

Tecnatom, a Spanish engineering in a global market

I. Loizaga, L. Rejas & R. Izquierdo

Tecnatom has been successfully developing its activities for more than fifty years thanks to a fully committed working team, its working capacity and its orientation toward innovation.

During the past years, a set of skills and expertise have been developed focusing upon the international market. Nowadays, Tecnatom is carrying on its activities in countries such as United States, Brazil, Argentina, China and United Arab Emirates to name but a few. The activities carried out here cover an ample range of tasks. Tecnatom is involved in the initial and continuous training of operational staff not only in facilities already in commercial operation but also in green field developments. Technical support during commissioning, emergency readiness plans drawing, development of innovative aids for operations and designing and developing main control rooms and full scope simulators are other mainstream projects on the way.

INTRODUCTION

Since Tecnatom was founded it has been providing its services, expertise and know-how to the Spanish Nuclear Industry. In fact, Tecnatom has not only been involved in the domestic developments but also has taken part in some punctual projects overseas. Taking advantage of the experience gained; at the end of the last decade the Company took the strategic decision to offer its expertise in a personalised attention to its international customers wherever they could be needed.

This decision has given us the opportunity to work in different cultural environments, under different legislation frameworks and for diverse corporations. In other words it has eventually allowed us to learn and put in practice the best industry practices, to enhance our performance, to develop better customer-oriented products and to strengthen our decision making capacity. All in all having a better grasp of our international customer's problems and eventually pouring the acquired know-how into our national nuclear industry.

As a result, the internationalization strategy results in Tecnatom making an effort of sizing and re-

cruiting a new work force and the establishment of the International Training Centre (ITC) as a new branch of Tecnatom Nuclear Training area.

INTERNATIONAL TRAINING CENTRE

The International Training Centre was initially established in 2011, after it was drafted four years previous. By then a new hiring campaign was undertaken in order to gather, select, hire and train the best possible workers for the challenge.

The International Training Centre mission is to deliver training with the best technical and educational experiences, in the most efficient time periods and at the best cost-benefit for customers. This demanding objective can only be achieved thanks to a flexible structure, team-work, decision-making ability and independence from other internal structures. Putting these qualities together allowed us to answer any training request, anywhere and, in most cases, exceeding customer expectations.

Thirty instructors trained in the state-of-the-art nuclear technologies - AP-1000, KWU, PWR, BWR, are the core of the team. However, support from other training centres along



IÑIGO LOIZAGA

is Industrial Engineer in Energy and Executive MBA by Instituto de Empresa, Madrid. He joins Tecnatom in 1991 qualified as "Senior Reactor Operator" and with more than twenty years of experience in Nuclear Power plant Training, working several years as instructor and different training projects. He is currently heading the International Training Centre in Tecnatom.



LUIS REJAS

is a mining engineer, Master degree, specializing in Energy and Fuels, joins Tecnatom in 1996 obtaining the qualification of "Senior Reactor Operator" in PWR-3 loops. He has developed his career synchronizing tasks operating personnel training and implementation of HFE in new reactors. Since 2009, he is the head of the department of design of new control room.



RAMÓN IZQUIERDO

is aeronautical engineer for the UPM. He works in Tecnatom since 1990. He is currently Simulation Senior Engineer. He has participated in several NPP simulators development (Zorita, Almaraz, Vandellos, Trillo, Laguna Verde, Garoña, Atucha II, etc.). He has worked as a developer of model builder tools as well.

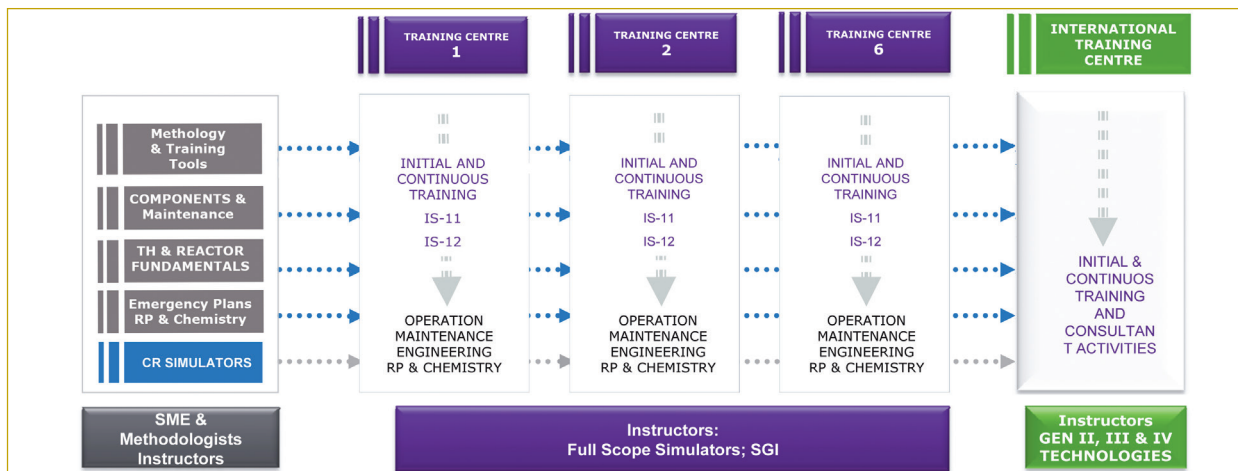


Figure 1. Training Organization.



Figure 2. International Instructors.

with the availability of assistance from subject matter experts makes the International Training Centre fully capable of undertaking any project. Figure 1.

Some of the international instructors have started their careers within one of the Spanish training areas and after a successful time were considered to become part of the thrilling ITC project, however a number of these instructors have been recruited, selected, hired and trained to face International Projects.

Tecnatom runs an in-house selection department to carry out the screening, selection, and hiring of people with the particular qualities sought. The selection process takes as its basis a well-defined Job Profile. Here, intellectual aptitudes, personality, atti-

tude towards work, and organisational culture styles are analysed.

Here there is only room for highly motivated, globally available and goal-oriented instructors that face each overseas project as an opportunity to increase nuclear safety and spread their knowledge and cultural heritage.

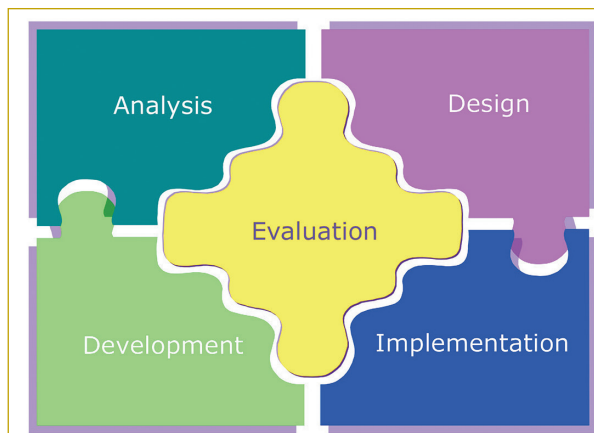


Figure 3. Systematic Approach to Training.

Today part of the team consists of fourteen AP-1000 Senior Reactor Operator Instructors certified by Westinghouse Corporation. These highly experienced instructors combined their activities among the Chinese Nuclear Power Plants under commission in Haiyang and Sanmen sites, in the offices of Westinghouse in Cramberry, Pennsylvania, United States and in our headquarters in Madrid, San Sebastian de los Reyes. Figure 2.

This group has followed a demanding training programme in order to become operation instructors of Gen-II nuclear technology and, subsequently, were trained as operation instructors of AP-1000 Technology.

So far, among the projects they have been involved are the development of training material for the Operation and Maintenance Support Engineers using the Systematic Approach to Training (SAT) methodology, the design of training programs for Maintenance Technicians, Operation Supervisors and Operation and Maintenance Support Engineers. They have delivered training for Non-Licensed personnel as well as training for Reactor Operators and Senior Reactor Operators through theoretical and full scope Simulator training in the Chinese nuclear power plants. Finally AP-1000 Instructors work in the Certified Training for AP1000 Vogtle plant in the USA. Figure 3.

The International Training Centre also has a team of five nuclear operation instructors who carry out their day to day activities in the United Arab Emirates (UAE), specifically in Abu Dhabi.



Figure 4. Angra NPP.



Figure 5. Features for a Global Challenge.

For this particular project a customized Nuclear Training Preparatory Course has been designed, developed and implemented. The course aims to develop students' basic skill and knowledge for completion of Nuclear Power Plant training and qualification. This course is addressed to future Reactor Operators, Senior Reactor Operators and Engineers of the Barakah Nuclear Power Plant.

The project was started in mid-2012 and is expected to last until mid-2014. During this time more than two hundred engineers and technicians from the UAE receive a nuclearization course. It not only enables them to face, with confidence, the rest of the training period but also introduces them to the nuclear behavioural expectations and safety culture standards.

Today, five more instructors from the ITC are dealing with the training

of Angra NPP in Brazil at different levels. They are involved in the initial training of Reactor Operators, Senior Reactor Operators and Operation Instructors. CN Angra also relies upon the requalification of its operation crews in the full scope simulator as well as the training of the NPP managers. Figure 4.

The collaboration between Tecnatom and Angra NPP dates back more than twenty year. Nowadays, it has been intensified due to the generational change and new regulatory requirements.

The good relationship between CN Angra and Tecnatom has implied that on many occasions; Tecnatom has acted as a link between Brazilian nuclear power plants and Spanish nuclear facilities. The objective has always been to find a successful solution, usually through benchmarking, to common problems such as, the digitization of

the Control Room or the review of procedures, to name but a few.

The ITC activities are not only related to the training area. The team is also responsible for providing technical support to those Nuclear Facilities beyond the Spanish borders. In this regard, another group of instructors are helping with the commissioning of the Atucha II nuclear plant in Argentina.

Another activity that is carried out by the ITC instructors for ATUCHA NPPs is the methodological training of their team of instructors. ITC provides them with the know-how, skills development and required knowledge to deliver training in an outstanding way to the operation shifts and oversight the activities of NASA's instructors during the full scope simulator and theoretical session.

Its training, the deep knowledge of nuclear plant systems and operation, the experience gained in past and current projects drawing and reviewing operating procedures, the experience working with full-scope simulators makes this team of nuclear instructors' ideal for this type of work.

To conclude, features like personality, principles, resilience, social skills and the ability to manage relationships are necessary traits to cope with the global challenges. All of them have been taken into account when selecting this group of professionals. So far the ITC involves instructors from three different nations Spain, United Kingdom and the United States. Figure 5.

The international experience gained serves also as a benchmark in the domestic market. It allows assessing and noting the high degree of qualifications achieved by the instructors and their flexibility to address tailored-to-needs training programs.

Today the International Training Centre instructors are present in five geographic areas – Europe, Middle East, Asia, North America and South America. Becoming a trustworthy company has required persistence and innovative approaches to problems faced. However, keeping their confidence would be even more demanding. Performing a better job every day is our vision and our challenge.

TRAINING SUPPORT. INTERNATIONAL NUCLEAR POWER PLANT SIMULATORS

Simulation is an essential technology for training, operation and engineer support in which Tecnatom has over thirty years of experience.



Figure 6. Atucha II Simulator Project Team.

As a result, the construction of simulators for training purposes is one of the main aspects of Tecnatom's business.

In the last fifteen years, Tecnatom has focused on diversifying and expanding its services in the training area, meaning that its participation in the construction of international nuclear power plant simulators has increased significantly. At the end of nineties and the start of the new century, Tecnatom actively collaborated with the construction of simulators in Lugmen (Gongliao, Taiwan) and Laguna Verde (Veracruz, México). The successful results in both collaborations consolidated Tecnatom's position in international simulation projects, therefore generating the necessary desire to undertake new international adventures.

In February 2010 NASA (Nucleoeléctrica Argentina S.A.), the public company owner of the nuclear power plants in Argentina, awarded Tecnatom with the construction of the full scope control room replica simulator for Atucha II.

Furthermore, at the end of 2011, Tecnatom won the international tender promoted by the company ELECTROBRAS-ELECTRONUCLEAR, owner and operator of nuclear power plants in Brazil, for the construction of the control room simulator for Angra I.

Both contracts confirm not only the technical and economic competitiveness of Tecnatom at international level, but also its increasing presence in the Latin American market.

The scope of both projects included the supply of a full size

control room replica simulator and, for Atucha II, also the supply of a Classroom Simulator (Interactive Graphic Simulator) based on virtual panels and process diagrams. The duration of these projects was committed to being thirty six months for Atucha II and thirty four months for Angra I. This meant that the projects ran consecutively there was in fact a short overlap between them.

The development of the simulation models that reproduce the systems of both plants and how they are operated from the control room, were carried out entirely in Tecnatom by project teams made up of over thirty people, including engineers from the awarded Companies. Tecnatom addressed these projects using its own technology that has been continuously developed and updated since the 1980s in order to achieve a high level of fidelity under the strict compliance with normative and international standards.

At the same time as the development of simulation software programs, all of the panels and instruments that were to exactly reproduce the interface of the control room were being constructed. To complete the installation, Tecnatom's interface system was integrated in the simulator.

It goes without saying that, in order to carry out projects with such characteristics as these, it was necessary to hire new technical workers. For all of the new young people with university degrees, resources, language skills and, for the majority, their first working experience, a specific and in-depth training in

nuclear technology was required as well as training in the simulation programs and tools implemented in Tecnatom.

This training process encouraged the professional and personal development of these new young engineers, allowing them to evolve inside and outside of Tecnatom.

The continuity in time for both projects allowed Tecnatom to "re-use" the new engineers, continuing the advantage of having them on board. This meant that, when the Atucha II project ended its development phase, these trained and experienced engineers were little by little transferred to the project of Angra I. This continuity avoided carrying out the traumatic and slow recruitment process for new staff. Figure 6.

For Tecnatom, these two large and challenging projects have represented a qualitative leap in the areas of technology, methodology and human resource management and training. It has also allowed a quantitative leap to be made in the number of people who are directly or indirectly involved in these areas. But the latter aspect has also provided a "lifting" effect in the staff and caused an accentuate rejuvenating effect that allows the company to have a young, dynamic, motivated, qualified and passionate organization that guarantees the generational replacement in a slow manner.

HFE ANALYSIS: OPERATING DISPLAYS AND MAIN CONTROL ROOMS DESIGN

Since the "Three Mile Island" accident, Human Factor Engineering (HFE) application to the design of Nuclear Operator's work places, main control rooms, mimic instrumentation panels, and operation displays has proved to be an effective method for reducing human error during Plant Operation. Since the nineties international organizations have adopted this technique as a necessary tool to ensure safe operation standards and to minimize the occurrence of human errors.

Tecnatom's participation in the development of safer operation started in the early nineties, with projects like AP600 with Westinghouse, or FOAKE and Lungmen with General Electric, but it was in 2009 when the decision for the internationalization of Tecnatom



Figure 7. Fangjiashan NPP simulator.

at a global level was made. In that year Tecnatom started working on several projects in parallel, such as two units of South Texas Project (STP) with Westinghouse, as well as eight units and three full scope simulators (Fuqing 1-4, Fangjiashan 1-2, Hainan 1-2, and their corresponding three simulators). Figure 7.

The scope of these projects includes design, fabrication, integration, V&V, and testing, based on the Human Factors Engineering, of the control rooms (consoles, mimics, remote shutdown panels etc.) as well as the system operating displays for normal operation, and operation in case of failures or emergency. On top of this, the projects cover operation supporting systems such as computer based procedures, alarm engineering (filtering and prioritization), or the design of special systems like the SPDS (Safety Parameter Display System).

All of the above works have been carried out with a strict adherence to both European and American international regulations. This has been done by developing our own methodologies and tools, which have been optimized to achieve very competitive products in the world market that have been licensed in countries like USA, China, Taiwan, Brazil,...

These activities, carried out in a brief time frame, have been a big challenge for Tecnatom. Once again, they have required an enhancement of staff members, addressed by hiring young nuclear engineers who are well prepared

and knowledgeable but lacking in previous experience. In order to meet the demanding requirements of the projects, a big effort has been made in these years with important investments in both economical and human resources. During this time we have always kept in mind our goal of having a stable staff unit of engineers with high levels of training and knowledge in nuclear power plant operation. As well as this, we have always taken advantage of the lessons learned in the projects carried out in the international market, allowing us to provide high added value services to the Spanish NPP fleet.

The initial difficulties of employing young personnel when these projects began have now become one of the biggest strengths of the company as the projects are successfully coming to an end. It means that Tecnatom currently has a high percentage of engineers of less than thirty five years old within its staff, all of whom have more than five years experience in the design, fabrication, and startup of the new Reactors Control Rooms.

These projects have consolidated and reinforced the position of Tecnatom as a company recognized worldwide, consolidating its leadership in the nuclear business and allowing us to advance towards important projects such as for the granting of important projects for our group as the Electrical Power Research Institute (EPRI) Human Factor Guides revision. Additionally, we have achieved the right to attend international conventions of the American Nuclear

Society (ANS), International Electrotechnical Commission (IEC), or the EPRI working group ANT (Advanced Nuclear Technology) amongst others.

The future is still to be written but in Tecnatom we will keep on working on the advanced reactor's continuity and diversifying our activities in other types of reactors such as the fusion reactors, the Small Modular Reactors (SMR), or the High Temperature Reactors. It may even be possible to expand into other Industry sectors where Safety Culture is especially important such as the aerospace market, immediate response centers, radwaste storage facilities, or conventional power plants.

CONCLUSIONS

Internationalization has brought a sustainable work force increase. Around 300 people have been hired, trained and are growing professionally day by day. It is at the heart of Tecnatom to help them reach whatever goals they have but always keeping the employees aligned with the corporate values that are the cornerstone of the company.

Going global is understood by Tecnatom as an opportunity to create value, to bring the best workers in and that eventually benefits also our national customers. Close contact with international markets boost innovation. In other words, the quality and commitment of the team allows them to be able to do their best so as to resolve and succeed in complex situations.

Internationalization is a privileged observatory for identifying and anticipating future industrial needs. What is more, it is the place to be in order to develop new products and services, to exchange know-how and to generate a contact network for rapid response to any situation in which it is required.

To conclude, Tecnatom commitment towards internationalization is firm. It has meant an important investment in human capital and in designing and developing new products and services through innovative approaches that have led to strengthen the foundations of Tecnatom and also have boosted the position of Spanish NPP within the world. ■