCON-xt and BISON codes in terms of the predictive capability of sheath hydration and internal pressure. Both codes provide similar results. It was presented by **Carlos Aguado**.
- "*Models of Spent Fuel behaviour under AGP conditions*": discussed the complexity of forecasting spent fuel behaviour in a deep geological disposal situation, taking into account the time scales involved and the different physico-chemical mechanisms that need to be modelled. **Laura Duro** presented it.
- "*Effect of power heterogeneity in the 3D thermo-fluid-dynamic simulation of metallic spent fuel containers*": studies using CFD the heterogeneous thermal load in a container instrumented with temperature probes to determine the impact of different approaches in the CFD calculation of the maximum temperature reached by the fuel cladding. It was presented by **Luis E. Herranz**.

Antonino Romano
PRESIDENT

Miguel Á. Rodríguez
COORDINATOR

SESSION 19 DECOMMISSIONING (II)

The session included eight presentations grouped into three blocks: dismantling the José Cabrera NPP, engineering studies, and technological developments to automate radiological characterisation.

Concerning the dismantling of the José Cabrera NPP, **Francisco Manuel Vivanco** (MONLAIN) began by reviewing the different works contracted by ENRESA for the dismantling, decontamination, and demolition of equipment and buildings. The presentation demonstrated the various techniques used for cutting and decontamination and the complexity of the tasks involved in handling the elements up to their disposal in the appropriate containers.

Álvaro Díaz (EMPRESARIOS AGRUPADOS INTERNACIONAL) described the latest modification of the radioactive liquid effluent treatment system. The current reconfiguration has been based on simplifying the treatment processes and relocating the elements and components that are still necessary so that the Auxiliary Dismantling Auxiliary Building (EAD, former turbine building) could be dismantled and demolished.

The last presentation on the dismantling of José Cabrera NPP, delivered by **Alberto Alcántara** (ENRESA), described the Methodology for the Dismantling, Declassification, and Demolition of the EAD. The work began with dismantling the equipment and components and subsequent decontamination of the radiological part before the declassification process was carried out. The non-classifiable elements, such as the drainage network and disposal chambers, were removed as radiological elements to be managed as waste and not to re-impact the rest of the debris.

Javier Bárcenas (EMPRESARIOS AGRUPADOS INTERNACIONAL) described the risk analysis carried out for the decommissioning of graphite reactors, including alternatives for their management and possible mitigation measures. The conclusions show that there are risks that depend to a large extent on the configuration of the graphite in the core and the effects of irradiation, the type of components in the reactor, or the lack of experience in handling and treating graphite.

Alain Rodríguez (WESTINGHOUSE ELECTRIC SPAIN) gave two presentations on advanced methodologies for calculating the activation inventory of structures and components.

Alicia González
PRESIDENT

Manuel Leal
COORDINATOR

The aim is to estimate a more accurate and realistic list, developing a 3D model of activation distribution, which is very useful in optimisation, segregation, and classification processes or the location of hot spots.

In the second presentation, Alain Rodríguez explained the use of this methodology to study the activation of the vessel, internals, and structures inside the dry well of the Santa María de Garoña NPP. The presentation showed the results of the neutron flux distribution, the energy spectrum, the critical nuclide reaction rates, and the resulting activity distributions on a fine grid in activation maps.

About technological developments in characterisation, **Zied Hmissi** (DAMAVAN IMAGIN) presented the results of applying a new measurement system using 3D Compton tomography, which, based on static measurements (without rotation) with three probes, manages to obtain a 3D map of the gamma activity in a waste canister in just 10 minutes.

Miriam Lloret (ENUSA Industrias Avanzadas) presented the work carried out for the treatment and analysis of the data obtained with the new developments to automate the radiological characterisation of facings. Work procedures have also been developed, including initial planning, selection of inspection parameters, dynamic measurements, establishing points for static measurements, and data analysis, to ensure compliance with the MARSSIM methodology.

SESSION 20 QUALITY, REGULATION, ORGANISATION AND HUMAN RESOURCES (I)

The session featured five papers, all of the high quality:

First, **Inocencio Fernández** from Cofrentes NPP spoke about the human factors analysis of the Fukushima accident and its impact on Cofrentes. After a brief description of the accident, he focused on the personal conditions in which the plant operators had to work, managing the situation without data and without knowing the fate of their families and loved ones. He highlighted the great sense of responsibility and ownership of the TEPCO staff and the fact that there were plenty of volunteers among the workers to carry out the tasks. C.N. Cofrentes carried out an exhaustive analysis of these experiences from the perspective of FFHH, as a result of which a programme has been developed to improve the Interior Emergency Plan (PEI).

Joaquín Hernández from COFRENTES explained the Master Plan for the Prevention of Human Error. On 9/9/21, after more than twelve years at the plant without scrams, a reactor trip occurred attributable to human error. After analysis of what happened, the Management decided to implement this PDPEH at the plant, which the field workers and project managers have accepted after ten months of implementation. Emphasis was placed on the need to be present in the field so that the messages were adequately conveyed to the executors.

Ana Belén García and **Francisco Ruiz** of TECNATOM then described how to identify and transfer knowledge in a nuclear organisation, attempting to minimise the impact of the exit of people possessing critical knowledge. To this end, crucial knowledge is first mapped, and transfer plans are drawn up, followed by the execution of these plans. Finally, processes are set in motion to capture and transform this knowledge into an organization's asset.

Next, **Julián Mendoza** from GDES described the Safety II programme, which focused on improving occupational risk prevention. It aims to promote the positive aspects of processes, extending good practices. This method is handy in organisations like nuclear power plants, which already have excellent accident rates.

Finally, **Francisco Moragas** and **Laura Puigdollers** from ANAV spoke about immaterial incentives, or those that are not monetary but are in the hands of middle management and allow them to manage the satisfaction and motivation of employees to improve their performance and well-being. The phrase "my mum spoils me" allowed for a very interactive presentation with the audience.

The session was of great interest, and there was a high standard from all the speakers..

Iñaki Hermana
PRESIDENT

Fernando González
COORDINATOR

SESSION 21 ENGINEERING AND INNOVATION (III)

The session included seven exciting presentations on different projects and experiences related to various topics: component inspection, spent fuel, and the application of innovation and other digital technologies to improve plant maintenance and operation.

The session began with a presentation of ANAV's experience implementing digital twins. **José Ignacio Alutiz** showed the development process and the plans for their use.

Domingo Lima then showed how EQUIPOS NUCLEARES is applying automation and robotics to introduce significant improvements in the execution of inspections in its nuclear component manufacturing processes.

Also, from Nuclear equipment, **Moreno Pombo** presented the feasibility study for an investigation and argon cooling system that will allow the transfer of damaged spent fuel, preventing the oxidation of UO_2.

This was followed by a presentation on developing a generic multi-unit Small Modular Reactor simulator. **Patricia Romero** explained the developments at TECNATOM and the challenges and applications of this simulator, which consists of up to 12 reactors.

Alfonso Laín then presented TECNATOM's approach to applying Artificial Intelligence to non-destructive testing (NDT) through the automation of analysis, the analysis of historical data, and real-time monitoring.

This was followed by a presentation of Westinghouse's experience in reducing maintenance activities through an accurate assessment of the state of the plant through real-time data. **Karina Martínez** explained the experience recently gained in units 1 and 2 of the Salem power plant.

Finally, **Alice Cunha da Silva** presented WESTINGHOUSE's approach to implementing an open innovation system throughout its organisation through the Innovation Factory, together with some examples of the results obtained.

In summary, the session, animated by various questions and comments from the audience, showed different experiences developed in other areas over the last year and confirmed the growing application of new digital technologies in the nuclear industry.

Fernando Ortega
PRESIDENT

Rubén Moreno
COORDINATOR

SESSION 22 MAINTENANCE, INSPECTION AND TESTING (II)

Seven papers were presented within the session. All the speakers were authors of the documents. The seven participants presented their work sequentially and in a programmed manner, with the audience asking the relevant questions at the end of the presentations. It was dynamic and participative for the audience and the other speakers.

In the first presentation, SGS TECNOS shared with the attendees the development and application of a methodology that allows early knowledge of the mechanical integrity of materials to manufacture pressure vessels. He described the phases of the method capable of assessing the suitability of materials for service.

In the second presentation, ANAV explained the methodology used to carry out diagnostic tests in the dynamic regime for motorised valves. This process was described and applied in four valves during the last refuelling at the Vandellós II plant, which responded favourably to the requirements of the applicable regulations.

In the third presentation, the company Westinghouse shared with us different real experiences in which they have had to develop inspection and repair equipment. Among the cases described, I highlight the development of an inspection system for welded joints inside small-diameter pipes.

During the fourth presentation, TECNATOM clearly explained the development of a complete set of inspection equipment for work at the Hinkley Point reactors. It was undoubtedly challenging to adapt the equipment to the new regulatory requirements, completing the corresponding documentation and acceptance tests.

In the fifth presentation, IBERCAL described how to inspect inaccessible pipes using the guided wave technique, explaining the medium and long-distance inspection modes and the advantages and limitations depending on the pipe contour conditions and the fluid inside the pipe.

Pedro Ortiz
PRESIDENT

Carlos Gavilán
COORDINATOR

TECNATOM presented an exciting tool during the sixth session; the device could control and track loose parts on the steam generator's secondary side to assess the tube wall's structural integrity.

During the seventh presentation, IBERDROLA explained how the inspections were carried out on the outer sheeting of the cooling towers at the Cofrentes plant. After the examination, he also explained how they were reconditioned until they were in optimum condition for the plant's operation.

Generally, the speakers presented their technical papers with outstanding clarity and order, always within the allotted time. The chairman and the coordinator thanked the speakers for the exciting session and, at the same time, acknowledged the interest and active participation of the 29 congress participants who attended the session.

SESSION 23 NUCLEAR SAFETY, LICENSING AND HPA (III)

The session began with a presentation by **Miguel López** (IBERDROLA), who described an automatic reactor shutdown event at Cofrentes NPP due to an anomaly in the new generation switch installed during the last refuelling outage. It was impossible to replace the faulty circuit breaker since no spare part was available, and its manufacture would take an extended period. The authorisation was therefore requested from the CSN and obtained to implement a design modification (temporary) to allow the plant to operate without this circuit breaker.

The following presentation was given by **José Guerrero** (EMPRESARIOS AGRUPADOS INTERNACIONAL), describing the current work that the nuclear industry is developing to define nuclear safety criteria applicable to molten salt liquid fuel nuclear reactors. Other definitions, terminologies, and design capabilities specific to MSRs were also described, highlighting their advanced safety advantages compared to LWRs.

Subsequently, **Mateo Ramos** (TECNATOM) gave a powerful presentation on SMR (Small Modular Reactor) and MR (Micro Reactor) and their treatment as a possible solution for the nuclear industry to the technical, economic, and environmental challenges. In this type of reactor, the degree of automation must be more significant and poses challenges in instrumentation and control. It was presented how these factors are considered in the design and development of the Argentinean reactor CAREM, led by the CNEA.

Vicente Nos
PRESIDENT

Rafael Bocanegra
COORDINATOR

The session continued with the presentation by **Borja González** (WESTINGHOUSE) of the calculation of the frequency of the Plant Damage States of the APS of level 2 fires in other operating modes of Vandellós NPP within the framework of IS-25. The integration of the methodology described in NUREG/CR7114 was highlighted, having been necessary for the definition and use of marker-type events to undertake the quantification, due to the high number of cases to be solved.

The presentation by **Kevin Martin** (UPC) focused on the technical aspects of the effects of scaling in the thermal-hydraulic analysis of Break Intermediate LOCA scenarios within the framework of the scientific collaboration between the UPC and CSN.

Finally, the session concluded with a presentation by **Javier Gutiérrez** (ENDESA) with an excellent communication of the analysis of the results and important conclusions obtained in the 1st phase of the "Cross-border emergencies in the EU" project, which should serve for the appropriate management of such emergencies between countries, should they occur.

SESSION 24 SNE COMMISSIONS

The unique technical session on the SNE Commissions began with a few words of welcome from the president, highlighting the importance of this session for the internal and external dissemination of the work done by the more than 100 members that make up the different commissions and encouraging all members to participate in them. After stressing that the commissions are "the engine and soul of the SNE," he gave way to the speeches of the protagonists.

The **Communication Commission** explained its objectives, actions, and new strategies to enhance our society and its members. Made up of a team of highly proactive communicators and technicians, they have presented multiple initiatives to make SNE communication a matter for all its members. From working with those who are the 'voice' of the organisation through training in spokespersonship to improving digital channels and content, creating new audiovisual dissemination materials, and creating specific actions to increase visibility and notoriety in public opinion.

The **Young Nuclear Commission** outlined the strategic changes they have made in the organisation of activities in the current context of increased interest in the 'nuclear world.' In this presentation, they presented the results and lessons learned from their new initiatives, such as the organisation of the Nuclear Energy Management School, which was held as part of ENYGF'21 in September 2021 in Tarragona. The organisation of the first edition of the Nuclear Technology Seminar "Nuclear Tech: The Future is Now!" on neural networks and their applications in the sector, and the participation of JJNN in the organisation of the World Nuclear University - Summer Institute, an important annual initiative of the World Nuclear Association held in Madrid. JJNN has expanded its range of actions, including its new presence in Tick Tock.

The **Employment and Professional Development Committee** presented the fundamental pillars that structure its actions to meet its main objectives:

- integrating companies in the sector and students in the industry
- offering an exciting training offer
- attracting and retaining talent

Divided into different groups by objectives, they work intensively to offer SNE members solutions of great added value, such as, among many other things, an informative offer in line with the current times, and as proof of this, they presented the success of the Blockchain Workshop (developed through the SOUL platform) or the facilitating role of the Employment and Companies group that works to bring together the needs of the sector and project them to the labour reality and the actions developed during the last year for the Attraction of Talent.

The SNE **Technical Commission** highlighted and explained all the activities they have been carrying out as one of the SNE's longest-standing working groups for over 35 years. They told us about

Héctor Dominguis
PRESIDENT

Pedro Ortega
COORDINATOR

their objectives and the value of their team. Their crucial work at the 'Normativa' level (of interest not only nationally but also internationally), the balance of the last Annual Technical Conference, the award for the best doctoral thesis, their multiple dissemination actions such as position notes, technical notes, their innovative podcast project or the value of the *Pirámide Normativa* service.

The **Programmes Commission**, created to provide a space for dialogue and knowledge among members 40 years ago, gave an overview of the actions carried out in the 21-22 period. From the Operational Experiences Day as its main event and the Nuclear Thursdays to the cultural, sporting, and technical visits as the activities most accepted by the members, who are the true protagonists of this Commission and who were encouraged not only to continue participating but also to join this great team. Among their following challenges are to know the members' opinions, identify new proposals, and interact even more with the rest of the SNE commissions.

A historical reference to the evolution of the Spanish nuclear sector. The **Spain Nuclear Review Commission** also celebrates its 40th anniversary. The magazine was launched in July 1982, and from that month, it was published monthly, uninterruptedly, on paper, until December 2019, the year in which www.revistanuclear.es was born. During this period, 412 issues were published, with nearly 3,000 articles written by more than 3,000 authors and more than 400 interviews. To commemorate the 40th anniversary of the Journal, the Editorial Committee has coordinated the creation of a newsstand-hemerotheque (with all the publications produced in the history of the SNE) and a particular issue that brings together the excellence of the Spanish nuclear sector, in addition to the information generated at the Operational Experiences Conference.

The WiN Commission dedicated its presentation to the presentation of its plan of dissemination and communication activities carried out during the last year, the year of its 25th anniversary. They recounted the keys to their participation in the annual meeting of the SNE both in the STEM Workshops (mentoring

workshops for young students together with the NEA), their participation in conferences aimed at the society of Cartagena, webinars, and participation in interviews and debates in press, television, and radio during 2022; in addition to the presentation of their comprehensive social media plan.

The Organising Committee of the Annual Meeting presented its modus operandi for the organisation of the main event of our Society and the challenges they have had to face. An event whose organisation requires collaboration and teamwork for a whole year, full of milestones to be met, and in which the Committee has found external facilitating supports to be taken into account for future editions thanks to the contribution of great added value that RASNE brings to all the cities it visits.

The SNE Technical Committee provided attendees with a comprehensive and detailed overview of the collective effort of its members for the excellent technical impact of our annual meeting. They explained their work in the organisation and coordination and the keys to the success of the coordination of sessions, compilation of documentation, selection of speakers, and design of the technical programme in collaboration with the rest of the commissions and connected to the current affairs of our industry.

All in all, it offered the attendees a reasonably complete and detailed overview of the collective effort of each of the SNE's commissions and encouraged intercommunication and the exchange of experiences among its members; the president would therefore like to thank the attendees, both speakers and the rest of the audience, for their participation and interest in this session, which was undoubtedly productive and exciting for everyone.

SESSION 25 THERMOHYDRAULICS AND NEUTRONICS (I)

During the first technical session on thermohydraulics and neutronics, eight papers were presented to an audience of approximately 20 people. The papers are summarised below in the order in which they were given:

- "*Cobaya improvements for reflector modelling of SMR*" presented by **Luis Felipe Durán Vinuesa**, dealt with the activities carried out to reduce the methodological biases of the COBAYA code developed at the UPM, which consisted of reducing biases in the neutron code NEWT on the one hand and improving the results produced by COBAYA on the other.
- "*TVA watts-bar fuel depletion analysis with Triton*" also presented by **Luis Felipe Durán Vinuesa**, showed an analysis of the position-dependent burn-up calculations performed with the TRITON code belonging to SCALE applied to the OECD/NEA TVA Watts Bar Unit 1 Multi-Physics Multi-Cycle Depletion Benchmark, with particular interest to the realisation of methodologies to reduce the computational impact of self-armoring modelling.
- "*Proposal of nuclear data uncertainty reduction for advanced fast reactor design*" given by **Nuria García Herranz**, described how nuclear data propagates uncertainty to reactor reactivity parameters and how they have generated a list of priorities to provide to the JEFF group to improve nuclear data for fast reactors.
- "*Nuclear data assimilation for sodium-cooled fast reactors using integral experiments*" also presented by **Nuria García Herranz**, dealt with the evaluation of the uncertainty due to nuclear data in reactivity parameters in two sodium reactor designs and how, using existing experimental data in similar reactors, they have managed to build an adjusted data library that reduces these uncertainties in this type of reactors.
- "*Comparison of the simulation of the RHR system failure in ¾ loop operation with the apt versus the PKL i-project experiment*" presented by **Francisco Javier Hernáez Delgado**, described the simulation of the RHR system failure scenario in ¾ loop operation with the Trillo Plant Analyser, to compare the results with the data from the experiment of the PKL installation configured to operate as a 3-loop KWU power plant.

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Francisco Álvarez
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- "*Simulation of a SBO transient with additional failures in a 3-loop PWR reactor using the TRACE code*", given by **José Ordóñez Ródenas**, studied the effect of an extended SBO accident under design extension conditions on a typical 3-loop LWR reactor, showing how a partial depressurisation through a single steam generator using a mobile pump to maintain the inventory in the secondary can keep the primary stable without compromising its integrity.
- "*Reproduction of results from RBHT Reflood Heat Transfer experiments with TRACE code*," given by **Lucas Álvarez Piñeiro**, showed that the TRACE modelling of the flooding experiment of the NRC/PSU RBHT installation over-predicts the maximum temperature of the rods, while the cooling time is predicted in agreement with the experimental data and that the fraction of entrained liquid differs significantly from that obtained experimentally.
- "*Optimisation and validation of the reactor trip controls of a 3D tracev5p5/parcsv3.2 model of a PWR-KWU reactor*", presented by **Bárbara Navarro Mas**, dealt with the optimisation of the control logic that obtains the reactor trip signals in a 3D thermohydraulic-neutronic model made with TRACE/PARCS of the vessel of a PWR reactor, with particular emphasis on the evolution of the PUMA 1/3 transient. The analysis focuses on how the power distribution in the reactor core evolves under a fast power reduction command.

SESSION 26 WASTE MANAGEMENT (II)

The first presentation, entitled "*Situation and trends in spent fuel and radioactive waste management*" was given by **Emilio García Neri** (ENRESA). The lecture presented the nuclear sector's situation about managing low and intermediate-level radioactive waste and spent fuel and high-level waste.

The second paper, entitled "*Ciemat participation in the PREDIS Project*" was presented by **Eva María Márquez Franco** (CIEMAT). The article describes the authors' participation in the PREDIS project (Pre-Disposal Management of Radioactive Waste), the result of the EURATOM call for proposals for the development of activities before the disposal of radioactive waste.

The third paper, "*Orano Mobile Hot Cell to Sort and Segregate Waste,*" was presented by **Yannick Pons** (ORANO). The report introduced the concept of a portable hot cell for sorting and segregating nuclear waste.

The fourth presentation, "*New metallic waste treatment facility at Cofrentes NPP*" was given by **Susana Gutiérrez Martínez** (IBERDROLA). The lecture presented the new facility by Cofrentes NPP for treating metallic wastes, mainly from the plant's design modifications.

The fifth paper, "*SISCAREN equipment for characterisation of VLLLW in Large Volumes*" was presented by **Alfonso Córdoba González** (ENUSA). The presentation explained the result of the collaboration project between ENUSA and CIEMAT for developing ENUSA's radiological characterisation systems (SISCAREN). The first equipment designed is for characterizing large volumes of VLLLW waste.

The sixth presentation, entitled "*Preliminary analysis for the qualification of incineration as a method for the management of compact LILW*" was delivered by **Tomás Recio Miranda** (TECNATOM). The presentation included an analysis of the possibility of incinerating compactable LILW at facilities in the United Kingdom and the benefits that might be derived from this type of project.

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The seventh presentation, "*Evolution of radioactive waste management at the Juzbado fuel assembly factory*" was given by **Saúl de la Hoz** (ENUSA). The new radioactive waste management systems were presented at the Juzbado fuel assembly factory to optimise the quantities and volumes of waste generated.

The eighth presentation, entitled "*Portable installation for radioactive waste management (IPRE)*" was given by **Esther Sánchez Benavente** (ENUSA) and **David Rodríguez Cano** (ENSA). The talk presented the design of the modular, portable, configurable, and autonomous installation (IPRE) for waste management at nuclear facilities, which aims to reduce the volume of nuclear waste.

The ninth presentation, entitled "*On-site treatment techniques for radioactive waste: resins, concentrates, and sludges*" was given by **Romain Fourny** (CYCLIFE-EDF). The lecture presented the system developed by Cyclife for managing resins, concentrates, and sludges that form part of the plant's operational waste to be addressed before its transfer to ENRESA for decommissioning.

SESSION 27 FUSIÓN (II)

The panel was represented by **Luis Cerrada** (EAI) as coordinator and myself (**Sofía Corino**, ENSA) as chair. It was a pleasure to listen to our 11 speakers and to discover the advances and research being developed around this technology, given its relevance in the future of nuclear energy.

First, I would like to thank the Technical Committee member and the session coordinator for their proactivity and time management. Despite many presentations, the session ran smoothly and met time limits.

The session was opened by **Amador Sillero**, from TECNATOM S.A., with his presentation on the "*Robotic system for the ultrasonic inspection of the ITER First Wall Panels*". The developed and validated system was presented, along with the next stage of the project, which consists of the qualification of the complete inspection process on three actual prototypes and the inspection of the first series of FWP's during their manufacturing.

The second speaker was **Santiago Bermejo** from EMPRESARIOS AGRUPADOS INTERNACIONAL, with his presentation "*External Events Analysis. Aircraft Impact Assessment in IFMIF-DONES*". He presented the methodology and the preliminary analysis, demonstrating that the facility complies with the established objectives, guaranteeing that it does not constitute

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PRESIDENT

Luis Cerrada
COORDINATOR

an undue risk to public health and safety as a consequence of the impact of an aircraft.

The third speaker was **Elena Fernández** from EMPRESARIOS AGRUPADOS INTERNACIONAL, with her paper "*Melcor Scenarios Analysis for the EMP Design in Liquid Metal Circuits inside IFMIF-DONES Facilicty*". The work carried out was presented, and according to the preliminary results obtained, it was concluded that the studied configuration of two pumps in series seems to be the most suitable to guarantee the presence of the lithium layer in any transient beyond regular operation.

The fourth speaker was **Gema Donoso** from EMPRESARIOS AGRUPADOS INTERNACIONAL, who presented "*High-Performance Thermal Insulation of Tokamak Cooling Water System (TCWS) Qualification*". She explained the state-of-the-art approach to the qualification programme proposed for the qualification of the thermal insulation material for ITER's primary cooling system, the Tokamak Cooling Water System (TCWS) piping network, and equipment.

The fifth speaker was **Laura María Ruesga** from EMPRESARIOS AGRUPADOS INTERNACIONAL, who presented the "*Detailed design of the control cabinets and operating console of the ITER Nuclear Security Control System*". She explained the final design process of the cabinets of the ITER project's Nuclear Security Control System (SCS-N) once the technology had been selected and the control architecture defined.

The sixth speaker was **Ana María Hernández** from EMPRESARIOS AGRUPADOS INTERNACIONAL, who presented "*Analysis of the obsolescence of the ITER Nuclear Security Control System*". She showed the tasks to be carried out to analyze and manage the obsolescence of the Nuclear Safety Control System (SCS-N) of the ITER project by presenting the criteria, strategy, and methodology selected for the maintenance of the qualification of the components.

The seventh speaker was **Pablo I. Resa** from TECNATOM S.A., with his presentation "*Main projects developed for the inspection of ITER components*". The main projects developed by Tecnatom for ITER and manufacturing companies over the last ten years were reviewed, such as the system for the UT inspection of vacuum vessel seal welds.

The eighth speaker was **Gilberto Villescas** from IDOM, with his paper "*Thermohydraulic Modelling of HCPB-TBM Auxiliary Systems with Trace*". The results were presented, showing an adequate response to the different transients analysed, thus demonstrating the robustness of TRACE as a tool to aid in the design of thermohydraulic systems with a non-conventional operating fluid, in this case, low/high-pressure helium.

The ninth speaker was **Roberto Pizarro** from EMPRESARIOS AGRUPADOS INTERNACIONAL, with his presentation "*ITER power supply system. Progress in the design and installation of the Steady Satet and Pulsed Power networks*". The progress of the installation was presented, including the substations and main transformer of the two 400 kV power grids, the auxiliary transformers and power centres of ITER, and the interconnections with many of its buildings to distribute the electricity supply to all the loads of the plant.

The tenth speaker was **Abdulrahman Al-Awad** from the Polytechnic University of Catalonia, with his paper "*Atomistic Simulations and Theoretical Predictions of Helium Nucleation in Liquid PB-Li Eutectic Alloy*". Simulations and results were presented and were consistent with theoretical predictions under the assumptions of extreme helium supersaturation conditions in the LLE. The very low solubility of helium in the LLE is verified.

The eleventh and last speaker to close the session was **Patricia Romero** of TECNATOM S.A., with her presentation "*ITER Simulation Platform. Integration and Co-Simulation*". She presented the simulator developed, which will not only be used for operator training but will also accompany the design and construction of the facility, providing engineering support and serving as a tool for the revision of operating procedures.

Many thanks to all the speakers for the high quality of their presentations and their very innovative and interesting presentations.

SESSION 28 RADIATION AND ENVIRONMENTAL PROTECTION (II)

A total of 5 papers were presented in this session, with an average attendance of 10-12 people.

Firstly, **Iñigo Vildosola** (ASCÓ-VANDELLÓS NPP) presented the evolution of dosimetry management at the Vandellós II Nuclear Power Plant. In this evolution, he went through the analogue beginnings in the 1980s, the digital development in the 21st century, and the consolidation of management with networked dosimetry systems. In addition, the speaker presented a series of new challenges they plan to carry out.

Professor **Eduardo Gallego**, from the Polytechnic University of Madrid, presented the paper "*Study of radiological protection in SMRs (Small Modular Reactors) using Monte Carlo codes.*" This presentation introduced the different types of modular reactors, focusing on describing the FUJI-U_3 reactor based

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on molten salts (MSR - Molten Salt Reactor). The speaker explained the primary radioactive sources of this reactor and the model used for determining neutron and photon doses.

The following paper, entitled "*Methodologies and tools to assess the environmental radiological impact of a nuclear fusion test facility,*" was also presented by Professor **Eduardo Gallego**. This paper explains different tools and methodologies for analyzing a nuclear fusion facility's radiological impact on the regular operation and a possible accident with a release of radioactivity. The tools on which this work focuses are NORMTRI (KIT - Germany), CROM (CIEMAT - Spain), PC-CREAM08 (HSA - United Kingdom), and GENI v2.10 (PNNL - United States) for regular operation and UFOTRI (KIT - Germany) and GENII v2.10 (PNNL - United States) for the radiological impact on the public in the event of an accident.

Marina Sáez Muñoz, from the Environmental Radioactivity Laboratory of the Polytechnic University of Valencia (LRA-UPV), presented the paper "*Determination of polonium-210 in environmental matrices*". This paper describes the procedure for determining polonium-210 in environmental samples such as aerosols, tobacco, grass, or soil. The accuracy and repeatability of the method are studied, obtaining good results in most models.

Finally, **Léo Talec** (FONDERIE LEMER) presented the company's capabilities of the company FONDERIE LEMER for manufacturing lead shielding.

SESSION 29 ENGINEERING AND INNOVATION (IV)

Technical Session 29, "Engineering and Innovation (IV)," featured six presentations on new challenges.

The first, by **Marcos Celador** of EMPRESARIOS AGRUPADOS INTERNACIONAL, analysed the integration of a small modular lead fast reactor coupled to an energy storage system in electricity markets with high penetration of variable renewable sources in load-following operation mode.

Xavier Bailo of EMPRESARIOS AGRUPADOS then explained the technical due diligence process carried out before the resumption of construction of the Angra 3 nuclear power plant in Brazil.

Paolo Ferroni of WESTINGHOUSE presented the lead-cooled fast reactor as his company's next generation of high-capacity nuclear power plants.

Jordi Freixa, from the Polytechnic University of Catalonia, spoke about load following in the Spanish electricity system of the future with very high-temperature gas-cooled Generation IV reactors.

Maite Pérez, from EMPRESARIOS AGRUPADOS INTERNACIONAL, analysed the implementation of the environmental qualification programme for mechanical equipment, presenting some practical cases.

María Vega
PRESIDENT

Martina Trueba
COORDINATOR

The session ended with **Carlos Gavilán**, from IBERDROLA, presenting the use of factorial techniques (PCA) to reduce variables in prediction problems and optimize models applied to systems engineering..

SESSION 30 TRAINING (II)

In this session, most of the presentations were devoted to the production of virtual reality (VR) tools used in training nuclear power plant workers. Some of them are already implemented and operational, and others are still in the process of development or initial testing.

Stella Zamudio from GE HITACHI presented the new VR innovation platform aimed at reducing costs in the area of personnel training. **Rafael Díaz**, from ANAV, explained the continuous training to deal with extensive damage emergencies in the start-up and the use of portable equipment to mitigate them. **Álvaro Arconada**, from SOLUTE, presented a tool developed in collaboration with CNAT to improve training in a maintenance procedure, making it more accessible and practical for field operators. **José María Albert**, from TECNATOM, presented challenging games as an advanced solution in education and training with virtual dynamics applied to non-leisure activities, thereby reducing the drop-out rate in e-learning, increasing engagement and motivation, and increasing efficiency and productivity. **Christian Schöenfelder**, from SCHÖENFELDER TRAINING, presented the initi-

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Mateo Ramos
COORDINATOR

ative of ENEN and a consortium of 40 European educational institutions to offer, within the framework of the Horizon-Euratom-2021 project, a programme of competencies in the nuclear sector through structured and advanced training actions. **Antonio Cruzado**, from TECNATOM, presented his company's project for the design of training programmes for the new small modular reactors, specifically the X-Energy reactor, taking into account the particularities and differences to reactors of previous generations, which to a certain extent, implies a change of paradigm in terms of both methodology and acceptance by the regulatory bodies. **Vanessa Barambones**, from TECNATOM, presented the 3D model created for training processes and work performed in the transfer channel, which constitutes a critical path in the planning of refuelling tasks.

Finally, **Rafael Díaz Heredia**, Head of Training at ANAV, was awarded the prize for the best paper in the Technical Training Area with his work "Use of virtual reality in practical emergency training.".

SESSION 31 NUCLEAR SAFETY, LICENSING AND HPS (IV)

Session 31 featured eight presentations:

The first one, by **Alberto García Herránz** (UPM), presents a novel Methodology for identifying the so-called design basis extension (DEC) sequences to identify improvements to increase the safety of nuclear plants after the Fukushima incident.

Raquel Velasco (ANAV) takes us on the back of the RG-1.189 through the outdoor areas of the Ascó and Vandellós II NPPs to carry out a complete analysis of the fire risks, assessing the presence of in situ or transient fuels, as well as the ignition sources, evaluating among other things the protection for the shutdown systems.

Jorge Sánchez Torrijos (UPM) To demonstrate the applicability of a tool (TRACE/PARCS) developed in his research group, its application to a double guillotine steam line break sequence in the NuScale SMR is presented. For this purpose, a TRACE model has been developed based on using 1D components together with a 3D PARCS model.

Luis E. Herranz, on behalf of **Rafael Iglesias Ferrer** (CIEMAT), presents a methodology to assess the radiological consequences of DBA and DEC-A accidents in the SGTR and LOCA categories. Using the MELCOR 2.2 code, these were performed on SGTR accident sequences under DEC-A conditions. The limitations of the code observed in the modelling of iodine transport from the fuel to the environment encouraged the code's extension to describe better both the release from the fuel and the primary-secondary transfer.

David Calvo Romero (IBERDROLA) surprises us with the impact of significant human actions for risk according to PSA analysis (internal events, fires, floods, shutdowns, etc.) in the accident scenarios in the Trillo NPP simulator.

Rafael García
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Francisco Osorio
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Julia Herrero-Otero (UPM) presents the advantages of the regulatory body having its standardised tools and models; specifically, for PSAs, the SPAR-CSN model for understanding and assessing the risk associated with the operation of Spanish nuclear power plants.

Andrea Serrano Costafreda (IDOM) presents a methodology to quantitatively analyse the risk associated with a combination of earthquake and turbine missile events using the probabilistic level 1 safety analysis of internal-to-power events. This methodology is advantageous to complete the analysis of event combinations recommended by IAEA SSG-3.

Finally, **Luis E. Herranz** (CIEMAT), in his second round of this session, presents an analysis, implemented with the MELCOR code, of modifications to the design of Framatome PARs. These modifications aim to increase the PAR hydrogen recombination rate in oxygen-free atmospheres..

SESSION 32 MEDICINE AND HEALTH IN THE NUCLEAR FIELD

Eight papers of high technical quality were presented, summarised below:

- *Monte-Carlo simulations for the reconstruction of neutron spectra in a radiotherapy room using BSS*, illustrated by **Rafael Miró**, Professor at the Polytechnic University of Valencia (UPV).
  The simulation using the Monte-Carlo method of the measurement of neutron fluence during the use of a radiotherapy room at La Fe Hospital in Valencia, measured with a Bonner Sphere Spectrometer (BSS), versus the experimental results, obtaining the differences to minimise the doses to patients depending on the different locations and shape of the neutron spectrum in the Radiotherapy Room was presented.

- *Computational generation of phase spaces at the exit of the multilaminar collimator (MLC) of a linear accelerator (Linac) for Monte-Carlo simulation*. By **Rafael Miró**, professor at the UPV. The phase-space technique (PSF) is used to simulate a Linac with Monte Carlo. The aim is to minimise irradiation to the structures surrounding the tumour. Different PSF configurations have been validated by simulating the Linac, which will have a corresponding shape depending on the angle of the accelerator arm throughout the treatment.
- *Reconstruction of medical computed tomography (CT) images using out-of-core methods on GPUs*, presented by **Vicente Emilio Vidal**, PhD in Computer Science and Artificial Intelligence, UPV.
  This research project has developed GPU software for real-time image generation. QR factorisation using out-of-core techniques has been used to reduce transfer times between disk, CPU, and GPU, achieving an implementation up to 6.5 times faster with improved image quality.
- *CT image reconstruction using the QR method: single vs. double precision*, by **Vicente Emilio Vidal**, from the UPV.

  In CT, the time required to obtain the images is critical to minimise test time and, thus, patient dose. In CT, single or double-precision algebraic methods are used to convert electronic signals into interpretable images. The work proved that it has been possible to reduce test times by between 2 and 2.5 times with single precision. All of this demonstrates, at the same time, that the image quality necessary to obtain the clinical information sought in the test has been recovered. In addition, the image resolution can be increased without requiring more storage capacity.
- *Approach to the evaluation and management of psychosocial factors in companies in the nuclear field*, by **Mr. Francisco Miguel Castillejo**, head of the Enresa Occupational Health Unit.
  The paper develops a methodology that combines the psychometric characteristics of quantitative methods with the uniqueness of qualitative methods, providing greater assessment consistency. The study was applied to the Enresa work centre in El Cabril using the form published by the National Institute for Health and Safety at Work (INSST), published in April 2020.
- *Update of clinical and biodosimetric biomarkers in the health surveillance of exposed workers*. Dr. **Óscar Alonso** presented them from the Irradiated and Contaminated Care Centre of La Fe Hospital in Valencia.
  The work updates the national and international regulations on biomarkers and the practice of their use in Spain when necessary. The study concludes by identifying technical and management improvements such as the development of a national protocol for biological dosimetry, the establishment of a nationwide network of biodosimetry laboratories, updating federal regulations on the subject, and assessing the possibility of incorporating new clinical markers into the health surveillance systems of professionally exposed workers.

Mª Luisa Estupiñán
PRESIDENT

Óscar Martínez
COORDINATOR

- *Actuación y transporte medicalizado del paciente contaminado en la Comunidad Valenciana*, By Dr. **María Pilar Bayo**, SAMU doctor of the Servicio de Emergencias Sanitarias de la Comunidad Valenciana.
  The Territorial Emergency Plan of the Valencian Community, which dates back to 2013, needed more specific measures regarding out-of-hospital care and transporting patients contaminated with radioactive substances. The work presented details the coordination work carried out between the medical staff of the SAMU and the Radiation Protection Service of the Hospital La Fe in Valencia, which has allowed the generation of the necessary technical procedures for the treatment of the patient, avoiding the spread of contamination, the training of medical staff and the establishment of communication protocols to facilitate the correct performance of the work, by the different Emergency Coordination units.
- *Medical management of Covid-19 in a nuclear power plant. Experience of 5 reloads at the Agrupación Nuclear Asco-Vandellós (ANAV).* Dr. **Ester Estevill**, head of the Medical Area of ANAV, presented them.

  The work describes both the material and the working methods implemented at the Asco and Vandellós nuclear power plants to manage the pandemic without jeopardising the continuity of operation of the facilities while safeguarding the workers' health. Emphasis is placed on refuelling owing to the large influx of workers from collaborating companies joining the facilities.

SESSION 33 THERMOHYDRAULICS (II)

A total of eight papers were presented at the session, four of which focused on thermohydraulic aspects and four on neutronics. The speakers scrupulously kept to the established time limit, which allowed for a question-and-answer session after each presentation.

The behaviour of turbulent jets in an aqueous medium is of interest not only in nuclear power plants but also in other industrial applications. In the first presentation, **Yaisel Córdova** from UPV presented a numerical analysis, using the ANSYS CFX code, of the behaviour of horizontal jets of gases discharged in

subcooled water. The second paper, presented by **David Blanco**, described the versatile JEBEA installation developed at the UPV for the experimental study of gas and steam discharges in stagnant water.

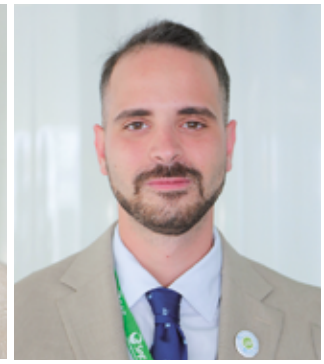
Next, David Blanco again gave an exciting presentation describing the fractional scaling methodology and its application to a small LOCA. In particular, it has been applied between the experimental LSTF facility and a commercial Siemens KWU reactor, quantifying the scale distortions between both facilities in the first phases of the analysed LOCA.

Francisco Álvarez-Velarde from CIEMAT presented the fourth session paper focused on the design of a burner version of the sodium-cooled reactor born from the European Horizon2020 ESFR-SMART project.

César Serrano gave the fifth presentation from IBERDROLA GENERACIÓN NUCLEAR, who addressed the integrated simulation capacity of the MAAP5 code for the analysis of the thermal-hydraulic behaviour of the containment in the event of high-energy breaks.

The following presentation was on cogeneration plants based on high-temperature gas reactors and was given by **Ramón Pérez Vara** from EMPRESARIOS AGRUPADOS INTERNACIONAL. He stressed the importance of evaluating the transient behaviour of the various nuclear cogeneration systems being proposed and presented the potential of the EcosimPro tool for their simulation.

Nuria García
PRESIDENT



Luis Felipe Durán
COORDINATOR

In the seventh presentation, **Daniel Suescun** from the Universidad Surcolombiana presented a method capable of reducing fluctuations in the calculation of reactivity by means of the inverse equation of point kinetics.

Continuing in the area of neutronics, the last talk, given by **Vicente Bécares**, was devoted to the advances made in the SUMMON tool developed at Ciemat for analysing the sensitivity and uncertainty of neutron parameters to nuclear data.

Although the session did not have a large audience, it was participatory and gave rise to interesting comments and exchanges that made it enjoyable and enriching.

SESSION 34 FUEL (III)

Nico Vollmer presented FRAMATOME's fuel efficiency improvement strategies. The status of the PROtect project with solutions for ATF fuels, the results of various irradiation campaigns, and manufacturing capabilities were presented.

Pau Aragón continued evaluating the thermomechanical behaviour of the FeCrAl cladding in a steady state as ATF fuel. It has been modelled with FRAPCON-4.0 resulting in no significant performance differences between FeCrAl and Zircaloy-4 at the end of their lifetime, except for their creep rate stress states.

Lucile Fallot presented the WESTINGHOUSE design fuel element inspection programme at C.N. Trillo. Eight 16x16 WSE Demonstration Elements with ZIRLO Optimised sheaths were irradiated. The results of the inspections performed, the significant challenges, and the companies' capabilities were presented.

Pilar Ortego spoke about ATF fuel in the framework of the delegated act of the EU green taxonomy. The act establishes that from 2025 this type of fuel must be implemented in plants eligible for EU subsidies. FORATOM is submitting a proposal for applying the taxonomy criteria, including projects with ATF fuel and trying to define ATF.

Alicia Sanchez demonstrated the assembly of spigot devices in irradiated fuel assemblies in non-vertically accessible positions in the storage pool, presenting the assembly tool. These under-balcony spigot repairs were successfully carried out at the plant for the first time in 2022.

Rosa González
PRESIDENT

Roberto Plaza
COORDINATOR

Sergio Fernández spoke about advanced ATF fuels with uranium oxide matrix doped with metal oxides, the purpose of which is to increase safety and the degree of burn-up. The influence of the heating ramps, sintering times, and temperatures of the pellets manufactured at CIEMAT was analysed, analysing their mechanical properties and the influence of the sintering parameters.

Adrián Ahufinger and **Ana Artés** presented the integration of Power Bi in monitoring manufacturing and fuel quality at ENUSA and how it helps every day with the enormous amount of information generated. Power BI has been a breakthrough in terms of time optimisation, process control, and speed in decision-making.

Finally, **Alejandra de Lara** spoke about the performance of AGR-type FHR fuel.

It was shown that switching from CO_2 to fluoride salt is feasible from a fuel performance point of view for the same range of parameters. Although the internal pin pressure increases, raising the cladding creep, it would be reduced with a larger fuel grain size.

The session was of great interest to the audience and generated several questions, the answers to which complemented the high technical quality of what was presented.

SESSION 35 RADIATION AND ENVIRONMENTAL PROTECTION (III)

The session featured seven presentations related to RP and AM as follows:

- "*Estimation and analysis of the radon transfer rate coefficient*" by **Aina Noverques** (Institute of Industrial Radiophysical and Environmental Safety (ISIRYM), Universitat Politècnica de València). The research on the behaviour of radon gas released from water to air through the concentration gradient was presented.
- "*Determination of the radon diffusion coefficient of monolayer or multilayer barriers composed of polymer and aluminium*" by **Beatriz Ruvira** (ISIRYM, UPV). In this work, the ISO/TS 11667-13:2017 standard is modified to calculate the radon diffusion coefficient of different materials that can be used as monolayer or multilayer barriers.
- "*Radon detection in a Spanish natural gas well*" by **Aina Noverques** (ISIRYM, UPV). This research studies the radon content in natural gas at 4 points along an extraction well and in different production phases (technical stoppages, extraction, and injection).
- "*Natural radioactive loads in an erupting volcano: a case study of Cumbre Vieja 2021, Canary Islands*", by **Cristina Trull** (ISIRYM, UPV). Experimental results obtained from the Strombolian explosive episode during the eruption of La Cumbre Vieja volcano have been presented to clarify the outgassing patterns observed in the biological samples, thus estimating the total radioactive load released into the environment.
- "*Determination by alpha spectrometry of uranium and thorium in ceramic materials in secular disequilibrium*" by **Aixa Sevilla** (Environmental Radioactivity Laboratory. MEDASE-GI Group. UPV). The procedure was developed to quantify uranium and thorium isotopes by radiochemical separation in samples of ceramic pigments that are not in secular equilibrium. Therefore, their complete characterisation by gamma spectrometry is not viable.
- "*Radiological control in chemical cleaning tasks of oil platform elements*" by **Benjamín Mora** (GD ENERGY SERVICES S.A.U.). At the same time as the chemical cleaning work, the implementation of a radiological control campaign for personnel and the environment has been presented at the last oil platform in Spain.
- "*Characterisation of the shielding components of a cyclotron*" by **Benjamín Mora** (GD ENERGY SERVICES S.A.U.). The work has characterised the metallic shielding of a cyclotron for transport to a French radiopharmaceutical company, which had previously acquired a disused cyclotron installed in Spain.

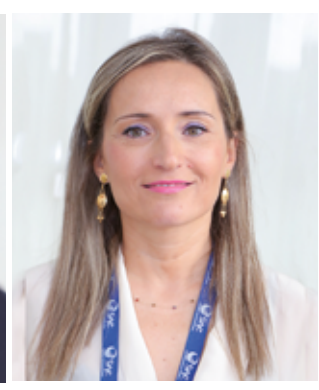
Raúl Muñoz
PRESIDENT

David Soro
COORDINATOR

SESSION 36 ENGINEERING AND INNOVATION (V)

Session 36, with a total of six papers presented, had a good level of attendance, a high level of technical interest, good presentations in terms of quality and time, and was very participative with questions for all the speakers. The first paper, presented by **Rafael Torrealba** from EMPRESARIOS AGRUPADOS, dealt with the replacement of the generation switch recently carried out at the Trillo nuclear power plant, with a detailed and engaging description of the challenges, technical development, and results of the project. The next presentation was given by **Patricia Guerrero**, also from EMPRESARIOS AGRUPADOS, on the technical details of the construction of the new heliport for the Almaraz nuclear power plant with the capacity to accommodate large helicopters with high load capacity. In the third presentation, **Luis Osorio** from EMPRESARIOS AGRU-

Javier Alonso
PRESIDENT



Gema Alcalá
COORDINATOR

PADOS gave a descriptive overview of several design modifications carried out in recent years at the Trillo and Almaraz plants, highlighting how these actions, which have been carried out since the plants began operating, have kept them in a perfect operational and safety state. The fourth presentation, given by **Daniel Alcaraz** of GD ENERGY SERVICES, was devoted to a detailed presentation of developing two mobile power generation units for emergencies, currently in the final phase of execution by GDES for EdF. The fifth presentation by **José Ignacio Roselló**, also from GD Energy Services, dealt with the digitalisation of scaffolding services at the Vandellós II nuclear power plant. This initiative is part of a global digitalisation plan for this company, which is expected to improve its services' efficiency significantly. And, completing the session, **Mercedes Palomo** of TECNATOM gave a detailed presentation of the new technical capacities and services (reverse engineering, qualification and dedication engineering, databases, testing laboratories, etc.) deriving from the agreement established with Westinghouse in the field of the obsolescence of nuclear class equipment and spares and applicable to any reactor technology..

SESSION 37 MAINTENANCE, INSPECTION AND TESTING (III)

The session featured seven presentations and was attended by an average of 30 professionals from the nuclear sector, who had the opportunity to obtain additional explanations in the question-and-answer sessions after each of the presentations.

In the first presentation, **Jesús Aldariz Martín** (ANAV) described two structural rehabilitation actions carried out at the Ascó and Vandellòs II Nuclear Power Plants. These were the repair of the forced draught towers at Ascó NPP and the repair of the discharge channel walls at Vandellòs II NPP. In both cases, the objective of the repairs was to recover affected structural elements so that the design criteria continued to be met.

The second presentation was given by **Amparo Ponce Serrano** (GDES) and dealt with the integral maintenance of tanks used for the storage of effluents generated in the chemical cleaning of the secondary side of the steam generators of French nuclear power plants and how GDES has managed to manage 297 tanks from eleven plants with satisfactory results and return them to operation.

Subsequently, **Susana Merino Oviedo** (CIEMAT) presented a paper on the Analysis of Bearing Failure of a Multiplier Bearing belonging to a Charge Pump in which the different degradation mechanisms were described, and evidence was shown that the failure is related to the loss of lubrication induced by the low clearance between the bearing and the shaft, the viscosity of the oil or poorly assembled parts.

The fourth presentation was given jointly by **Sergio Rodríguez Francás** and **Jordi Ortega Sarlé** (ANAV) and described resonance phenomena detected in rotating equipment at the Vandellòs II Nuclear Power Plant, as well as the modifications implemented to reduce the vibration levels to acceptable values, with the comparison of the vibration levels initially detected compared to those obtained in the equipment after the implementation of the modifications being presented as success stories.

Next, **Felipe Belinchón** (GE HITACHI), in the fifth presentation, explained risk management and maintenance optimisation with digital solutions. Felipe showed how to reduce the effort for

Antonio Martinavarro
PRESIDENT

Ángel Luis Ferrer
COORDINATOR

data processing of maintenance plans, spare parts requests, and budget management through digital solutions that automate and simplify the tasks of data acquisition and control. They also allow for eliminating repetitive tasks and displaying information more straightforwardly for decision-making.

The sixth presentation was given by **Luis Rey Peinado** (IBERDROLA GENERACIÓN NUCLEAR), proposing a methodology for alarm setting in spent fuel cask pressure monitoring based on the fact that pressure values decrease, as expected, with long-term waste heat decay and fluctuate with ambient temperature variations.

Finally, **Juan Antonio Muñoz** (NUCLEONOVA) gave a presentation on good practices in obsolescence management, proposing proactive rather than reactive management based on the early identification and prioritisation of solutions before incidents occur in the facilities. Juan Antonio mentioned the advances and working groups associated with this end promoted by organisations such as the IAEA, EPRI, INPO, and CSN.

In conclusion, all speakers presented their work with outstanding clarity and order, keeping the session within the allotted time.

Finally, the chairman and the coordinator thanked the speakers for the engagement session and the high technical quality of their work.

SESSION 38 NUCLEAR SAFETY, LICENSING AND HPS (V)

In the last technical sessions dedicated to Nuclear Safety, Licensing, and PSA, six of the seven papers scheduled were presented since one of the speakers declined to give his work (paper 38-04). Due to coordination needs between technical sessions, papers 15-05 of Session 15 became part of this Session 38.

The session was attended by around 15 participants and began with a presentation by **Pino Díez**, from IBERDROLA GENERACIÓN NUCLEAR, on the analysis of the consideration of preventive venting to try to reduce the risk of hydrogen combustion for a BWR Mark III containment. The scenario chosen was the in-vessel phase of an accident with total loss of external energy (SBO). The venting simulation was performed with and without Passive Autocatalytic Recombiners (PAR). The main conclusion is that if the venting strategy is performed correctly, it can reduce the hydrogen hazard associated with BWR Mark III containments.

Rafael Iglesias, the researcher in nuclear safety at CIEMAT, continued with the presentation dedicated to analyzing combustion risks in European PWR reactors (AMHYCO Project). As part of this project, the most relevant sequences chosen according to a set of agreed criteria have been modelled.

The third presentation, given by **Elisabet Marcos** from Westinghouse, presented the results of the Level 2 PSA for power fires at Vandellòs II NPP. The scope of the work consists of analysing the behaviour of the containment building in the event of an internal fire that has led to damage to the reactor core, as well as the classification in terms of magnitude and time of release and the quantification, in terms of frequency of occurrence, of the potential radioactive releases that may be produced outside the reactor.

Gregorio Socorro, from NATURGY INGENIERÍA NUCLEAR, presented the necessary documentation to be submitted to the Commission of the European Union, as requested in the Commission's recommendation on the application of article 37 of the Euratom Treaty, intending to summon a permit for the decommissioning of a facility, as well as the data that this documentation should include being able to report on the work related to such decommissioning adequately.

In the fifth presentation, **Belén Martínez**, from Empresarios Agrupados, described the licensing process for a second-category radioactive facility. She presented a detailed description of the technical documents that, according to the legislation in force, are necessary to obtain the operating permit for these facilities: a descriptive report of the facility, safety study, verification of the facility, operating regulations, internal emergency plan, and decommissioning provisions.

Pascual Cámara
PRESIDENT

Álvaro Fernández
COORDINATOR

The session ended with presenting two papers by **Luis Enrique Herranz** from CIEMAT. In the first one, he gave the results of the analyses carried out by CIEMAT to explore the evolution of an unmitigated SBO in a BWR/3-MkI nuclear power plant, taking into account the uncertainties in the estimation of the fission products released in the vessel. The results have indicated that the delays affect not only the magnitude but, most notably, the timing of the release.

Luis Enrique's second presentation dealt with the analysis of the large quantities of fuel, fission products, and contaminated sodium that can be discharged into the containment due to vessel failure in case of an accident in sodium-cooled fast reactors. The results have shown good agreement with experimental data and, at the same time, are conservative.

The questions posed at the end of each presentation made it possible to go into more detail and hold the ensuing debate. The speakers' willingness, who generally kept to the limited time available, is worth noting.

The session was closed by thanking the speakers for their participation and the attendees for their presence.

SESSION 39 COMMUNICATION

The 39th session of the 47th Annual Meeting of the SNE was dedicated to communication from diverse perspectives and complementary points of view, conveying to the attendees the idea that "everything communicates." The content encompassed ten presentations of a very different nature, began with **Alfredo García**, better known by his alias on social networks as @OperadorNuclear, who spoke about his personal experience in dissemination and the transformation experienced in more than a decade of presence in different channels. **Laura Gala** also moved within the dissemination framework, presenting the "Educational Corner," a powerful tool created and developed by Foro Nuclear that allows various materials to be made available. The world of networks and new channels was also featured in presentations by **Laura Escribano** and **Laura Ortega**, who introduced the use of TikTok as a channel also available for dissemination. For his part, Manuel Vila focused his speech on the strategy of nuclear communication and the need to reach opinion generators beyond the work that is already being done in dissemination.

Other exciting experiences raised in the session were those of **Pablo García** and **Ana González**, who brought to the field of communication the management of insurance at nuclear facilities, and **Matías Urrea**, who shared his experience, once he had finished his work at Cofrentes NPP, contributing to society his knowledge acquired in, among other areas, the management of the plant's Site Emergency Plan.

Other communication actions were also presented at the session, such as the one undertaken by WiN to create its "Alara", the fictional character with which to provide a common thread to its publications and content as WiN on social networks, or that of the Spanish Society for Radiological Protection, which presented its Decalogue of recommendations for safe mobile phone use.

The last of the talks, presented by **Manuel Fernández** and chosen as the best of the session, was entitled "the great leap" and consisted of an original journey through the world of myths and led the audience to ask them to participate in the deployment of communication as a vital asset of the nuclear industry since everything and everyone communicates.

Montse Godall
PRESIDENT

Vanessa García
COORDINATOR

SESSION 40 POSTER

In the poster session, a total of 7 papers were presented in different fields, such as waste management, radiation protection, or fusion:

Yasiel Córdova, from the Polytechnic University of Valencia, presented an "*Experimental study of the effect of temperature on interfacial waves in the air-water downward annular flow*" where the results of an experimental fluid dynamic study obtained in the GEPELON+ (Wave Film Generation + heating) installation are presented.

Francesca Maggini from ASNALDO NUCLEAR presented Asnaldo Nuclear's capabilities concerning waste management and decommissioning in the poster entitled "*Bespoke solution for treatment, conditioning, and handling of radioactive waste.*"

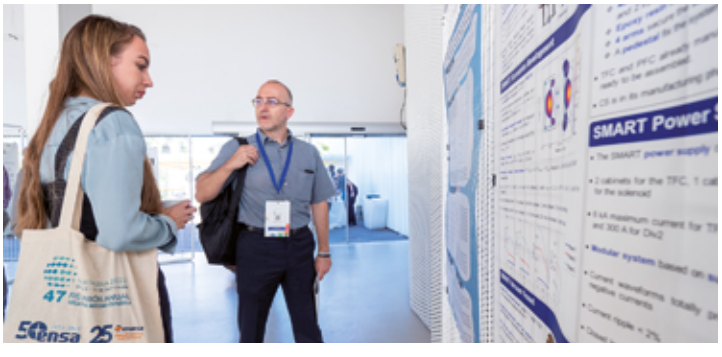
In "*Application of the AHP methodology for the selection of optimum SMRs to enhance maritime traffic decarbonisation*" **Sara Martín Montes** (IDOM) carried out an evaluation of different SMR designs with the AHP (Analytic Hierarchy Process) methodology to provide energy to cargo ships. This study ranks five SMR reactors in order of their suitability for the intended purpose, concluding that the most optimal design for this type of application is a high-temperature gas-cooled reactor (HTGR).

In the poster "*FME supervision, monitoring, and control service*" **Julián Gómez Medinabeitia** presented the different capabilities of the company GDES for the control and monitoring of FME (Foreign Material Exclusion).

Marta González Roldán, from Westinghouse Electric Spain, in collaboration with ENRESA, presented "*New code for calculating scale factors*". This work shows a new code to obtain scale factors to quantify the activity of isotopes that are difficult to measure (weak alpha and beta emitters) through the measurement of other isotopes that are easy to measure (generally Co-60 or Cs-137).

The work "*Study and determination of doses in organs undergoing thyroid treatment with radioactive iodine using Monte Carlo simulation*" by **Sandra Oliver** (Universitat Politècnica de València) presented the procedures for estimating the dose absorbed by patients after the administration of radiopharmaceuticals, specifically the ingestion of I-131 tablets for hyperthyroidism treatment. For this purpose, a high-resolution anthropomorphic computational mannequin, MatLab for the study of the biokinetic analysis of iodine, and Monte Carlo simulation for the study of radiation transport inside the mannequin were used.

Alessio Mancini from the University of Seville presented the SMART (Small Aspect Ratio Tokamak) experimental device for studying high plasma confinement modes in a wide range of triangularity.



WOMEN IN NUCLEAR (WIN)

Within the framework of the 47th Annual Meeting of the Spanish Nuclear Society, WiN Spain organises and develops two activities aimed at the society of the host city during the day before the beginning of the meeting itself. These activities are in line with the objectives of the association.

MENTORING WORKSHOP WIN SPAIN - NEA (OECD)

Women in Nuclear España, a non-profit organisation that brings together professionals working in the different areas of application of ionising radiation, such as energy production, medicine, industrial applications, research, and the restoration of works of art, has as its primary objective the dissemination of information aimed at different social groups, especially women, and the promotion of the role of women in the professional sphere.

The OECD Nuclear Energy Agency (NEA) has developed the NEA International Mentoring Workshop to encourage young people to pursue careers in science and engineering, promoting gender equity. These international events have recently been held in several countries (e.g., Japan, Russia, Kenya, and Spain). They bring together international and local female mentors with young female students to advise them on their future careers.

Under this objective of promoting science and technology among young girls, since fewer and fewer STEM careers are being studied, WiN Spain, in collaboration with the NEA, has once again organised, for the fourth consecutive year, the International Mentoring Workshop: Promoting future leaders in science and technology, aimed at secondary school students in the city of Cartagena. The workshop, held in the magnificent Poniente Hall of the historic CIM building on loan for the occasion from the Polytechnic University of Cartagena, brought together 13 mentors with 70 students aged between 12 and 15, who shared their experience and knowledge. Professionals from different companies and organisations participated as mentors: CIEMAT, ENSA, EPRI, Foro Nuclear, GE, GDES, Iberdrola, and Naturgy.

Ms. Natalie Bonilla (Deputy Head of Human Aspects of Nuclear Safety AEN/OECD) and Ms. Susana Falcon (President of WiN Spain) attended the event's opening.

Various highly motivating videos were shown electronically to the students by Ms. Sama Bilbao (Director General of WNA), Mr. William D. Magwood (Director General of AEN), and Ms. Monica Regalbuto (Director of Nuclear Cycle Technologies at Idaho National Laboratory and INL).

It is inspiring that both the NEA and the professionals of WiN Spain work and

organise events like this so that the younger ones can get to know women who have contributed to the field of science from its beginnings. People in whom they can find references and who give the best example of the fact that success is not a question of gender but of dedication, motivation, and

effort. During the activity, a space was provided for each of the participants to have the opportunity to talk, think and reflect on their future; to meet with people who have already taken the path that perhaps they would also like to take and who was able to give them information and clues to help them find the field of activity towards which they would like to direct their professional future. Undoubtedly an enriching activity that will be organised again in future meetings.

CONFERENCE "FROM THE NAUTILUS TO VIRGINIA: THE EVOLUTION OF NUCLEAR PROPULSION."

The second WiN activity, framed within the dissemination facet towards society, was the conference *From the Nautilus to Virg*inia: the evolution of nuclear propulsion given by Carolina Ahnert, Emeritus Professor of Nuclear Engineering at the ETS of Naval Engineers of the UPM. Cartagena, the base city of the Spanish submarines, was the perfect place to give this conference and learn about the different types of nuclear submarines and the differences between them and the conventional propulsion submarines built at Navantia's headquarters in Cartagena. The meeting took place in the auditorium of the Roman Theatre Foundation, in the heart of the city centre, and was presented by the vice-president of the SNE, Emilio Mínguez, and by Susana Falcón, president of WiN Spain. The guest speaker, Carolina Ahnert, an expert in nuclear propulsion submarines, holds a PhD in Physics and a diploma in Nuclear Engineering and specialises in the design of nuclear fission reactors at NUS Corporation (USA). After almost 20 years as a researcher at the Nuclear Energy Board, she joined the UPM as a full professor of nuclear engineering and later as a full professor. She is the first woman to achieve this teaching category in our country's nuclear engineering area. And the first woman professor in the history of the School of Naval Engineers. She has also been president of WiN Spain.

From left to right: Carolina Ahnert, Susana Falcón & Emilio Mínguez.

Carolina presented a magnificent conference, from the beginnings to the present day of the evolution of nuclear-powered submarines, from the USS Nautilus (SNN-571) of the United States Navy, the first nuclear-powered submarine in history and the first vessel to cross the North Pole submerged, which had an S2W naval reactor, a pressurised water reactor built by Westinghouse Electric Corporation, to the latest and most modern submarines of the Virginia Series, in service since 2004.

The speaker reviewed the 70 years of this technology, explaining the different types and number of nuclear reactors that submarines carry inside them, which countries have them, the various series, and their military and civilian uses. The talk, both informative and technical, showed the plans of the different types of submarines and their unique characteristics and designs. There are currently 11 aircraft carriers and 144 nuclear-powered submarines active in the world, of which there are 88 SSNs, 13 SSGNs, and 43 SSBNs for military use, to which must be added the Russian civilian submarines, eight icebreakers and a cargo ship used for geographical research and a floating nuclear power plant, the *Akademik Lomonosov*.

We learned that nuclear-powered submarines predate nuclear power plants. That PWR reactors were developed for submarines, which are more in number than power-generating reactors (Russian submarines usually carry two reactors). They are the forerunners of Small Modular Reactors. And the US decided in 1974 that all its submarines and aircraft carriers would be nuclear. Their range can be as long as the life of a submarine, so they are constantly on the move patrolling the world's seas and oceans.

Finally, Carolina presented a comparison between this type of submarine and the conventional propulsion submarines of the S80 class currently under construction at the NAVANTIA shipyard in Cartagena.

After the end of the conference, an exciting question and answer session took place, which was a great pleasure.

NUCLEAR YOUTH

ACTIVITIES DURING THE 47th ANNUAL MEETING

Jóvenes Nucleares (JJNN) took advantage of the 47th Annual Meeting of the SNE to carry out multiple activities aimed both at young professionals and students and the general public, materialising its now traditional flurry of activity during this special week in the city of Cartagena. This year all the JJNN activities at the Annual Meeting were coordinated by Elisa Gil (TECNATOM) and Luis Felipe Durán (IDOM), members of our Board of Directors.

The week started strong (Monday 26th and Tuesday 27th September) with the coordination by JJNN and the Organising Committee of the Annual Meeting of the STEM (Science, Technology, Engineering, and Mathematics) Workshops for high school students, which took place at the Polytechnic University of Cartagena and, as a novelty this year, at the NAVANTIA facilities, including a visit to their installations. Talking to the attendees after the visit and the workshops, we could not help but be proud of the comments from teenagers who thought of becoming engineers after attending this event.

This year included six workshops organised by ENDESA (Sustainable Chemistry), FORO NUCLEAR (Magic to spread science), WiN Spain (DiY Polymers), IBERDROLA (Nuclear 360), ENRESA (Scape Box: "Mission El Cabril") and Jóvenes Nucleares (DiY Holograms). Thanks for all your hard work to the participating companies and especially to Miguel Barreiro (Organising Committee, ENDESA) for his help in coordinating the workshops.

If the week was already off to a good start, on Tuesday 7th, the Communication Commission and Jóvenes Nucleares organised the Course for Journalists, intending to disseminate basic concepts on nuclear energy in an activity aimed at all the journalists in the area who might have an interest in the sector, as well as at journalism students. The course was held at the Faculty of Communication and Docu-

Luis Felipe Durán (IDOM), JJNN Communications Officer and Vice President of the RA Technical Committee, are giving the JJNN STEM Workshop.

Miriam Díaz (Tecnatom), our Multimedia Manager, and Ana González (ARN), our treasurer, giving the journalists' workshop in a post by UMU Divulga (Scientific Culture and Research Promotion Unit of the University of Murcia). We also thought it was spectacular to disseminate and learn in collaboration with you!

Elisa Gil, our school talks officer, and the Annual Meeting Organising Committee member, gave a presentation at *La Cangreja* bar.

mentation of the University of Murcia. It included lectures by Miriam Díaz (TECNATOM, JJNNN Board of Directors) and Ana González (ARN, JJNNN Board of Directors).

That same Tuesday evening, Jóvenes Nucleares organised the session *La Ciencia es la Caña* at the bar *La Cangreja* in Cartagena, where, with a nuclear roulette, short presentations on current issues in the sector were chosen, given by members of our Board of Directors, followed by Q&A and debate with refreshments in hand.

Wednesday 28th, saw the official start of the congress and, with it, the Nuclear Technology Workshop, organised by Jóvenes Nucleares (Laura Martín Huete (IDOM, responsible for activities in Catalonia of JJNN) and Alejandro Carrasco (ENUSA, vice-president of JJNN)) and the Technical Committee of the Annual Meeting. The congress participants were able to see first-hand the latest technological advances in the sector. More than 200 congress participants could interact with virtual reality environments, augmented reality, robotics, and artificial intelligence technologies exhibited by 13 companies.

The workshop creates a space in which large and small companies can showcase their latest developments in the most appropriate way for this type of technology: in an interactive way. For more details on this session, see the article dedicated to the session in this magazine.

In addition, on 28 September, our colleagues Ana González and Miriam Díaz participated in the radio programme of Onda Regional de Murcia *Tarde Abierta* with the title, *La nuclear, ¿una energía de transición?* Bringing visibility to local media of the celebration of the Annual Meeting. We want to take this opportunity to thank the SNE Communication Commission (especially its president, Montse Godal (ANAV)) and the SENDA Group for their support and advice in organising this media appearance and all our appearances throughout the year.

Participation of our colleagues in the Murcian regional radio.

Thursday 29th, was packed with activities: the second day of the Nuclear Technology workshop continued in the morning, the presentation of the paper New Young Nuclear Activities and Initiatives at the technical session of the Commissions and the Basic Course on Nuclear Science and Technology at the University of Cartagena.

This course was a great success, with 185 university students enrolled, to whom the speakers delivered ten 20-minute topics:

- **Topic 1:** Principles of Nuclear Physics and Radiation, by Cristina Trull Hernandis (UPV)
- **Theme 2:** Nuclear power plants, by Samantha Larriba del Apio (ENUSA).
- **Topic 3:** Nuclear fuel, by Pau Aragón Grabiel (CIEMAT).
- **Theme 4:** Nuclear Safety, by Miriam Díaz Hernández (TECNATOM).
- **Theme 5:** Radiation Protection, by Elisa Gil Crespo (TECNATOM).
- T**opic 6:** Radioactive Waste and Decommissioning and Decommissioning of Radioactive and Nuclear Facilities, by Charlie Vázquez Rodríguez (UPM).
- **Topic 7:** Nuclear power plants of the future, by Araceli Domínguez Bugarin (UPM).
- **Topic 8:** Other uses of Nuclear Technology, by Luis Serra López (UPM).
- **Theme 9:** Nuclear energy in the face of climate change and sustainability, by Paco Suárez Ortiz (TECNATOM).

On Friday 30th, our member Laura Ortega gave the presentation *NuclearSI: Dissemination of Nuclear Energy* on Tiktok, in which she commented on the successful *NuclearSI* project launched by Jóvenes Nucleares and WiN Spain, which has achieved more than 30,000 followers on Tiktok, being a leader in nuclear scientific dissemination on this social network, which is so widely used nowadays.

In this edition of the Annual Meeting, Jóvenes Nucleares also participated in the Mentoring Programme, organised by the SNE Employment and Professional Development Commission, through the coordination of our colleague Elisa Gil Crespo (TECNATOM) and in the coordination of the plenary session Is nuclear energy green? Organised by the Technical Committee of the Annual Meeting and coordinated by our colleague Luis Felipe Durán Vinuesa (IDOM). Furthermore, activity did not stop in Madrid this week, with Jaime Redondo (TECNATOM and head of Social Networks for Jóvenes Nucleares) attending local media in Cartagena for an interview and Azucena Bello (CNAT and secretary of the Commission) giving a course at the Rey Juan Carlos University in Madrid.

The JJNN Basic Course, with the Paraninfo Hall of the University of Cartagena full. At first, we wondered if this hall would be too big, but it looks like it will have to be enlarged in future editions!

JJNN Board of Directors at the Gala Dinner of the SNE Annual Meeting.

Jóvenes Nucleares would like to thank all the people and institutions that have supported us in carrying out these activities, starting with the Spanish Nuclear Society and the Technical and Organising Committees of the Annual Meeting for their trust. We would especially like to mention Beatriz Liébana (IBERDROLA) and Patricia Cuadrado (WESTINGHOUSE) for their support, good humour, and efficient management of all the calls and tasks (we could even call them brown) that we have had to deal with in the organisation of the Annual Meeting.

Of course, to all the people who have been speakers and organisers of these activities, to NAVANTIA and to the Polytechnic University of Cartagena for welcoming us to their city and collaborating in the shared objective of scientific dissemination, so crucial in these times. Last but not least, I thank all attendees for their interest and participation in these activities.

Nuclear Youth Board of Directors (Pau Aragón Gabriel, Azucena Bello Fernández, Miriam Díaz Hernández, Araceli Domínguez Bugarin, Lucile Fallot, Luis Felipe Durán Vinuesa, Elisa Gil Crespo, Ana Gonzalez Felgueroso, Samanta Larriba del Apio, Laura Martin Huete, Aina Noverques Medina, Laura Ortega Pastor, Jaime Redondo Morais, Alejandro Carrasco Sánchez, Francisco Suárez Ortiz).

COMMUNICATION

The 47th edition of the Annual Meeting of the Spanish Nuclear Society, held in Cartagena, has turned this meeting into an essential point of the nuclear sector for a whole week. Nearly 700 professionals were able to catch up on technical advances in different branches of nuclear science and technology through the work of their peers, strengthen networking between other agents in the sector and analyse the many challenges that will be encountered in both the short and medium term.

In the section on communication, the Commission's primary objectives were to promote the dissemination of an interesting programme among the congress participants, go deeper into the themes of the sessions designed by the Technical Committee, as well as to launch a series of messages to the media and the general public that the Society has set as crucial in the current situation.

The president of the SNE, Héctor Dominguis, attended the media.

In this way, the Communication Commission developed a communication plan that followed the lines of the last editions and placed particular emphasis on improving the messages to congress participants and the organisation of the entire work team deployed in Cartagena. Regarding this last point, it is worth highlighting the work of these communication professionals from the nuclear sector and external professionals in communication, social networks, and audiovisuals, who have worked together and in coordination to highlight, now more than ever, the importance of this meeting and the fundamental role of nuclear energy in our future.

This plan, which was drawn up in coordination with the Organising and Technical Committees, was accom-

The Mayoress of Cartagena, Noelia Arroyo, during the inauguration of the 47th Meeting.

The president of the SNE and the president of the Organising Committee, Beatriz Liébana, and the councillor for the Coastal Area, Cristina Pérez Carrasco, during the press conference at Cartagena City Hall.

panied by the elaboration of different vital messages that we wanted to highlight during the event, such as the global trend to include nuclear energy in the energy strategy for the coming decades to achieve climate objectives without compromising supply, the need for Spain to reconsider its position concerning its energy strategy, the possibility of our nuclear fleet maintaining its operation for at least another 20 years and the positive impact of holding a meeting of this calibre in the city of Cartagena.

In terms of the media, a notable impact has been achieved, especially in the region. The tone of the publications has been very positive, and, in general, the media's interest has allowed the SNE to launch the strategic messages we had set out. Following the line initiated in Cartagena, the strategy has given adequate space to the local authorities, which has allowed our statements about the Annual Meeting, its activities, and nuclear energy to be more widely disseminated and to reach them more forcefully.

Work was also intense in the digital area, where a specific social media plan was prepared to reinforce the activity on our social media channels during those days. Similarly, a Course for Journalists was held in collaboration with Jóvenes Nucleares at the Faculty of Communication and Documentation of the University of Murcia.

A new Annual Meeting that allows us to continue growing as a team to face the coming editions with more experience and resources. The Cartagena edition has allowed the communication team to return to work with total normality in its strategy, based on a mix of actions in different areas that made our messages reach the diverse internal and external target audiences we had set as necessary. See you in Toledo!

The president of the Nuclear Youth, Francisco Suárez, with the journalists.

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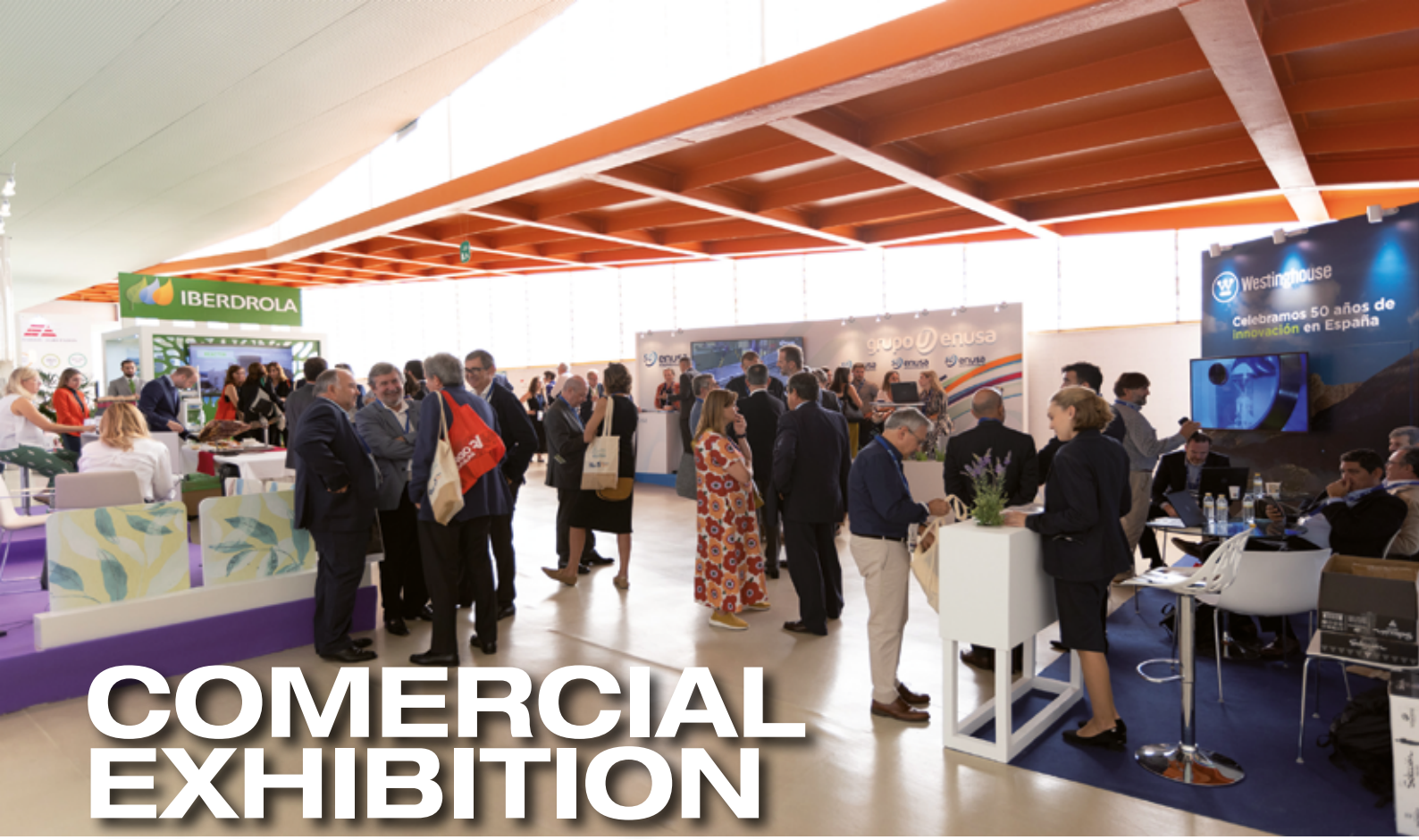

COMERCIAL EXHIBITION

CENTRAL NUCLEAR DE
COFRENTES

IBERDROLA GENERACIÓN NUCLEAR, HOST AT THE 47th ANNUAL MEETING OF THE SNE

For you. For the planet

This is how IBERDROLA GENERACIÓN NUCLEAR presented itself in Cartagena during the 47th edition of the Annual Meeting of the Spanish Nuclear Society (SNE), where the company was represented by a large number of technicians led by the CNO, Francisco López.

IBERDROLA GENERACIÓN NUCLEAR, in addition to hosting this edition, was responsible for chairing the Organizing Committee of an event involving the participation of over 600 nuclear experts and high-level administration officials from the Region of Murcia.

IBERDROLA personnel participated actively during the Annual Meeting as session coordinators and also as speakers. Similarly, presentations on the operation of nuclear power plants were made for local schools using virtual reality goggles, and workshops were held to provide attendees with the opportunity to learn about maintenance activities by means of digital technology.

During this event, IBERDROLA made explicit once again the nuclear leadership values present in all its facilities, being an international reference in terms of operational nuclear power plant results and providing society with safe, clean and affordable electricity.

With the aim to protect the planet, we are committed to a technology which ensures a reliable, emission-free power supply, 100% environmentally friendly and firmly committed to the society and economy of areas where our facilities are located.

In our exhibition stand, which served as a meeting point for professionals, we were once again nuclear ambassadors during this prestigious national and international sectoral event, and further reiterated our commitment to the SDGs, expressing the alignment of Iberdrola to the generation of affordable, clean energy.

EMPRESARIOS AGRUPADOS

EMPRESARIOS AGRUPADOS once again proactively participates in the preparation and coordination of the Annual Meeting of the SNE, being sponsors of the event and coinciding this year with the 50th anniversary of the company as strategic partner committed to the power generation sector and the reliable operation of nuclear plants, both in Spain and internationally.

On this occasion, a large team of more than 40 people with different technical profiles travelled to Cartagena, accompanied by representative figures for EMPRESARIOS AGRUPADOS such as Javier Perea Sáenz de Buruaga, CEO, and Fernando Martí Scharfhausen, Manager of Institutional Relations. It should be noted that this large group not only included the most experienced professionals of the company, but EMPRESARIOS AGRUPADOS wanted to showcase its talent with younger profiles of recent incorporation, who stood out for their proactivity and capabilities with the presentation of high technical level and thematic presentations of great depth.

EMPRESARIOS AGRUPADOS, very proud of its team and talent, presented 25 papers, being 4 of these second classified for the award in their corresponding technical areas: Jesús Soriano, "Analysis of internal flooding"; Ana María Hernández, "Analysis of the obsolescence of the ITER Safety Control System"; Rafael-Bibiano Torrealba, "Civil Aspects of the replacement of the generation switch at the Trillo Nuclear Power Plant"; and Maite Pérez, "Implementation of the Environmental Qualification Program to Mechanical Equipment: Analysis, Practical Cases and Documentation".

In this edition of the SNE Annual Meeting it is also worth mentioning the impressive stand of EMPRESARIOS AGRUPADOS in one of the most outstanding places of El Batel, Auditorio y Palacio de Congresos de Cartagena. This included some of the most emblematic projects of EMPRESARIOS AGRUPADOS, such as IF MIF-DONES, dedicated to the research and development of construction materials for future fusion reactors, and ITER.

From left to right: Gonzalo Saez, Pablo León, Gonzalo Carbó, Miguel Barreiro, Javier Gutierrez, Manuel Leal y Eduardo Serra.

endesa

ENDESA, as the leading electricity company in the Spanish and Portuguese system and the number one nuclear operator in Spain, was present at the 47th Annual Meeting of the Spanish Nuclear Society (SNE). Endesa remains committed to this event and, once again, was represented by the company's General Manager - Nuclear Power, Gonzalo Carbó, along with representatives of the Organising Committee, the Technical Committee and the Board of Directors. The company was also present at the Technical Sessions through chairmen, coordinators and speakers.

On this occasion, and given the characteristics of Cartagena's Palacio de Congresos conference centre, ENDESA presented a more open island stand format so as to improve visibility and accessibility and communicate its steadfast support for and commitment to nuclear energy in Spain. ENDESA is committed to nuclear energy as a reliable and safe technology, able to guarantee electricity supply in multiple scenarios. These characteristics make it a sustainable generation source that will play a pivotal role in the decarbonisation of the economy.

◄ From left to right: Beatriz Liébana, Héctor Dominguis, Gonzalo Carbó, Cristina Pérez, from Tourism of the City of Cartagenaa, Pablo León, Pedro Ortega & Javier Villar.

ENUSA atended the 47th Annual Meeting of the SNE held on this occasion in Cartagena.

The chairman of ENUSA, Mariano Moreno, inaugurated the ENUSA stand together with the highest representatives of the SNE and of the host city, as usual. ENUSA participated in the trade show with a stand that reflected the graphic aesthetics of the 2021 Annual Report and which, in turn, represented the 50 years of the ENUSA's history, which it is celebrating in 2022.

The trade show is a great opportunity to showcase projects, products and new developments. Throughout the event, ENUSA's engineer, David Verdejo, gave demonstrations with the augmented reality glasses to all the congress attendees who were interested in finding out more. He also participated in the Nuclear Technology Workshop, showing ENUSA's advances in this technology.

The ENUSA delegation, led by its chairman, was particularly notable and active on this occasion. Fourteen technical papers were presented, of which three were recognised with the Best Paper Award in their respective areas of knowledge.

Alejandro Carrasco obtained this recognition for his paper "NEUTRONET: Machine learning applied to the optimisation of recharge schemes", in the area of Engineering and Innovation. Alejandro Soria, with "Autonomous UNMANNED AERIAL VEHICLE (UAV) applied to the radiological characterisation and release of nuclear sites", won the award for Best Paper in the area of Decommissioning. For her part, Marta Berrios, with "Evaluation of isotopic composition measurements of BWR fuel by laser ablation" won the Best Paper in the Fuel area for the second consecutive year.

In addition, several people from ENUSA chaired technical tables during the different sessions and contributed with their knowledge and professional criteria.

On the other hand, ENUSA's presence was also notorious in the development work of the annual meeting itself, participating directly in the organization of the meeting and taking part and promoting different commissions.

In this year, which marks ENUSA's 50th anniversary, the company's participation in the Annual Meeting takes on even greater importance, as it was the ideal occasion to share and celebrate this historic milestone with professionals and experts from the nuclear sector.

Once again, the Annual Meeting was of great use in bringing together professionals from the sector, sharing knowledge, discovering new technical advances and applications and admiring the talent of the new generations in the sector.

GDES participates once again in the SNE Annual Meeting. Both the latest innovations of GDES and the thermal protection services, the new lines of activity of the Group, or our main international projects of Nuclear Operation and Maintenance, have been part of our exhibition stand this year. The stand not only showcased our services and milestones in QHSE. but also represented our geographical and sectorial diversification. Within the programme of presentations and technical sessions GDES has had a particularly active participation with the following presentations: "Decommissioning services of the main recirculation system at the Barsebäck nuclear power plant", "Radiological control in chemical cleaning tasks of oil platform elements" and "Characterisation of shielding components of a cyclotron". “Mobile boration units for action in emergency situations", "Digitalisation of the scaffolding service at Vandellós II NPP" and "Comprehensive maintenance of tanks for the storage of effluents generated in chemical cleaning of steam generators". "Improvement of the FME management process", "Safety II. Implementation experience in the nuclear sector" and "Evolution o of the José Cabrera nuclear power plant decommissioning project".

Naturgy

One more year, NATURGY has actively participated in the preparation and development of the Annual Meeting of the Spanish Nuclear Society - SNE (celebrated in Cartagena, Spain), presenting 8 technical papers from different thematic areas, chairing and coordinating 5 technical sessions, and with presence as well in the commercial exhibition. As in previous years, NATURGY has shown its commitment to the safe and efficient generation of energy. The motto selected for this Annual Meeting has been “Transforming to continue promoting an energy model respectfully with the planet" where Naturgy has reaffirmed its business model, focused on creating value, and committed to the sustainable development of society, guaranteeing the supply of competitive, safe energy and with the utmost respect for the environment.

Finally, NATURGY announced its mission as the host company for the 48th Annual Meeting to be held from October 4 to 6, 2023 in the city of Toledo (Spain).

RINGO VÁLVULAS

Once again, RINGO VÁLVULAS has participated the last Annual Meeting of SNE (Spanish Nuclear Society) held in Cartagena from 26th to 30th September under the slogan “Indispensable against the climate change”

Like every year, RINGO has actively participated with a booth where it has been possible to be in contact with their esteemed customers from Spanish Nuclear market, being able to be aware about market development with the main aim of continuing working as a reliable supplier of nuclear valves with the highest demanding values of Engineering and Quality.

During 2022, RINGO has strengthened its position in the national nuclear market, successfully performing many supplies of valves in all nuclear classes as well as spare parts to all the Spanish Nuclear Power Plants.

Furthermore, RINGO VÁLVULAS has increased its presence in the international nuclear market with some remarkable contract executions:

- In North America, several orders of N-stamped valves according to ASME III have been supplied, including, for example, CN 3 motorized globe control valves for the by-pass of the demineralized filter installed in the reactor water system of the Perry nuclear plant (USA) or CN1 3-way ball and check valves for the Bruce Power NPP heavy water circuit (Canada).
- In the Nordic market, it is also worth mentioning the supplies of fully forged motorized bellows control globe valves for steam service at 300ºC for Oskarshamn NPP (Sweden), as well as CN3 ball valves for ON/OFF and control services for one of the pneumatic systems of the Olkiluoto NPP (Finland).
- Finally, other relevant supplies have been made such as CN2 globe valves, for chromed water system for Doel NPP (Belgium) or valves of various types (bellow sealed globe, globe, check and diaphragm) for different systems of Atucha II NPP (Argentina).
- Considering all these references, RINGO VÁLVULAS has already installed base in more than 50 nuclear power plants around the world.

Definitively, RINGO VÁLVULAS continues clearly committed to nuclear energy: an energy with competitive production costs, stable, safe and emission-free. Therefore, an indispensable energy against climate change.

TECNATOM is a consolidated company in the nuclear energy sector with more than 65 years of experience, offering safety, cutting edge technology and confidence to our clients.

We achieve this through leadership and customisation of our activities, such as personnel training, operational support, process digitalisation, simulation, engineering, development and manufacturing of equipment for inspection by non-destructive testing and radioactive waste management, among others, always backed by the credibility of our highly qualified team of professionals.

This year, during our participation in the forty-seventh edition of the SNE Annual Meeting held in Cartagena, we were especially proud of the SNE medal awarded to our Director General, Francisco Javier Guerra, in recognition of his career and experience of more than 35 years in the sector, and to Manuel Fernández, with the José Maria Otero Navascués award, in recognition of his work in communication in the field of nuclear energy, contributing to knowledge and dissemination as head of communication.

In addition, we participated with numerous presentations in different sessions, sharing our knowledge through solutions in which we apply advanced technology, as a great added value in the market.

We are pleased to share new challenges, lessons learned and opportunities with other companies and colleagues in the sector.

Together, we are making the energy sector faces the challenges of the future.

This year, WESTINGHOUSE had the privilege of commemorating its 50th anniversary of operations in Spain at the 47th Annual Meeting of the Spanish Nuclear Society (SNE for its initials in Spanish), where it has once again participated as a sponsor of the most important nuclear energy event in the country.

Several WESTINGHOUSE experts participated in the event, including Zachary McDaniel, Acting Director, Partnerships and Grants, as speaker in the monographic session “Modular reactors, the future is already here”, as well as other team members with fifteen papers and two workshops on topics such as dismantling, engineering and innovation, maintenance and inspection, and nuclear safety. Also, one of the company’s innovation leaders, Patricia Cuadrado, celebrated her fifth year as president of the SNE Technical Committee.

Westinghouse representatives (from left to right): Jorge Baños, Director, Plant Engineering Solutions; Carlos Pulido, Customer Product Manager SBRE; José Manuel García Cerecedo, Customer Account Manager; Eduard Llibre, Director, Reactor Services; Jacques Besnainou, Executive Vice President & Chief Commercial Officer; Xavier Coll, Senior Vice President of the Outage and Maintenance Services (OMS) segment in EMEA, Latin America and Asia; Zachary McDaniel, Acting Director, Partnerships and Grants; Patricia Cuadrado, Principal Project Manager; Alberto Guillén, Senior Engineer; and Álvaro de Pablos, Lead Facilities Southern Europe and UK non-manufacturing.

The rise of interest in nuclear energy within the global energy framework has brought several opportunities for WESTINGHOUSE. In July this year, the company announced a new organizational model highlighting the creation of two new business units: nuclear fuel and global markets. This structure will allow the company to adapt to new market realities and respond more efficiently to challenges and opportunities in the areas of energy security, climate change policies, and technologies.

Moreover, in April 2022 WESTINGHOUSE announced an agreement to acquire the American company BHI Energy, aiming at expanding its global capabilities and services to the entire nuclear life cycle. In addition, at the beginning of October the WESTINGHOUSE purchase agreement was announced by the strategic alliance created between one of the largest uranium fuel traders, Cameco, and Brookfield Renewable. This transaction represents a long-term commitment to WESTINGHOUSE as a global leader in clean energy solutions.

WESTINGHOUSE is closing 2022 with a bright future ahead, and it’s looking forward to its next fifty year of success and growth in Spain.

BEST PAPERS

QUALITY, REGULATION, ORGANIZATION & HUMAN FACTORS AREA

20-07 **INCENTIVOS INMATERIALES**
Francisco Moragas Moreno y Laura Puigdollers Pladevall
A.N. Ascó-Vandellos II / Tecnatom

FUEL AREA

18-07 **EVALUACIÓN DE MEDIDAS DE COMPOSICIÓN ISOTÓPICA DE COMBUSTIBLE BWR MEDIANTE ABLACIÓN LÁSER**
Marta Berrios Torres[1], Miriam Vázquez Antolín[1], Lustolde Martínez Laorden[1] y Ana Muñoz Sicilia[2]
[1]ENUSA Industrias Avanzadas
[2]Empresa Nacional de Residuos Radiactivos, S.A.

DECOMMISSIONING AREA

03-02 **UNMANNED AERIAL VEHICLE (UAV) AUTÓNOMO APLICADO A LA CARACTERIZACIÓN RADIOLÓGICA Y LIBERACIÓN DE EMPLAZAMIENTOS NUCLEARES**
Alejandro Soria Velasco y Daniel Solís Tovar
Enusa Industrias Avanzadas

DESIGN AND BEHAVIOR OF SSC AREA

08-02 **LA RESPUESTA DE LA C.N. COFRENTES FRENTE AL INCIDENTE DE PÉRDIDA DE INTERCONEXIÓN CON FRANCIA EL 24 DE JULIO DE 2021 REVELA LA IMPORTANCIA EN LA ESTABILIDAD DE RED DE LAS CENTRALES NUCLEARES ESPAÑOLAS**
Jacobo Archilla Martín-Sanz[1] y Luis Rouco Rodríguez[2]
[1]Iberdrola
[2]Instituto de Investigación Tecnológica (IIT), Universidad Pontificia de Comillas

WASTE MANAGEMENT AREA

26-05 **NUEVA INSTALACIÓN DE TRATAMIENTO DE RESIDUOS METÁLICOS EN C.N. COFRENTES**
Susana Gutiérrez Martínez, Lorea Aresti Allende y Fernando Turrión López
Iberdrola

ENGINEERING AND INNOVATION AREA

05-07 **NEUTRONET: MACHINE LEARNING APLICADO A LA OPTIMIZACIÓN DE ESQUEMAS DE RECARGA**
Alejandro Carrasco Sánchez, Carlos Mesado Meliá y José Javier Herrero Carrascosa
Enusa Industrias Avanzadas

MAINTENANCE, INSPECTION & TESTS AREA

14-05 **RENTABILIDAD DEL MANTENIMIENTO CENTRADO EN LA FIABILIDAD (RCM) - CASO PRÁCTICO**
Laura Martín Huete, Xavier Amorós Trias, Samir Boulanouar Al Massati y Óscar Salvador Fernández
IDOM

MEDICINE AND HEALTH IN NUCLEAR AREA

32-02 **GENERACIÓN COMPUTACIONAL DE ESPACIOS DE FASE A LA SALIDA DEL MLC DE UN LINAC PARA SIMULACIÓN MONTE-CARLO**
Rafael Miró Herrero Gil, Sandra Oliver, Belén Juste y Gumersindo Verdú
ISIRYM, UPV

OPERATION AREA

16-04 **DIGITALIZACIÓN DE LOS PROCEDIMIENTOS DE OPERACIÓN DE LAS CENTRALES NUCLEARES. ESTRATEGIA DE IMPLANTACIÓN**
Mateo Ramos, Javier Gil y Javier Barroso
TECNATOM

RADIATION AND ENVIRONMENTAL PROTECTION AREA

35-03 **DETECCIÓN DE RADÓN EN UN POZO ESPAÑOL DE GAS NATURAL**
Aina Noverques Medina[1], Belén Juste, Benjamín Mora[2], Antonio Arribas[2] y Gumersindo Verdú[1]
[1]ISIRYM, UPV
[2]GD Energy Service

NUCLEAR SAFETY, LICENSING, AND PSA AREA

38-01 **ANÁLISIS DE LAS ESTRATEGIAS DE VENTEO Y EVOLUCIÓN CONCENTRACIÓN DE H2 DURANTE UN SBO EN UNA CONTENCIÓN BWR-6 CON GOTHIC 8.3**
Pino Díez Álvarez-Buylla[1], Samanta Estévez-Albuja[2], Gonzalo Jiménez Varas[3] y Carlos Gavilán Moreno[1]
[1]Iberdrola Generación Nuclear (C. N. de Cofrentes)
[2]Universidad Politécnica de Madrid (Seaborg Technologies)
[3]Universidad Politécnica de Madrid (ETSII UPM)

SIMULATION WITH NUMERICAL CODES +3D AREA

09-01 **SIMULACIÓN NUMÉRICA DE SECUENCIAS DE ACCIDENTE DE COMBUSTIÓN DE HIDRÓGENO CON LARGE-EDDY SIMULATION Y QUÍMICA DETALLADA. CAPACIDADES PARA SIMULAR LA ACELERACIÓN DE LLAMA Y LA TRANSICIÓN DE LA DEFLAGRACIÓN A LA DETONACIÓN**
Ramón A. Otón Martínez, Francisco J. Sánchez Velasco y F. Nicolás-Pérez
Universidad Politécnica de Cartagena

COMMUNICATION AREA

39-10 **EL GRAN SALTO**
Manuel Fernández Ordoñez[1] y Lucía Gómez Sanchis[2]
[1]Tecnatom
[2]GD Energy Services

TRAINING AREA

30-02 **USO DE LA REALIDAD VIRTUAL EN LA FORMACIÓN PRÁCTICA EN EMERGENCIAS**
Rafael Díaz Heredia[1] y Benet Soler[2]
[1]A.N. Ascó-Vandellos II / Tecnatom
[2]Boost4Pro

FUSION AREA

11-02 **INFLUENCIA ISOTÓPICA EN LOS PARÁMETROS DE TRANSPORTE DE HIDRÓGENO EN MATERIALES ESTRUCTURALES DE REACTORES DE FUSIÓN TERMONUCLEAR**
María Urrestizala[1], Jon Azkurreta[1], Natalia Alegría[1], Igor Peñalva[1], Fernando Legarda[1], Marta Malo[2], Carlos Moreno[2] y David Rapisarda[2]
1- Universidad del País Vasco (UPV/EHU)
2- CIEMAT

THERMOHIDRAULIC & NEUTRONIC AREA

33-03 **DESIGN OF A BURNER VERSION OF THE ESFR-SMART REACTOR**
Francisco Álvarez Velarde
CIEMAT

POSTER AREA

40-08 **ESTUDIO EXPERIMENTAL DEL EFECTO DE LA TEMPERATURA EN LAS ONDAS INTERFACIALES EN FLUJO ANULAR DESCENDENTE AIRE-AGUA**
Yago Rivera, José Luis Muñoz-Cobo, Alberto Escrivá, César Berna y Yaisel Córdova
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