EUR

THE 20TH ANNIVERSARY BOOK

LIST OF THE MEMBERS OF THE EUR ORGANISATION
AS OF NOVEMBER 2011

"THE EUR IS A GREAT ACHIEVEMENT... AND STILL ON ITS WAY"

Twenty years ago, a small group of representatives of European electricity producers involved in nuclear generation met in Lyon to set up a light structure that would help coordinate the actions of its members both in Europe and in the US in what was not yet called Generation III nuclear plant development. The European Utility Requirement organisation was born. It had a long-term objective: foster the development of competition in the European nuclear industry through writing common technical requirements for the new plants. The initial target was to finalise a set of common design requirements by the end of the 1990s. Of course, this target was quickly proven rather unrealistic: the European legal and political environment changed in depth, the organisation attracted much more candidates than initially thought and the assessments of compliance of the designs took much more resource and time than expected. Nevertheless, the first stabilized version of the specification (the Revision C) was actually released in 2001 and since that time it has been extensively used by the utilities that were building bids as well as by the vendors that were developing new projects. The EUR has become a reference document, well beyond the initial circle of European utilities that promoted it.

Twenty years later, the story is continuing. New projects have been assessed, covering the whole of the LWR technologies offered in Europe and a new comprehensive revision is being produced, which should be released in 2012.

This bold endeavor could not have succeeded without the deep involvement of key actors that left their footprints on the organization and its products either as technical leaders, project managers, or simply because of their strong personalities. This booklet has been designed to offer them an opportunity to express their views on this achievement. It offers the reader a kaleidoscopical view that is a good picture of the diversity of what made them believe in this project.

Pierre Berbey,
former EUR secretary


20

YEARS OF INCREASING SUCCESS IN A CHANGING ENVIRONMENT

FROM 1991 TO 2000: EARLY STEPS

◆◆◆ Pierre Bacher, first chairman of EUR

"From the beginning, we wanted to promote co-operation between utilities, vendors and regulators. We were convinced that it would help us to better understand the different point of views and then start an evolution that it would lead to harmonization. After Three Mile Island, we have had very interesting discussions about how to deal with such incidents. It was soon discovered that control centers had to be reviewed in order to report what was really happening. This approach led us to improve the safety level of facilities."

In the 1980s, it became obvious that the US nuclear industry was organizing in order to expand and find new markets for its vendors. As a matter of fact, American industrials have often used standards to reach this goal. When the EPRI decided to publish a "requirement document", it was clear that the American nuclear industry was implementing the usual scheme. It was likely to be successful because European countries were already testing American nuclear plants. Furthermore, most European utilities were close to American standards because some of their nuclear engineers had been trained in the US.

After Three Mile Island, there were debates both in the US and in Europe about safety. On both sides of the Atlantic, lessons were learned from TMI and modifications were implemented. But the discussions led to a clear difference between the US approach and ours. Whereas in the US, a generating station would be regarded as safe as long as it continued to meet its initial standards, most European countries were demanding that improvements should be implemented in all facilities, whatever the time they were built, as new and safer techniques would be discovered.

There was also another point at stake in Europe, i.e., impulse harmonization between utilities, vendors and national safety regulators. It was already implemented in France, with a single utility, a single vendor, and a single Safety Authority. The question was how to achieve such a scheme at a European level? It was necessary to start with a closer co-operation between France and Germany, the leading countries of the European Union. Two major industrial actors, the French Framatome and the German Siemens decided, in the early 1980s, to create a common subsidiary. This was the first step that led to the launch of the EPR project. Meanwhile, there were already contacts between utilities at the European Community level, in a technical committee. These contacts convinced the utilities of other countries that a common requirement document was also necessary in Europe.

"From the beginning, the EUR had a large scope. Its members wanted to tackle the technical aspects of all third generation reactors. This decision led to the broadening of the number of vendors that could compete on the European market, thus fostering competition."

In 1991, the founding members of the EUR initiative came from Belgium, Italy, Spain, Germany, UK and France. Two years later, there were three new members: the Netherlands, Finland and Sweden. In order to make a simpler process, it was decided that English would be our working language.

From the beginning, the EUR had a large scope. Its members wanted to tackle the technical aspects of all third generation reactors. This decision led to the broadening of the number of vendors that could compete on the European market, thus fostering competition.

The EUR founding members decided from the beginning to produce three requirement volumes depending on the subject. The first volume tackled the overall specifications (safety principles, connection to the grids and so on) while the second aimed at detailing the specifications related to electricity generation (the so-called conventional island). It took us three years to achieve these two first steps. The third volume aimed at requirements specifically adapted to each vendor design: the EUR requested from the vendors that they check how they were meeting the overall requirements exposed in the Vol I & II. Then, the EUR drafted a few specific requirements adapted to each design.

◆◆◆ **Georges Servières, special advisor to the President of EDF**

"The first meeting of the EUR, in Lyon, was quite weird. There were 6 people, from Germany, Belgium, Spain, Italy and France. We were wondering how we could work together to reach common demands vis-a-vis the vendors. We focused on the key points of a facility, from a conception standpoint. But we had different mindsets. It was really interesting to understand the grounds on the different reasonings. It helped create confidence among all the participants, which in turn, made co-operation easier."

GROWING SCOPE AND ENLARGED PARTICIPATION

◆◆◆ Bernard Roche, 2nd EUR chairman, former Senior Advisor of EDF Nuclear generation and engineering Branch

"The entrance of Russia in the EUR was not so simple. First, it was a very powerful country, when compared to the other members. There were two potential problems: either the EUR would be too much dependant on Russian demands, or the EUR could not accept them and it would become a diplomatic issue. Fortunately, our Russian colleagues were very clever so that their entrance run just well."

Since the first release of volumes I & II, the EUR organization has kept growing. By the years 2000, the EUR organization had won also recognition among US vendors that wanted their projects to be assessed. At the same time Rosenergoatom, the Russia utility, was knocking at the door. Some EUR members were wondering if the design of the Russian reactor, the AES92, would abide by the requirements of the EUR. Later on, it would proved that it was the case. From 1998 onwards, the EUR welcomed few new utilities from Eastern par of Europe, i.e., Ukraine, Hungary and the Czech Republic. These newcomers had different goals. Ukrainians and Hungarians were operating Russian reactors and were looking to diminish their dependance on the former Soviet Union technology. The Czech Republic people were in a different situation since their managing elites were mainly-US trained.

The Vol III of the EUR specifications was launched at that time. The team studied 8 diferent reactors. On average, it was necessary to spend two years for each of them to perform a full assessment. Each case required that the EUR Steering Committee, held 3 to 4 times a year, and a reactor dedicated expert group whose meetings were at least three times more numerous to review and finalize EUR positions towards the proposed design.

This demonstrated that the previous work done to achieve Vol I and II was clearly adapted to the real life of nuclear industry. These overall specifications proved to be well balanced, as the different Steering Committees could assess the main aspects of every project introduced by the vendors i.e.: mainly the Safety level; how easy and safe the maintenance would be and how competitive they were.

"The second most important conclusion the EUR could draw was that all the projects submitted to its experts were meeting the requirements they had previously elaborated. In most cases, only minor changes were suggested."

The second most important conclusion that the EUR could draw was that all the projects submitted to its experts were globally meeting the requirements that they had previously elaborated. In most cases, only minor changes were suggested to the vendors. This meant that vendors could meet almost all of the 3,000 specific requirments of Vol I and II, and more specifically the 50 to 60 related to Safety, operability and life expectancy of the facilities. This successful accomplishment of EUR compared to the market was particularly important since Europe was the place operating one third of the nuclear plants around the world.

At the beginning of the 2000s, the EUR members also decided to promote their approach worldwide. Many members introduced their requirements approach and assessment of design in international conferences, either in the USA, in Russia, in Europe or even in China.

At that time began also the revision C drafting which aimed at clearing out the EUR from requirements no longer relevant. It lasted many years since the Steering Committees and the work groups had to examine every project, gather the information and then decide which general specification was no longer relevant. This stage was achieved also thanks to the different technical support authorities that were kind enough to co-operate and assess the EUR.

MATURITY IN A CHANGING ENVIRONMENT

◆◆◆ Dr. Michael Micklinghoff, Senior Advisor at E.ON Kernkraft and Chairman of the CORDEL Group

"When I joined the EUR organization in the early 2000s, it was really the only international entity in Europe where technical experts could meet and freely share their views. External cooperation was then strengthened, in particular with the CORDEL workgroup and the creation of the ENISS initiative, which offered us a complementary platform for more operational issues. The work achieved both in defining specifications and in the evaluation of new designs is now a reference for any company wishing to build a new reactor. On a more personal level, my years of working with the EUR organization were an opportunity to build strong friendships with European colleagues, to widen my horizons and to learn a lot about technology."

At the dawn of the 2000s, a new era began for the EUR organization. The relative stability of the late 1990s was followed by a period of nuclear renaissance in Europe and the world, when several countries such as France, Finland, Russia and the US decided to launch new construction projects. Based on the work achieved with revisions A, B, and C of the documentation, the EUR organization has played a central role and was a key contributor to this revival. The crucial issue was to define relevant and balanced harmonized design specifications for safety and operating performances power grid interface in order to enhance the competitiveness of safe nuclear energy… and to obtain adequate solutions from vendors.

Meanwhile, the geopolitical and regulatory environment was changing rapidly. The civil nuclear option appealed to a growing number of newcomer countries in the nuclear industry in Europe and around the world. From a political and regulatory perspective, the role of the European Commission was growing while the different safety regulatory bodies of the European Union and Switzerland were joining to form the Western European Nuclear Regulators' Association (WENRA), with the objective of establishing common safety reference objectives.

It is in this context that, under the leadership of its new Chairman François Hedin, the EUR organization adopted a strategic plan to strengthen the collective of European utilities in the field of new reactors. Its scope broadened beyond the writing of technical specifications. Vendors started seeking its well-proven network of experts to evaluate their products. Three types of reactors were then reviewed: the Westinghouse AP1000, AES-92 by the Russian company Atomstroyexport, and Areva's EPR.

Another important focus of this strategic plan was to ensure the influence of the EUR organization, by increasing contacts with new entrants in the sector - for example, Poland - or even with non-electricity generating companies. The organization positioned itself as a key player in the revival of nuclear energy in Europe by increasing its attendance at international conferences and by developing training activities

"The crucial issue was to define relevant design specifications to safety and operating performances up to the grid interface in order to enhance the competitiveness of safe nuclear energy..."

for students and young engineers. Above all, this desire for openness was reflected in close collaboration with other key organizations in the sector, such as the International Atomic Energy Agency (IAEA), the ENISS initiative on safety standards launched in Brussels in 2005, chaired by Luc Vanhoenacker, or the Coordination Group on Cooperation in Reactor Design Evaluation and Licensing (CORDEL) of the World Nuclear Association (WNA), chaired by Michael Micklinghoff.

In the late 2000s, the European nuclear industry's momentum from the beginning of the decade diminished somewhat under the impact of operational difficulties encountered by the projects under construction, but mainly because of local political contexts and the economic and financial crisis that penalized a heavily capital-dependent industry. But the EUR organization may consider its mission accomplished: it emerged from the downturn with a significantly enhanced technical background, thanks to exchanges as a key interface, capable of uniting the positions and views of manufacturers, during discussions with WENRA regulators or with its Electric Power Research Institute-URD counterpart in the US.

Now is the time for the EUR organization to choose to open a new chapter in its history by beginning to work on a new revision of the document, the D revision, which will incorporate feedback from programs of the past decade, answers to recent regulatory developments, new safety objectives promoted by regulators and feedback from the experience of the Fukushima event.

◆◆◆ **François Hedin, Vice-president Nuclear Engineering, EDF Inc. (USA) and former Chairman of the EUR Organization**

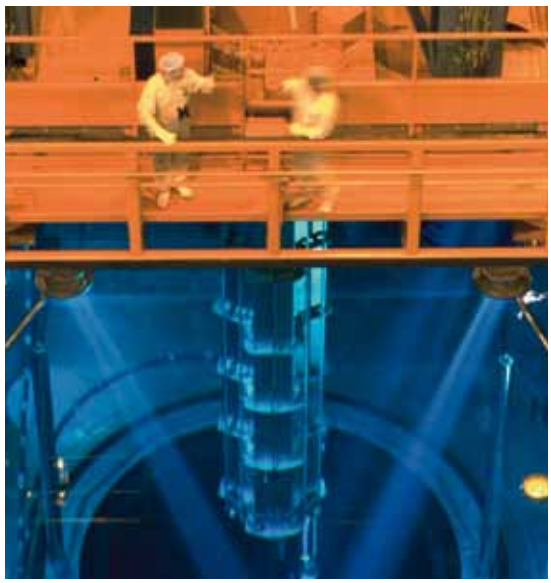
"From my perspective, the EUR organization has been a success story since the 1990s. This club of utilities – uniting competitors around common issues, in a mirror position vis-à-vis the club of regulators, managed to achieve a visionary and pioneering approach in the international harmonization of new reactor specifications. The use of the EUR document was a continuous source of value for member companies. Today, the EUR organization remains more relevant than ever in the post-Fukushima era, where there is room for safe, sustainable and competitive nuclear energy. I am convinced of the importance of further strengthening its role and effectiveness by providing it with even more diverse and complementary skills. For, as the Japanese disaster sadly reminded us, it is the utility and not the manufacturer that ultimately bears the responsibility of the power plants' safety."

EUR HAS BECOME A COMPELLING STANDARD AND A DRIVER FOR VENDORS

◆◆◆ Gianfranco Saiu, Program Manager for AP1000 activities at Ansaldo Nucleare

"The EUR helped and is continuing to help vendors understand the utilities' point of view, their needs and the way they operate nuclear plants, both directly through the document itself and as a by product of the interactions during the plants' assessment efforts. The document has been a major driver for improving plant design, plant safety, and for further improving the competitiveness of the nuclear market in Europe, and of the nuclear option more generally. It has had a remarkable influence on several safety issues and, in particular, setting the framework to address, since the design phase and the severe accidents and complex sequences are a major topic that differentiate Generation III plants from the previous generation designs. Following those premises, I assume that the next step for the EUR will be to address extreme natural hazards both from the plant design and accident management point of view. After the Fukushima event, this is the hottest topic that needs to be fully addressed and cleared to recover both investors' interest and public acceptance. In the longer term, I expect that the EUR may start to think about Generation IV reactors, even though the organization wasn't initially intended for this purpose."

From the very beginning of the project in 1991, the EUR has been considered very closely by vendors, who immediately understood the value of the document and its influence on increasing the competitiveness of the European nuclear market. The harmonization of safety objectives and plant design would indeed simplify and improve the activities of reactor manufacturers. Defining and setting common standards and requirements, the EUR facilitates the licensing of third-generation power plants and their development in European countries, and only limited fittings are required to be compliant with the national requirements and regulations. Thanks to the document, for the first time vendors had a clear view regarding utilities' expectations and needs.



"Thanks to the document, vendors had for the first time a clear view regarding utilities' expectations and needs."

Then, many development projects are based, partially at least, on the EUR as a general framework. For example, the design of EPR (European Pressurized Reactor initially, now Evolutionary Power Reactor) carried out by AREVA NP in the 1990s is closely related to the premises of the EUR project. The first exchanges between the two organizations date back to 1994, and the EUR document then established a foundation for the design of the EPR: EUR references were systematically used during the different phases of the reactor's development.

In the same year, the European Passive Plant (EPP) Program was initiated from the cooperation between the vendor Westinghouse, its Italian partner Ansaldo Nucleare and a group of European utilities. The aim of the program was to develop a Pressurized Water reactor design based on a passive plant technology that would meet the EUR requirements. Thus, EPP Industrial Partners and the Utilities worked together with EUR in order to assess the passive technology plants: first, EP1000, a three loop 1000 MWe plant, first, and later the AP1000 NPP (which is, at present, the EPP program reference design) produced the subsets dedicated to the two designs within the EUR Volume IV.

The EUR turned out to be a key design document for vendors, as well as a driver for improving their plants. It still is today.

◆◆◆ **François Bouteille, Senior Vice-President for Safety & Licensing, Areva**

"As a representative of a European vendor, the EUR is a reference document. And it will remain so, particularly at a time when the EUR is starting the process of revision D. We always pay attention to the compliance and updating of our designs according to the latest revision. The peak of our collaboration with the EUR took place in 2009, when the organization certified the EPR. That judgment is truly important for us: towards potential customers, the EUR's positive assessment brings additional credibility to the reactor's design, which is a valuable factor in terms of marketing and sales. The detailed examination of EPR with the EUR has been outstanding, thanks to the technical excellence of its analysis process. Actually, I think the success of the organization owes a lot to the high quality and expertise of its teams."

A KEY TOOL FOR HARMONIZATION AND STANDARDIZATION

◆◆◆ Georges Van Goethem, Senior Scientific Officer at the European Commission, Innovation in nuclear fission and Education & training / DG RTD, Energy (Euratom)

"The EUR organisation has become a key player in the European Union because of its representativeness and de facto legitimacy. At the General Direction for Research and Innovation, when we launch Euratomprograms for the 27 Member States, we always seek to contact associations or groups of stakeholders, so as not to favor one actor over another. Beyond this unifying aspect, the EUR organisation has achieved a very important work of standardization, focusing on the safety and performance of nuclear power plants, which earned them a deserved recognition in the world. The existence of the EUR is vital to European and global research because they contribute to the setting up of the right priorities and to the active involvement of the end-users. Indeed, in a world governed by the short term, the members of the EUR are animated by a passion for research, in synergy with the key stakeholders, with a view to the long term. With this in mind, I also think that they should strengthen their training actions (in particular, in collaboration with the universities), for the benefit of the whole nuclear fission community."

In 1991, major European Nuclear utilities decided to develop their own vision of the specifications for future Light Water Reactors. This was an alternative to the specifications recommended by EPRI (Electricity Power Research Institute), the US agency responsible for managing R&D cooperation programs intended to support the nuclear industry, in line with the program Atoms for Peace promoted by President Eisenhower as soon as in the… 1950s.

The approach advocated by Europeans was different from that of Americans, since it came from the very beginning as a comprehensive framework of requirements applicable, slightly translated, in the specifications of the EUR organisation.

"The EUR organisation has gained real legitimacy, and every vendor in the industry wishes to have their designs and products evaluated."

Through a consensus process, the EUR members developed a common vision with two major expected benefits: first an improvement in the licensing process and in the public acceptance, and secondly the strengthening of a fair competitiveness within Europe.

During its 20-year track-record, the EUR organisation has gained real legitimacy, and every vendor in the industry wishes to have their designs and products evaluated in order to obtain the "informal label" of the EUR. Was it possible to foresee such achievements at the beginning of the EUR adventure? Maybe not, but the informal structure of the organisation and its founding principles perfect equality between members and overall cooperation on a voluntary basis made it a very proficient and enriching approach: it proved that actual cooperation cannot be decided from the top, it can only be made alive by its stakeholders. This model is now duplicated throughout sister-associations, such as ENISS, specifically dedicated to safety standards.

◆◆◆ Luc Vanhoenacker, Deputy Department Head, Tractebel Engineering Nuclear Department (GDF-Suez), EUR Vice-Chairman and Chairman of the ENISS initiative

"The founders of EUR were visionaries, who reasoned in the long term (i.e. decades), and the association they created has become a model within the European Union and the world of civilian nuclear power. The key success factor of the EUR is to bring together the end users (i.e. the people who will operate the new plants). In some way one could make some analogy to a kind of consumers group that truly advocates their vision and requests. Beyond that, the fact that members continued to work together, even though they had altogether entered an competitive era in the European market, is a sign of intelligence, and willingness to harmonize. Similarly, the provision of EUR volumes to all vendors and utilities that make the request, anywhere in the world, is a good example of the spirit of professional and responsible cooperation, and of the organization's willingness to disseminate good practices".

14

WITNESSES THAT HAVE BEEN INVOLVED

"THE EUR IS A PROCESS THAT MAKES ALL OF US GROW"

JEAN-CHRISTOPHE FERRIER

PROJECTS MANAGER AT EDF, FORMER EUR CHAPTER LEADER AND SECRETARY OF THE ADMINISTRATION GROUP

◆◆◆ Age 47, Jean-Christophe Ferrier is a graduate of the Engineering School of Grenoble (France). He started his career in 1988 as a study engineer for EDF Generation Dispatching Center in Paris and EDF SEPTEN in Lyon. After working with the EUR organization between 1994 and 1999, he became project manager for nuclear design studies at EDF SEPTEN, notably in charge of the evaluation of third-generation designs competing with the EPR. Since 2006, he has been working for for EDF CIPN in Marseille, where he oversees several projects in nuclear engineering.

From 1995 to 1999, I was an active member of the EUR organization, first in charge of harmonizing the requirements for systems between evolutionary, passive nuclear reactor designs and pressurized, boiling designs. After that, I became EDF's representative in the working groups on BWR90 and EP1000 volumes III booklets, before being appointed EUR Executive Secretary of the Administrative Group.

I look back on this time as a very rich experience in human and scientific terms. I arrived shortly after the start of the project, when the Finns, Swedes and Italians became active members: this was the time when the entire nuclear community began to understand the interest of our approach, and when the EUR organization began to gradually become what it is today, an informal but widely recognized label.

The EUR organization brings together expert contributors, from all member countries and different backgrounds, but all driven by a passion for the engineering of nuclear plants. During these four years, my task was, generally speaking, to coordinate this scientific community, first to assess the compliance of boiling (BWR 90) and passive (EP 1000) reactor systems, in order to write two Vol III booklets. This required an understanding of brand-new designs and processes in order to assess them: contributing to these workgroups has proved to be a really exciting experience. Thanks to the high level of technical expertise of our members, we were immediately able to have discussions and points of view of high scientific value. And it was very interesting to converge these visions in order to achieve a consensus. Indeed, it should not be forgotten that the intention of all these exchanges was to create a Vol III, that is to say, generic guidance on requirements, used by every EUR member in Europe but also in other parts of the world.

Some have considered the EUR approach to be too conceptual. Yet this was the condition to make these requirements applicable everywhere, and I think that this has changed the approach of all our participants, benefitting the community at large. Indeed, the conceptualization necessary for the exercise involves one more step in our intellectual process, beyond the comprehension, analysis and description steps. But this common process of conceptualization brings together all participants of the EUR organization, beyond cultural differences and national backgrounds. This is why I view the working meetings of the EUR as some of the most rewarding moments of my career!

"PREPARING TOGETHER FOR THE FUTURE OF NUCLEAR POWER IN EUROPE"

OLIVIER ROUSSELOT

INTERNATIONAL SURVEY, EDF ENGINEERING DIVISION – BASIC DESIGN DEPARTMENT (SEPTEN)

◆◆◆ Olivier Rousselot has one degree in engineering from Institut Industriel du Nord (now Ecole Centrale de Lille, France) and one degree in nuclear engineering from Institut National des Sciences et Techniques Nucléaires (INSTN, Saclay, France). He started his career in 1979 at the Thermal Hydraulics Department of Framatome. In 1983, he joined EDF Basic Design Department (SEPTEN), first in the Thermal Hydraulics division, and then the Nuclear Physics division. In 1988-1993, he worked for the EDF Nuclear Fuel Procurement Department and then for the Engineering Center for Operating Plants. Between 1993 and 2006, Olivier Rousselot contributed to the EUR project, and is now serving as a senior engineer and international project manager at EDF SEPTEN, in charge of Generation 3 designs surveys.

My story with the EUR starts back in 1993, after I joined the EDF's Basic Design Department (SEPTEN), as part of Pierre Berbey's team. My first task was… to read the 5,000 requirements of Revision A! An enriching experience on a technical level, but also a great opportunity to improve my English…

I have gradually taken on responsibilities within the organization. I was responsible for drafting several chapters which I had to present and defend in front of the Steering Committee. I was appointed secretary of the Administration Group during the Revision B process, and I also attended two working groups, one dedicated to networks and the other to seismic analysis, a rare opportunity to gain an insight into the industry as a whole and to meet with leading experts. I also participated in another of the organization's major activities, contributing to the evaluation of the EPR design and the Russian AES92 design.

From 2006, I took a step back from the EUR organization, but I have been very involved once again since December 2010 and the launch of Revision D, for which I act as project manager. This is a major revision, since the previous one was issued 10 years ago, and in the meantime we have accumulated a lot of work. Today, we are integrating all of these materials to produce the Revision for June 2012, a very short deadline, which explains why we call this revision the "fast track". The purpose of this update is also to take into account our exchanges with the WENRA since the publication of its Safety Objectives in November 2010 and, of course, to draw the first lessons from the Fukushima Daiichi accident. I say "first lessons" because, of course, it will take years to fully look into the issue and draw all the consequences for the design of future nuclear power plants. This is indeed one of the major objectives of Revision E, which is just starting and should be released in 2014. Regarding EUR Revision D, the organization is well in place: 50 people from the EUR countries are working hard on it, allowing us to have first chapters ready for the Steering Committee review.

I think one of the EUR organization's great strengths has been to keep in touch and in business for 20 years people who were originally partners, but have then become competitors as the European market evolved. Despite these developments and our cultural differences, the relationships within the EUR organization have always been excellent and productive. We have goals and industrial tools in common: this creates a strong link between us and we give ourselves the means to prepare for the future together.

From a more personal viewpoint, my EUR experience has taught me a lot - both on a human and a technical level. Today, I am pleased to see a new generation of engineers gradually taking over. The mission of knowledge management is rooted in the work of the EUR organization. For example, although an EUR seminar represents a rather heavy workload for the EUR participants, it is our duty to train the young generation: there is no better way to enable young people to truly apprehend the EUR document and thus to consolidate the future of nuclear power in Europe.

"HARMONIZATION REQUIRED PARTICIPANTS TO BE JUST AS COMPETENT AS OPEN-MINDED"

MICHEL LIÉNARD

SENIOR ADVISOR PLANT DESIGNS AND INTEGRATION, TRACTEBEL ENGINEERING (GDF-SUEZ)

◆◆◆ A chemical engineer graduate from Polytechnical University of Mons (Belgium), Michel Liénard started his career in 1971 at Westinghouse Nuclear Europe. He joined Tractebel in 1974 where he occupied several positions as a design engineer, project manager and technical coordinator. The scope of Michel Liénard's expertise covers a wide range of issues from containment building leak tightness to thermal-hydraulic design of fluids systems for nuclear power plants. His career has led him to participate in or supervise numerous projects in Belgium, France, Slovakia, Sweden, Romania, Bulgaria, Ukraine, Pakistan and Taïwan.

I had the honor to participate early on in the drafting of EUR in the 1990s. I can admit it now: when I joined the administration group, I was quite skeptical at the time about the success of this new organization! There were still only five participating countries, but it seemed to me that our technical cultures and our national regulatory frameworks were too different to find any common ground of action. In Belgium and Spain, we were applying rules derived from the highly prescriptive US system, while the British had a close but more probabilistic system, and the French and German each had their own approach…

My fear was that it would be very difficult to arrive at a compromise. There were two pitfalls: on one side, agreeing only on generalities without any significant design and operational impact, i.e. harmonizing requirements only around our lowest common denominator; and on the other side, taking the whole of each company's requirements! In both cases, we would have missed the ultimate goal of EUR, which was to reach a degree of standardization sufficient to allow competitive business models for future reactors.

Nevertheless, we managed to attain our goal– sometimes after long and difficult discussions! I believe that if we were able to meet this challenge, it was primarily due to the quality of the participants. All contributors were experts in their technical areas, and very familiar with the rules and practices in their country - so that everyone knew what they could accept or not. We all had to be open-minded to achieve this harmonization effort. And sometimes the most difficult thing was not to come to an agreement between ourselves in the EUR organization, but to convince our colleagues in our own companies of the benefit of some changes we were prescribing… In retrospect, I think we can be proud of the important work accomplished during these two decades.

"INNOVATION FOR SUSTAINABLE NUCLEAR POWER"

IVO TRIPPUTI

INTERNATIONAL RELATIONS MANAGER, SOGIN

◆◆◆ Ivo Tripputi is a nuclear engineer with almost 40 years' experience in design and managing NPPs and in nuclear safety matters. He worked for ENEL from 1976 to 1999, spending several periods in the USA supporting ENEL nuclear plans. After participating in the development of the US/EPRI requirements for advanced NPPs, he joined the EUR group at the beginning of the 1990s, contributing to the issue of revision B. Later he moved to Sogin, where he held various positions, including management of all Italian research installations in decommissioning. After several experiences, he is currently international relations manager at Sogin. He is a member of several groups at national and international levels and he is currently the chairman of the OECD/NEA group on decommissioning (WPDD) and the Italian expert in the group for Article 37 of the Euratom Treaty. He has also acted as an expert in several IAEA missions.

In the mid 1990s, I participated in revision B of two EUR chapters related to Safety and Containment System requirements, while also holding the role of coordinator of dedicated groups of European colleagues. This was a great professional experience and we managed to develop an approach with several innovative features, integrating many lessons learned from operating experience including the TMI and Chernobyl severe accidents.

These requirements demonstrated European utilities' interest and responsibility of safety matters, and placed the EUR at the forefront of worldwide safety and technical requirements for advanced NPPs. They were achieving sustainable and competitive nuclear power and maintaining a proper balance between innovation and proven technology. The interest in the EUR was widespread and the IAEA (International Atomic Energy Agency) also took our requirements as a reference to develop their standards that were proposed worldwide. Later, with reference to the subsequent revision C of the requirements, they have been considered also by the European regulators aiming to a greater harmonization on safety criteria in Europe that has not been achieved since 50 years. I also remember the discussions at the time with the Vendors. Finally, many of them, including AREVA, Westinghouse, General Electric and the Russian industry, agreed to implement them, offering models compliant with EUR, confirming that the objectives were challenging, but reasonable. These plants would probably have survived the Fukushima event.

One of the striking memories is the long and tiring meetings, during which we discussed the different experiences of many experts sitting around a table, locked up in a room, sometimes until late at night and then going together for a quick dinner and continuing the discussions. This experience of working together generated much discussion, of course, but each participant felt part of the solution. We have demonstrated that an enthusiastic group of experts can achieve innovative results that may be considered as a real contribution to ensuring a safe energy source for Europe and for our children.

"A CATALYST FOR THE INTERNATIONAL NUCLEAR COMMUNITY"

MARTIN UHLIR

NPP DUKOVANY 5 PROJECT MANAGER

◆◆◆After graduating from Brno University of Technology, Martin Uhlir started work with CEZ Company as a control room operator. After six years of experience in the production of electricity, he held various positions in the Engineering Division – as a Licensing and EQ Specialist, Head of the Project Preparation Unit and Construction Manager. Since 2006, he has been working in the Investment Division as Temelin 3&4 Project Preparation Section Head. He is now responsible for new NPP construction at the Dukovany site, as Project Manager.

"These new requirements will help to improve the management of aging plants, to reduce costs and the duration of outages."

The company CEZ, which I represent, has been a full member of the EUR organization since December 2010, after having spent three years as an associate member.

We were the leader of a workgroup on Plant Life Management of power plants, in partnership with eight other members of the EUR, in order to prepare input for Revision D of Volumes I, II and IV. These new requirements will help to improve the management of aging of plants, to reduce costs and the duration of outages. We are proud to be a respected member of the European nuclear community.

Beyond pride, our entry into the EUR organization has a real scientific and technical importance for us. Indeed, the CzechRepublic has revived its nuclear industry since 2006, and we needed to consolidate and rejuvenate our generation of nuclear specialists. Though we have a real tradition of nuclear research, with a Nuclear Research Institute Rez founded more than 50 years ago, many key experts from the Czech scientific and manufacturing nuclear industry have now retired or are on the point of ceasing their activities. To recreate this sector in our country, the support of partners and external knowledge bring real benefits. Our integration within the EUR framework has already had a practical implication: the last training courses held by the EUR organization took place in Prague in September 2010, and we support all initiatives to attract the younger generation back to the nuclear sector. The second fruitful implication was in November 2011, when we published a Bid Invitation Specification for the construction of new reactors, with the EUR used as a basis to our requirements. This enabled us to save time and money.

Finally, I would like to emphasise the fact that we are pleased to have joined the European community of nuclear energy and share experience with the other European nuclear utilities - in which nowadays it is within the framework of the main EUR activities that are under progress - preparation of revisions D and E of the EUR Volumes I, II and IV requirements. We are happy that we can perform this work together with our EUR partner utilities.

"SETTING UP COMMON TECHNICAL POSITIONS IN A COLLABORATIVE ACTIVITY"

MARIANNE JANNIN

EDF BASIC DESIGN DEPARTMENT (SEPTEN), EUR SECRETARIAT

◆◆◆ Holding a degree as a librarian, Marianne Jannin started her career at EDF as a librarian to the Basic Design Department (SEPTEN). Working in this nuclear power-specialized library allowed her to acquire basic knowledge of nuclear power both in French and in English. Four years later, she moved to another department while remaining at the SEPTEN. Within this department in charge of experience feedback, she collected information on incidents at nuclear power plants, and set up the related database. In 1992, she joined Pierre Berbey on the EUR Project to assist him in his project management work. Since then, her duties and responsibilities within the EUR project have grown continuously.

My training as a librarian did not particularly predestine me to work within an organization of this nature. Pierre Berbey was looking for a versatile profile, able to work in English, with good interpersonal skills. These criteria corresponded to me: I had worked in a feedback unit for nuclear power plants, and was operating in quite a transverse environment which enabled me to build a general knowledge base.

I was also used to the exercise of collecting information from engineers and making the interface between people. At first, the EUR project could seem confusing. We had no certainty about what it would become. What we knew, however, was that we wanted to produce the European equivalent of the North American "Utilities Requirements Document", and that the context was favorable to the establishment of an open collaborative framework. No construction of third-generation reactors was expected in the short term, making participants share their feedback and opinions even more freely.

The position that I was given did not have predefined responsibilities. It has become what I have done over the years. To sum it all up, I act as an interface between the members of the organization, making sure that all the conditions are met to achieve the schedule. I am also the contact person vis-à-vis the "outside world": organizing events and classes, handling requests. For an organization founded in 1991, the rise of information technology and communication was very helpful. From paper, we moved to floppy disk, then e-mail and finally to internet. We are currently developing a common database on the web. Moreover, we manage 2 web sites, an EUR website to share information on the EUR project and a public website to communicate with non-EUR visitors. This second site is very successful. Our organization's general approach is characterized by flexibility, modularity and above all a "zero cost" target. There are no headquarters, and no dedicated offices. Everyone works from its own "regular job" office, and meetings are held successively by the members and at their expense.

The EUR organization alternates between intense peaks of activity (for instance, when undergoing a revision or issuing a Vol III subset) and "quiet" periods, during which we strive to maintain the operation of our network of participants in order to continuously support the project. The global nuclear revival and the surge in the attractiveness of our industry encouraged us to organize courses to inform new generations of engineers. Hundred of them attended the course that we set up in 2010 in the Czech Republic, together with the European Nuclear Education Network (ENEN). I think it is a smart way to communicate the ideas of the EUR organization and to create a network between young engineers from different countries. These events benefit from an ever-growing popularity, proving the success of the EUR project.

Of course, we are going through quite difficult times, marked by a certain austerity following the Fukushima disaster. But more than ever, unity among EUR utilities is required to maintain and develop the EUR vision.

"NUCLEAR POWER PLANTS BY UTILITIES, FOR UTILITIES"

HANS FUCHS

MEMBER OF EUR STEERING COMMITTEE FROM 1998 TO 2003

◆◆◆ Hans Fuchs holds a diploma in Mechanical Engineering and a doctorate in Science & Technology from the Swiss Federal Institute of Technology of Zurich. Between 1964 and 1972, he worked at Wuerenlingen (now Paul Scherrer Institute) on several experiments regarding heat transfer to liquid sodium. He then joined Motor-Columbus Consulting Engineers (now AF-Colenco), where he undertook safety analyses, environmental impact studies, licensing of nuclear power plants, as well as intermediate and final storage. In 1992, he was appointed Head of Thermal Power Generation at Aare-Tessin AG for Electricity (now Alpiq), occupying several functions: managing director of NPP Goesgen, Board Member of NPPs Goesgen and Leibstadt, Intermediate Storage Facility ZWILAG, Final Repository Company Nagra, Thermal Power station Vouvry. From 2008 to 2010, he was a consultant to Alpiq for Niederamt's new NPP project.

"The team spirit and the cooperative work environment have greatly enhanced the effectiveness and achievement of the EUR."

On November 19, 1863, Abraham Lincoln delivered his famous "Gettysburg Address" in which he paid tribute to the Union and Confederation soldiers who died during the decisive battle on July 1-3 of that year. He enshrines in it the nation's principle of "government of the people, by the people, for the people" and its continuity over time.

By analogy, these words could apply to the EUR's doctrine on nuclear power plants: design specification from the point of view of utilities, by utilities and for utilities. In this respect, since its establishment, the organization has contributed since its to widely spreading the idea of standardization of nuclear power plant design. The initiation, promotion and implementation of such an idea could not have been accomplished without the passion and devotion of people: Pierre Bacher, Pierre Berbey and Bernard Roche played and continue to play an outstanding role in the EUR's success. Obstinacy and will can well describe the qualities needed for this longstanding project, but the most appropriate term would be stamina. Indeed, we are talking about setting specifications for the design of nuclear reactors that will be operating for many generations!

I joined the Steering Committee of the EUR in 1998 as a representative of UAK (now Swissnuclear), while the organization was looking for more countries to strengthen its ranks. Contacts had been established before the formal invitation, and several consultants and Swiss utilities were asked to give their comments on an earlier version of the document. The time I spent within the EUR up until 2003 is marked by major achievements, such as the process of revision C, but also the comparison of several reactor projects with EUR specifications: EPR, EPP, ABWR and SWR 1000. The team spirit and cooperative work environment have greatly enhanced the EUR's effectiveness and achievements. Cooperation between utilities and vendors, and later with the regulators, particularly with the Western European Nuclear Regulators Association (WENRA), was exemplary in this sense, to extend the EUR's influence and spread the idea of standardization, even beyond Europe. To such an extent that perhaps the European Utilities Requirements could someday turn into the World Utilities Requirements.

During these twenty years, I saw the organization's ability to face and address new issues. Lately, September 11, 2001 and Fukushima sounded like a call to order and helped to reiterate the importance of external events, to which the EUR gave an adequate response. It is quite a tradition for the EUR to accept new challenges, and Fukushima is just the latest of them. I am from Switzerland, and my country reacted badly to this disaster. Immediately, the Federal Council put the new reactor projects on hold and in May announced a gradual exit from nuclear energy ending in the 2030s, a proposal later confirmed by both chambers of Parliament. As a former manager of nuclear production and a member of an organization that aims to keep the nuclear option open and acting proactively for very high-safety designs, I judge this to be a rash and irresponsible reaction. Fortunately, in our government by the people, the voters will have the last word in a few years' time. Meanwhile, I am confident that the EUR will stay on course.

"ONE INNOVATIVE PROJECT MANAGEMENT FOR ONE AMBITIOUS YARD"

VALÉRIE BELLENS

PROJECT MANAGER AT TRACTEBEL ENGINEERING, PROCESS & SYSTEMS SECTION, NUCLEAR DEPARTMENT, EUR REVISION D DEPUTY PROJECT MANAGER

◆◆◆ Holding a masters' degree in Mechanical Engineering from Faculté Polytechnique of Mons (Belgium), and a Master of Science in Nuclear Engineering from BNEN – Université Libre de Bruxelles, Valérie Bellens started her career in 2000 working for a small office in Belgium on tank design, finite elements, piping and structural steel. She then joined Tractebel Engineering in 2004 as a design engineer, and was assigned to Areva in Paris for working on the Finnish EPR OL3. Since 2007, she is a project manager for many generation 3 technology watch projects and for CNT (Tihange nuclear power plant) modification projects. From 2007 to 2009, she was a member of the EUR Vol III EPR Subset coordination group, then a member of the EUR-EPRI/URD comparison update coordination group between 2009 and 2010. In November 2009, she became a member of the EUR Administration Group.

When I was requested to contribute to EUR for working on revision of a Vol III subset devoted to the analysis of the EPR, I did not hesitate long. At that time, I worked at Tractebel Engineering for plant design and integration within the Nuclear Department. Reaching EUR gave new impetus to my career, or at least a different consistency, with a broader emphasis on meeting and discovering new cultural and international environments.

The process of revision D of the document was initiated within the last year by the Administration Group of the EUR, and in December 2010, I was named deputy project manager, alongside Olivier Rousselot. Our initial term for the revision D is set at June 2012. The last revision process took place in 2001. At that time, no plans to build a third generation reactor had been implemented. Meanwhile, this situation changed, and the need for a new revision is even more urgent now since the feedback of several projects in Finland and France as well as three design assessments are available. A whole range of new inputs and information are to be considered, creating one heavy background: comments on revision C, analysis of many designs such as EPR or AP1000, updating of the comparison with URD, etc. This is the aim and the meaning of the process of revision D. For this occasion, the EUR innovates the way they organize such a project: for the first time, we have a two-party leadership, carried out by Olivier Rousselot and myself. The workings are substantial, the schedule is tight, the use of a two-headed management will help us to better manage the pressure. We are able to hand over one to another when necessary. The rest of the organization is structured like a pyramid: the core group comprises six "technical leaders", coordinators each responsible for a specific technical field (safety, electrical and I&C, civil works, mechanical, fluid systems, turbine, miscellaneous). They in turn get supported with the knowledge of more than 40 experts, in charge of providing a first draft of the chapters updated. In terms of project management, lack of hierarchical levers can sometimes seem problematic to move the project. It is difficult to demand and mobilize resources immediately. And then we must also demonstrate pedagogy and adaptation, to take into account different priorities between the 17 members of the EUR. But in general, the atmosphere and the working environment are quite remarkable. The people who contribute to this project know why they are there and pursue a common interest. Working in a collaborative framework such as the EUR, meetings can sometimes take place in some fabulous places, near Rome for the AG brainstorming for revision D, or in Helsinki for example. Such working conditions help to stimulate thinking and encourage our efforts. On the verge of its 20th anniversary, the EUR falls into a difficult period marked by the post-Fukushima context. More than ever, utilities must remain attached to the project. The organization is a showcase for the nuclear industry and we carry a certain responsibility towards the public. When the feedback from Fukushima is available, I am convinced that the value of EUR will be even more valuable and that we will again adopt a fluid dynamics.

"A GREAT ACHIEVEMENT THAT WILL HELP US ALL FIND SOLUTIONS IN THE FUTURE"

MAURICE ROCH

RETIRED HEAD OF THE NUCLEAR DEPARTMENT OF TRACTEBEL ENGINEERING

I co-operated with the EUR organization for 10 years. To me, it was a very useful period. The discussions held with people from other countries and other backgrounds were a great experience. When the EUR organization was launched, the US already had the URD. I was convinced that the Europeans needed a document of the same kind. The French began to talk with the Belgians and then the Spanish and the Germans joined the initial core.

The EUR was born thanks to the European Commission. In the 1980s, there was in this institution a work group gathering utilities and authorities. The idea of harmonizing the demands was already at stake but the different states did not want to implement such a project. Despite this drawback, that period was very useful because people from the different utilities that would later found the EUR organization could meet, get to know each other and discuss about what was already happening in the US.

The EUR organization, however, was not working like the URD team. Whereas the US was following the development of a few new designs of the industry, we sought to create specifications for any future project. This was a major difference between the two approaches. The most time-consuming was the Vol II, where all criteria in all domains had to be covered. Then Vol III had to examine every projet introduced on the market by the existing vendors. Along this lengthy process differences between the demands of every country around the table showed up. The way they should be expressed was also in debate. As work went on, all participants realized that it was mandatory to have common demands. Quite surprisingly, all of the decisions were made by consensus.

There was a great evolution during this period of 20 years. At first, the different utilities were not competing with each other. Then came the liberalization of the European energy market. Fortunately, the initial co-operation is still alive and safety remains the main concern. I regard it as a truly great achievement since it will help European utilities to keep on continue finding solutions.

"The EUR organization, however, was not working like the URD team. Whereas the US was trying to change the elements of existing facilities, we sought to create specifications for future projects."

"THE EUR PROPOSED A STRUCTURED APPROACH TO SEVERE ACCIDENT ISSUES"

MICHEL-LOUIS VIDARD

NUCLEAR SAFETY ADVISER, EDF ENGINEERING DIVISION – BASIC DESIGN DEPARTMENT (SEPTEN)

◆◆◆ Holding an engineering degree with a specialization in Thermodynamics and Fluid Mechanics, Michel-Louis Vidard started his career at the Commissariat à l'Energie Atomique (CEA) in Cadarache, France. From 1969 to 1982, he worked on the PEGASE experimental reactor, before joining the RNR (Réacteurs à Neutrons Rapides) Department, first as an engineer and then as a lab manager. In 1982, he took a position within EDF SEPTEN (Services Etudes et Projets Thermiques Et Nucléaires) and became Section Head in the Thermal Hydraulics Division. Afterwards, he was appointed project manager until 2006, with responsibility for reactor project assessment, NRC regulation analysis, and was also a member of several workgroups for the OECD dealing with severe accident management issues. He has spent the last five years in the US as Senior Advisor for nuclear in EDF's US subsidiary, EDF Inc.

The EUR is an initiative for defining utility requirements applicable to Advanced Light Water Reactors (ALWR). At EDF, EUR activities were carried out in parallel with the EPR design and a structured survey of international activities under development. Being responsible for the latter, I also served as an advisor to Pierre Berbey when clarification on some very specific issues was needed.

EDF being a member of the EPRI ALWR program (Electric Power Research Institute - Advanced Light Water reactor Program), part of my job was devoted to understanding the logic and specifics of the program, in particular the URD (Utility Requirements Document), a compilation of requirements US utilities felt appropriate for advanced reactors.

Basically, though presenting some similarities, the URD and the EUR were developed for compliance with two fundamentally different objectives. The URD contemplated four specific US designs. The objective was thus structuring and giving the rationales for requirements directly applicable to well identified design. Though the US were at the time characterized by the existence of a large number of utilities, writing the URD was facilitated by the fact that compliance with a single regulation (Nuclear Regulatory Commission, NRC) was required.

For most EUR members, on the contrary, the objective was to finalize a document that could be used for competitive bids, in a non-uniform regulatory environment (specific to member countries). In many cases also, no mention was made of severe accident issues in national regulations. The orientation adopted by EUR members was to structure the EUR document around generic requirements, both high-level, in this case very similar to URD's, and more detailed but applicable to a reasonably wide number of designs. In addition, EUR members decided to issue a well-structured Severe Accident Policy as part of their design requirements, on one hand, and as a proposal for future interaction with European regulatory bodies, on the other. Incidentally, the Design Release Limit (DRL) issue was considered key to the good neighbor policy EUR members intended to develop for public acceptance purposes. In this perspective, one can say that the EUR has been very instrumental in developing a rational approach to a complex problem, and synthesizing the conclusions in a user-friendly assessment formula applicable even to the most penalizing European sites.

Having spent quite some time dealing with Severe Accidents in International Organizations (e.g. Organization for Economic Cooperation and Development, OECD, or the International Atomic Energy Agency, IAEA), I could take advantage of the insights gained through interacting with international partners and feed them back into the DRL process.

As an outsider to the EUR process, I think it's now time to factor in changes in the nuclear environment, in particular the shift from a regulated to a deregulated electricity market, to revisit the document in view of factoring in key elements of this new environment. In this perspective, revision D appears a timely opportunity to add value to the EUR.

"A LIVING DOCUMENT"

CARLOS M. PADILLA MORENO

PROJECTS DEVELOPMENT DEPARTMENT, IBERDROLA INGENIERIA Y CONSTRUCCION

◆◆◆ Carlos M. Padilla Moreno graduated from Universidad Politécnica de Madrid. He is an Industrial Engineer (Energy'sTechnics). He has experience in international and national research projects in IBERDROLA, IBERDROLA Engineering & Construction, and before in ENUSA and GE Nuclear Energy. His main research activities have been focused on the areas of Building Sustainability, Environmental Technologies, CO_2 Capture and Storage, Oil& Gas, Biomass and Nuclear Reactors Design, in particular regarding EUR Project Development. He is the Project Director of the CENIT-E Project called VIDA (Integral Valuation of Microalgae) a project aimed to satisfy as much as possible all the potential City needs, controlling and using microalgae as fuel. He is a member of the Spanish Biomass Strategic Platform (BIOPLAT) regarding microalgae, and Project Director of a CO_2 Capture Project using Electromagnetic fields.

I was an active member of the EUR organization from September 1997 to July 2004. During this period, I served as a member of the Administration Committee, and participated in several workgroups, notably the Nuclear Safety Group that I chaired from 1998 to 2004. I think that is what makes this organisation so special is its unique ability to put together national interests of European countries, some of them being developers of nuclear technology and the others only consumers. While they have different strategies and compete with each other, member utilities manage to work closely together in the EUR framework with the clear common goal to develop a reference document to be use when necessary.

All the EUR activities are performed in a constructive and collaborative way. The people involved are very friendly, very professional, with a great work capacity and a true spirit of collaboration. I remember some good times like the meeting we had in Munich during Oktoberfest and tougher ones for a Mediterranean native: a temperature of -20°C during a meeting in January in Helsinki!

I faced my biggest challenge within the EUR organisation when I became a project manager for the revision C of the document. Once the project had been approved by the Steering Committee, I proposed to use all the documents and available Volumes C, as well as all documents proposed by any EUR member in relation to each requirement. To handle this huge volume of information and documents together, I proposed to use a large table where all of them would be introduced. In some cases, more than 30 documents were managed together in an easy way thanks to a serial of criteria to number any requirement in a coherent form. With these tools, it was so easy to use all the available information without errors and mistakes. This revision may not have been as in depth as I wished, but at least it incorporated all the comments available at that time.

I think the EUR organization advocates a strong and well supported common position. It has to continue in this way, and to continue to improve the EUR document as a living document. In my personal opinion, I think this organisation has to be promoted by all the European utilities, as well as by the European Union, to the level of a Reference Working Group. It could then develop the capability to create Industrial Safety Classification of Systems, definitions, regulations, rules and standards to be used in Europe in any new construction and/or operation of nuclear power plants.

"BRINGING A SPECIFIC SENSIBILITY TO ENVIRONMENTAL IMPACTS"

LUIGI NOVIELLO

EXECUTIVE VICE PRESIDENT OF UNI-CEN, THE ITALIAN STANDARD COMMITTEE FOR NUCLEAR TECHNOLOGIES AND RADIOPROTECTION.

◆◆◆ Graduated in electrotechnical Engineering, Luigi Noviello was engaged by ENEL (Ente Nazionale Energia Elettrica) in the Engineering and Construction Division. From 1977 to 1986, he was involved as the Technical Director in the development of the Italian Nuclear Standard Plant (PUN). After some years of participation in the EPRI ALWR program, in 1992, he was appointed as a member of the European initiative (EUR) SC and, in 1994, he was appointed as the Chairman of the EPP Steering Committee, the joint project of Westinghouse and seven European Utilities to adapt the AP600 design to EUR. Since 1999, after the formation of Sogin, Mr. Noviello was in charge of decommissioning planning and engineering and was also a member of the SC of the Consortium for the decommissioning of the Italian fuel cycle facilities. Luigi Noviello is the Executive Vice President of UNI-CEN, the Italian Standard Committee for Nuclear technologies and Radioprotection (UNI is the Italian member of ISO).

"It has been a great satisfaction to see that WENRA decided in 2010 to include the new EUR ideas in its own requirement for new plants."

After Chernobyl in 1986, there was a referendum in Italy that led to the shutdown of nuclear plants. The arguments brought against nuclear energy were mainly based on the economical damages caused by releases of radioactivity and on the difficulty to develop an effective evacuation plan on a heavily populated country. For instance, we had to realize that if a leakage like those accepted for generation II plants had happened in Italy, it would mean the loss of a some rice harvest worth 2.5 billion dollars each.

Regarding an emergency plan, we had to realize that the European population densities – Europe is naturally much more heavily populated than the USA – requested a limited emergency plan. This peculiar situation led the Italian team to have a specific vision. We brought to the EUR organisation our sensibility to the environmental impacts of accidents, including severe accidents. Thus, we contributed mainly to the chapters related to safety and we requested a chapter on containment considered as the last barrier, mainly passive, to mitigate releases to environment under all plant conditions.

Requirements on containment tend first of all to increase its free volume, which will help limit the concentration of hydrogen, and to diminish the number of penetrations that go through the containment walls to reduce the likelihood of leakages. We also developed methods to assess if releases from accidents could be acceptable or not. In this context, we also supported the adoption of new features like the core catcher, the primary circuit depressurization system and hydrogen recombiners, all directed to preserve containment integrity. Initially, the idea of a core catcher came from the German utilities and we supported it. In the EUR Vol II, we wanted requirements asking that the corium should be stopped as soon as possible. Implementation of those new requirements, of course, has requested new designs and testing, for instance the requirements on depressurization have requested a new type of valves that can operate even if the nuclear fuel is melting.

It has been a great satisfaction to see that WENRA (Western Europe Nuclear Regulators Agencies) decided in 2010 to include the new EUR ideas in its own requirement for new plants.

Regarding projects, we have been very active in the assessment of the new designs against the EUR requirements. Very important for us has been the contribution to the assessment of the Russian AES92, the EPR and the AP1000. About AP1000, we managed for some years the European Passive Plant project (EPP) aiming at adapting it to the European context starting from an increase of the size to 1000 MW.

"THE CREATION OF A COMMON DESIGN: THE EUR AS A COLLECTIVE ADVENTURE"

PIERRE BERBEY

CHIEF ENGINEER EDF NEW PWR DEVELOPMENT PROGRAM, EDF BASIC DESIGN DEPARTMENT (SEPTEN)

◆◆◆ A nuclear engineer, Pierre Berbey has worked within EDF design and construction branch since the mid 1970s. He was involved in the licensing of the early EDF PWR series then on the development of fast breeders: EDF 1300-1500 MW PWRseries and post-N4 series (REP2000 program). Pierre Berbey has been in charge of the EUR project since the early 1990s, together with long-term development studies on LWRs and Generation 4 designs. Since mid-2010, he has been the chief engineer in the EDF development program of new PWR designs.

In 1991, we did not think that one day we would celebrate the 20th anniversary of the EUR organization. Originally designed as a European surgeon for the work of the US EPRI URD, we believed that our work to harmonize the requirements for the design of European nuclear power plants would be completed by… 1994! But the EU enlargement and the deregulation of electricity markets have renewed the appeal of the EUR approach. Major European utilities joined our network, quickly followed by partners from Switzerland, Russia and Ukraine, to name a few, based upon industrial cooperation. Then, in the 1990s, at the opening of the European electricity market, the interest in our approach, dedicated to the harmonization of specifications and the standardization of designs, increased: it looked rather consistent to set unified standards and designs on a single market. We then extended our approach on joint evaluations of the level of compliance of nuclear power plants.

The EUR approach, rather informal and based on good will and cooperation between competing companies, might have appeared candid, or, to say the least, unusual. Yet it has paid off, as today calls for tenders for new plants were actually built upon the EUR specifications. At a time when the French EDF has become the largest operator of nuclear plants in Britain, when the Swedish Vattenfall is the largest player in the German nuclear market, and when four major reactor vendors dominate the worldwide market, this type of unification seems to be obvious, and our "Mother Gencos" understood it clearly. However, our approach and our success are still considered at the vanguard of cooperation and standardization, and many other European deregulated industrial sectors would like to have achieved this level of harmonization. Our common vision of a nuclear reactor design did not happen in one day: there have been years of cooperative work, meetings, exchanges, approaches and clarifications that were needed to achieve this common vision, overcoming difficulties of different natures. Political difficulties, exacerbated as they were between overarching national sovereignty on the atom issues and the expected leveling of the European market; difficulties in sharing together our approaches to conceptualization; comprehension difficulties between us all, speakers of different languages and united only by a functional and basic English. Yet we managed to animate and enrich this process for 20 years. Today, our approach is widely acknowledged, and the EUR are applied as far as China, and by every operator who requests it: our ambition is to disseminate as broadly as possible our vision so that that the harmonization area can grow well beyond Europe, thus allowing larger benefits. As far as I am concerned, the EUR organization is a lifetime travel! We have evolved, we have entered a new dimension, but our DNA – a common will to promote advanced nuclear safety at a reasonable cost, has been preserved. Moreover, beyond the technical endeavor, the personal involvement and commitment of the key persons has been essential. Working together for 20 years and sometimes fighting creates strong personal links and establishes a team spirit that I have never experienced in my other positions.

"SUPPORTING THE EUR PROJECT AT ALL TIMES"

KARL-FREDRIK INGEMARSSON

RETIRED SENIOR NUCLEAR ADVISOR VATTENFALL

◆◆◆ Working in the nuclear business more than 35 years, Karl-Fredrik Ingemarsson worked for Vattenfall in several positions. He held a shift supervisor license and participated in a leading position in the commissioning of the BWRs at Forsmark. Now retired, he was the responsible manager for nuclear safety at the Forsmak NPP for more than 15 years and held a position as a Senior Nuclear Advisor at Vattenfall Generation Division.

At the time when EUR started, I was working as the responsible manager for nuclear safety at Forsmark Nuclear plant with three modern BWRs, majority owned by Vattenfall. Later in the EUR process, I held the position of senior safety advisor at Vattenfall, responsible for international issues concerning the modernization of Vattenfall nuclear fleet. At that time, Sweden had set in place a large nuclear program producing approximately 50% of the country's electric power.

Already in the 1980s, I realized that most Swedes in the nuclear business had a vision that was too much home-centered and not taking part in the European development work. It became quite clear at that time that the future of nuclear development was to be drawn from a European level. Harmonization and cooperation to strengthen the nuclear option in a common deregulated market was a must for the European utilities. To me, it was obvious that an accident anywhere is an accident everywhere, so to prevent this from happening the next generation of reactors had to be even more safe than the existing. Even between competitors, improvements had to be made. Unfortunately, at that time, Europe had no major organization or strong institutions to deal with such issues. So the birth of EUR was a promising sign.

One consequence of the TMI accident was the decision by the Swedish politicians to hold a referendum in 1980 on the future use of nuclear power in Sweden. The outcome of the referendum and a subsequent parliamentary decision said that nuclear power should be phased out by the year 2010, and no new build should be allowed. A prerequisite for a phase-out was that it should not cause a shortage of electric power impacting industry and households.

In the years to come it became obvious to industry and politicians that a phase-out by 2010 was unrealistic. The nuclear industry realized that nuclear would play a major role even after 2010, and thus started preparations for a longer-term

"The Swedish modernization programs, mostly in the BWR fleet, have taken great inspiration from the EUR document, and extensive comparison studies between EUR requirements and the existing reactors have been performed."

future with nuclear power remaining one of the prime sources for electricity generation. Realizing that new construction would still be controversial, the perspective of long-term operation, "life extension" for the 12 operating Swedish reactors was the most viable way to go forward.
A consequence of this strategy, to operate reactors with designs from the 1970s far into next millennium it was understood that major modernizations would be required.
Vattenfall was aware of the work on NAPE and the EPR project. To get information of what would be the requirements on reactors in Gen III, it was decided to seek contact with the EUR project. One reason that guided the Swedish utilities was that BWR technology (represented in Spain, Sweden, Germany, Finland, the Netherlands and Switzerland) was not at that time included in EUR. Knowledge required for modernization had until then been collected from the US. A European approach seemed more attractive.
Our first contact with EUR was through a formal letter to Pierre Bacher, senior executive vice president of EDF asking for a membership in EUR. I met with Pierre in Budapest on an ENC conference and he invited us to the EUR, and explained the conditions for membership; becoming a full member, first a trial period to demonstrate commitment and active participation; and secondly that the Swedish regulatory organisation SKI approved.
To show commitment a Vol III project was formed for the BWR 90/ 90+ design. The sponsors were Finland via Fortum nuclear power/ TVO, NRG Netherlands and Vattenfall Sweden plus the vendor ABB ATOM. Leading people were Bert Endeback from NRG, Matti Komsi from Fortum and me. From the vendor, a brilliant person and engineer Mr. Ingemar Tirén was the lead. This Vol III project became somewhat a benchmark for others due to the great detail of the assessment work performed.
The interest in EUR from the Swedish regulator was very supportive. The understanding and need of a firm base of requirements for future modernization of the Swedish reactors was demonstrated many times, and the willingness to participate and take part of what was written with in the EUR was commenced.
The Swedish modernization programs, mostly in the BWR fleet, have taken great inspiration from the EUR document, and extensive comparison studies between EUR requirements and the existing reactors have been performed.
I can say that the Swedish participation and forming the Volume II Requirements part has been very valuable and extensive.

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CHALLENGES FOR EUR FUTURE: STANDARDISATION, HARMONIZATION AND INTERACTION

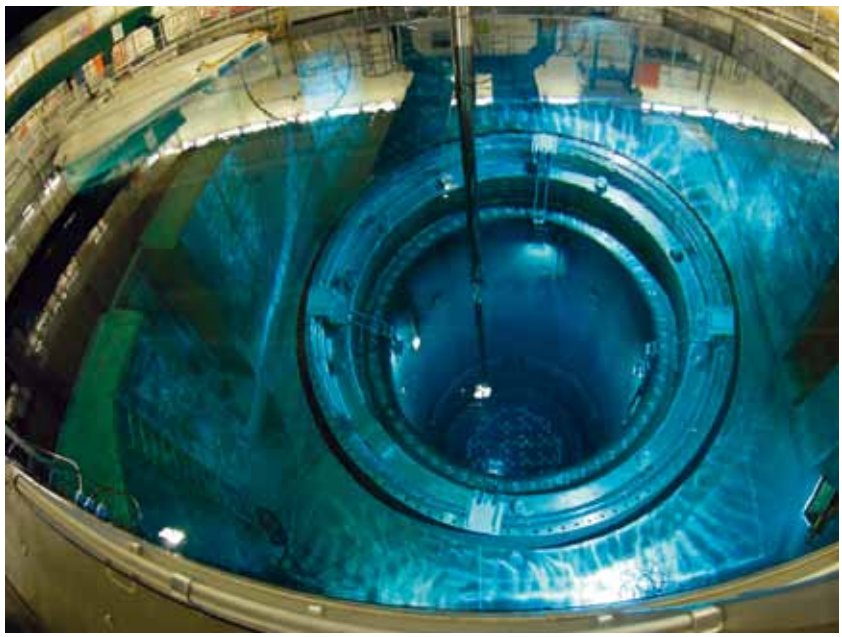
WHAT'S NEXT? TACKLING THE CHALLENGES OF THE FUTURE

◆◆◆ Eric de Fraguier, Director of New Models for EDF's Nuclear Engineering Division, elected Chairman of the EUR Organization in October 2011

"I am happy and proud of the confidence shown by the members of the EUR organization by appointing me as the chairman. It is an honor that I accept with a sense of the responsibilities that accompany the mission. I think the pioneering vision that led to the creation of the EUR 20 years ago remains more relevant than ever. Whatever the evolution of the European energy mix over the coming years, nuclear power will be a major part of it, provided that we continue to defend and develop the three pillars of our industry: Safety, Transparency and Competitiveness."

Twenty years and three revisions of the document later: the EUR organization and its members have already achieved some impressive work. They have been able to work together and develop a common vision of the pace of political and economic consolidation of Europe and its enlargement to the east. The pioneers of the approach have been joined by a new generation of contributors. New members have brought their expertise to the organization. Recently, others may put their participation in standby according to the evolution of their respective nuclear national policy. However, the adventure continues.

Today, the first challenge ahead of the EUR organization is the successful issue of revision D of the document, expected by mid-2012. Ten years after the last revision, many technological advances and requirements need to be revised in the effort to keep utilities' requirements at the highest level. Their role in the design of future



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reactors is essential more than ever in the quest for maximum standardization, itself necessary to maintain the competitiveness of nuclear power in Europe.

Second challenge: to take into account the effects of the Fukushima accident. The EUR organization must not only work on the technical impacts as the feedback will be worked out and their integration into the EUR requirements; it has to focus on reactions to the disaster among all stakeholders around the world. This is one of the organization's key missions to formulate answers to the questions raised by the public to the nuclear industry. And support harmonization processes broadly, in this respect. This is the way to contribute to better acceptance of nuclear energy, while the control of greenhouse gas emissions remains a major global challenge in the decades to come.

The third challenge for the future of the EUR organization lies in the strengthening of the links and views of its members, particularly through collaborative workgroups, so that the Nuclear Option remains open in future decisions to build new power plants wherever accepted. This will involve the organization in further enhancing its role as a privileged interface for discussions between utilities, builders, or vendors and European regulators.

EUR: THE 20TH ANNIVERSARY BOOK is published by EUR.
Conception and design: Editoria
Redaction: ADH press

Printed by GDS
November 2011
Document printed on 100% FSC-certified paper, partially recycled in a printing plant with the Imprim'Vert

European **U**tility **R**equirements
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