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Shaping the rules for a sustainable nuclear technology

ANNUAL REPORT 2017

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FOREWORD BY AFCEN'S PRESIDENT

Philippe BORDARIER,
President

"In September 2017, I was appointed President of the Association by AFCEN's Board of Directors. I would like to thank all the member companies for the trust and confidence that they have shown in my abilities by confirming my new role at the helm of the Association.

AFCEN's seven codes represent an exceptional asset that leverages the technical expertise and feedback that have been acquired over more than 40 years from designing, manufacturing and operating systems, structures and components in over 100 nuclear reactors around the world. New editions were released this year for six of the codes, representing the entire collection used for PWRs, which again bears testament to our determination to incorporate and build on the latest knowledge.

During 2017, we made a concerted effort to improve the quality of our relationship with France's Nuclear Safety Authority, particularly through our discussions on the work surrounding the ESPN nuclear pressure equipment regulation. The progress made in the ESPN program should allow ASN to formally endorse the AFCEN codes on mechanical components as being capable of satisfying the ESPN regulation's requirements. The extensive analytic work has helped strengthen the technical foundations of the rules within the codes, particularly the in-depth underlying demonstrations.

During 2017, we signed an agreement with China's Ministry of Energy (NEA) to renew the cooperative ties that have long existed between AFCEN and the Chinese industry.

We also brokered an agreement with AFNOR in 2017 aimed at modernizing our system for disseminating AFCEN codes and thereby providing all interested parties, especially our key partners in industry, with quick and effective access to our collections for all their employees.

This report paints a clear picture of how the AFCEN association is thriving. For example, the number of corporate members rose by 35% between 2014 and 2017 to reach 67. Better still, the number of experts in the Subcommittees climbed to 771, representing a 64% increase. Feel free to join one of our working groups and bring your expertise to a "collaborative development" strategy that benefits the nuclear industry by working together in raising the bar on the quality, safety and competitive advantage of nuclear projects and facilities around the world.

On behalf of all our members, it gives me great pleasure to present the 2017 AFCEN Annual Report. This report clearly illustrates the many achievements and events that our Association has organized and supported over the previous year.

I look forward to seeing you at the next AFCEN Conference in March 2019."

SIGNIFICANT EVENTS IN 2017

In 2017, AFCEN enhanced the RCC-M, RSE-M, RCC-C and RCC-CW codes

For the codes concerning civil engineering works (RCC-CW), nuclear fuel (RCC-C), and the construction and in-service inspection of PWR mechanical components (RCC-M and RSE-M), the 2017 revised editions incorporate new content to improve code quality. For instance, the RCC-M code now features rules for qualifying active mechanical components (pumps and valves).

V RCC-M 2017 EDITION

V RSE-M 2017 EDITION

V RCC-C 2017 EDITION

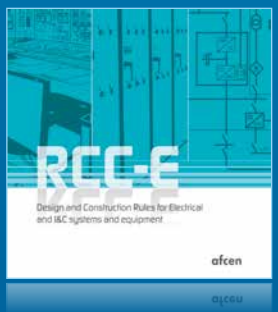
V RCC-CW 2017 EDITION

V RCC-F 2017 EDITION

In 2017, AFCEN published a new version of its fire code under the RCC-F label

In 2017, AFCEN released the first version of its fire protection code under the RCC-F label. This version draws on the experience with EPR reactors to update the principles of the ETC-F code, while enhancing and broadening the content to encompass any type of PWR reactor.

V RCC-E 2016 EDITION



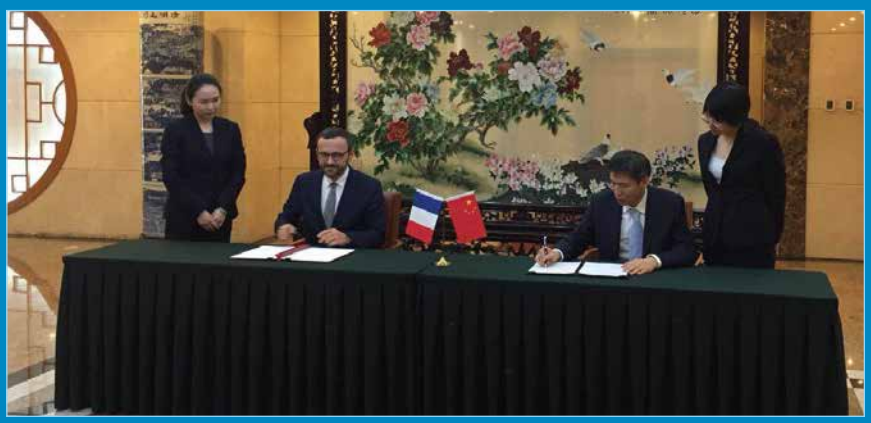
In 2017, AFCEN published a new version of its RCC-E code

In 2017, AFCEN released a major update of the RCC-E code on electrical and I&C systems and equipment. This edition (2016) includes feedback from current projects and especially the British Regulator's assessment of the UK's EPR. The revised code organizes requirements into key areas for easier identification and greater clarity in alignment with IAEA requirements and IEC standards for I&C systems.

SIGNIFICANT EVENTS IN 2017

In 2017, AFCEN strengthened its partnerships in China

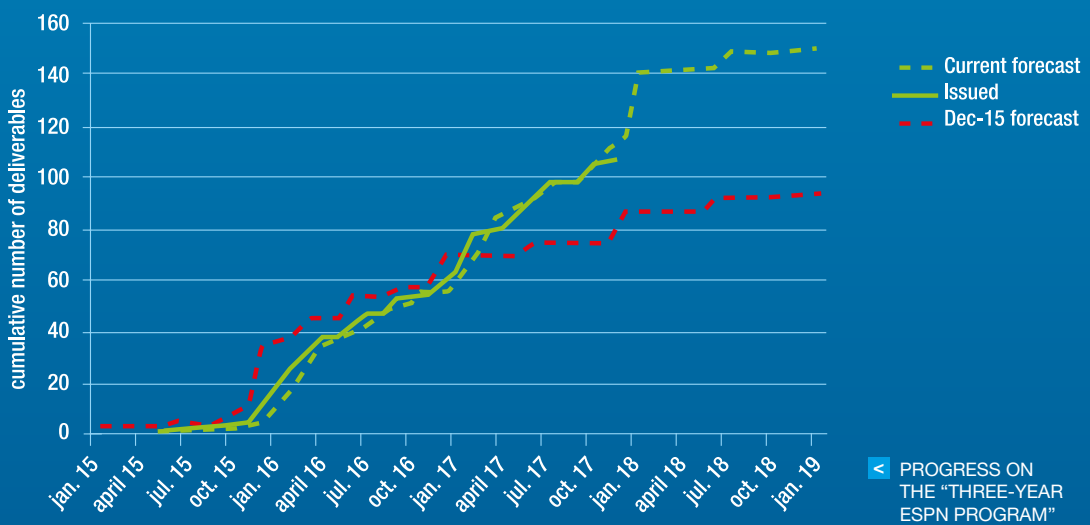
On November 30, 2017, AFCEN and NEA (National Energy Administration) signed a cooperation agreement to reinforce high-level technical discussions with Chinese experts. This agreement gives Chinese standardization bodies official permission to use AFCEN codes as a reference for drafting the country's future nuclear standards, while allowing for their translation into Chinese.



< SIGNING OF THE COOPERATION AGREEMENT BETWEEN AFCEN AND NEA

In 2017, AFCEN honoured its commitments towards the ESPN program

AFCEN is currently drafting a professional technical standard to address the essential safety requirements of the ESPN nuclear pressure equipment regulation. This standard is based on RCC-M and RSE-M addenda and on a set of guides (AFCEN technical publications) covering the topics addressed by the ESPN regulation. Progress on the "three-year program" (which is due for completion in late 2018) has been according to schedule. During the Nuclear Valley conference in November 2017, ASN (French Nuclear Safety Authority) gave encouraging signs that AFCEN could confidently receive formal endorsement that its guidelines are fully in line with ESPN requirements.



< PROGRESS ON THE "THREE-YEAR ESPN PROGRAM"

SIGNIFICANT EVENTS IN 2017

In 2017, AFCEN improved access to its codes

Thanks to an agreement between AFCEN and standardization organization AFNOR, any subscribers to AFNOR's WEBPORT platform can now access AFCEN codes on the portal!

V AFNOR'S WEBPORT PORTAL

In 2017, AFCEN brought its members and customers together

In early March 2017, the AFCEN Conference was attended by over 200 participants from across Europe, the United States and Asia. Attendees raised a host of questions relating to the use of the different codes produced by AFCEN, including how AFCEN updates the codes to reflect feedback and address the needs of the nuclear industry in France and at international level. AFCEN uses the information from the event to shape its roadmap for future developments.

^ PARTICIPANTS AT THE AFCEN CONFERENCE IN 2017

INAUGURATION OF THE RCC-CW UK USERS GROUP (CIVIL ENGINEERING) >

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Shaping the rules for a sustainable nuclear technology

1

NATIONAL AND INTERNATIONAL CHALLENGES

1.1 USE OF AFCEN CODES AROUND THE WORLD

AFCEN codes are used as a reference for nuclear components in over 100 power plants currently in operation (94), under construction (19) or in planning stages (13) around the world.

Since 1980, AFCEN codes have served as the basis for the design and fabrication of specific Class 1 mechanical components (vessels, internals, steam generators, primary motor pump units, pressurizers, primary valves and fittings) and Class 2 and 3 components, and electrical components for France's last 16 nuclear units (P'4 and N4) as well as for the construction of nuclear civil engineering works in South Africa (Koeberg) and South Korea (Ulchin). These reactors actually represent the first applications of AFCEN's codes. AFCEN codes will subsequently be used to design, build and operate the Daya Bay and Ling Ao power plants in China.

The table hereafter summarizes how the different AFCEN codes are used around the world during the planning, design, construction and operation of the reactors concerned.

Project	Country	States of the reactors			Number of reactors	Number of reactors that are using or have used AFCEN codes		Codes used						
		P	C	0		for design and/or construction	before commissioning and/ or for operation	RCC-M	RSE-M	RCC-E	RCC-CW	RCC-C	RCC-F	RCC-MRx
Nuclear power plants	France			58	58	16	58	C, 0	0	C, 0	C, 0	C, 0		
CP1	South Africa			2	2	2		C			C			
	South Korea			2	2	2		C			C			
M310	China			4	4	4	4	C, 0	0	C, 0	C			
CPR 1000 & ACPR1000	China		6	22	28	28	28	C, 0	0	C, 0	C			
CPR 600	China			6	6	6	6	C, 0	0	C, 0	C			
EPR	Finland		1		1	1		C						
	France		1		1	1	1	C, 0	0	C	C	C	C	
	China		2		2	2	2	C, 0	0	C	C	C	C	
	UK	2	2		4	4	4	C, 0	0	C	C	C	C	
	India	6			6	6	6	C, 0	0	C	C	C	C	
HPR1000	China	2	4		6	6	6	C	0	C		C	C	
	UK	2			2	2		C	0	C		C	C	
PFBR	India		1		1	1								C
Jules Horowitz Reactor	France		1		1	1								C
ITER	France		1		1	1								C
ASTRID	France	1			1	1								P
		13	19	94	126	84	115							

SUMMARY OF THE USE OF AFCEN CODES AROUND THE WORLD

Furthermore, AFCEN codes are being used as a reference for the EPR2 project in France. The EPR2 project is currently in a preliminary design stage and is based on the EPR design, but builds on the feedback from the design and construction of the Flamanville 3 and Taishan 1-2 projects. The codes used include the recent editions of RCC-CW and RCC-F, whose initial versions (ETC-) were used for the previous EPR projects and have since been updated.

In addition to these formal applications of the codes and given their reputation, AFCEN codes also serve for designing many other nuclear facilities and equipment, despite not being official standards. Examples include:

. The design of certain mechanical components and specific civil engineering works in nuclear research facilities: Institut Laue-Langevin, Laser Mega Joule, European Synchrotron Radiation Facility, European Spallation Source (ESS - under construction in Sweden), Multi-purpose hYbrid Research Reactor for High-tech Applications (MYRRHA - in the planning stages in Belgium).

. The design of nuclear steam supply systems for marine propulsion.

1.1.1 France

Nuclear power plants

AFCEN codes have gradually been used by France's nuclear industry with 1,300 MWe reactors: Cattenom 2 (first vessel manufactured with RCC-M) and Flamanville 2 (first steam generator and first pressurizer manufactured with RCC-M). The RCC-M, RSE-M, RCC-E and RCC-C codes are used for the operation of all of France's nuclear power plants.

EPR

AFCEN codes are also serving as a reference for certifying the EPR reactor in France (Flamanville 3 project). The RCC-M (2007 edition + 2008 addenda), RSE-M (2010 edition), RCC-E (2005 edition) and RCC-C (2005 edition + 2011 addenda) codes are used. The project's fire protection rules are based on EDF's proprietary specifications and the EPR's specific design requirements (ETC-F Revision G of 2006), which were subsequently included in AFCEN's collections (ETC-F 2010 edition). The project's civil engineering construction rules are based on EDF's proprietary specifications and the EPR's specific design requirements (ETC-C Revision B of 2006), which were subsequently included in AFCEN's collections (ETC-C 2010 edition).

Jules Horowitz Reactor

For the Jules Horowitz research reactor currently undergoing construction at the Cadarache site, the RCC-Mx code (predecessor to RCC-MRx) was chosen for designing and manufacturing the mechanical components that fall within the code's scope, i.e.:

. mechanical equipment with a sealing, partitioning, securing or supporting role,

. mechanical equipment that may contain or allow the circulation of fluids (vessels, tanks, pumps, exchangers, etc.) and their supporting structures.

For experimental facilities, application of the RCC-Mx code is recommended, but not mandatory.

ITER

ITER used the 2007 version of the RCC-MR code as a reference for its vacuum vessel and blanket cooling pipes. This code was chosen for the vacuum vessel on both technical grounds (the equipment and technology are covered by the code) and regulatory grounds (the code is adapted to French regulations). There are also plans to use RCC-MRx [2015 edition].

OTHER USES OF AFCEN CODES

Nuclear marine propulsion in France

The construction of nuclear marine propulsion equipment (generally concerning the key equipment for the main primary and secondary systems), which is the responsibility of the DCNS Group (now known as Naval Group), is based on a specific technical standard that refers to the RCC-M code for design. Standardization and fabrication conform to internal rules, which are technically highly similar to those of the RCC-M code.

This specific organization is related to the history of nuclear propulsion: this industry's expertise was long ago documented as a series of instructions and procedures, which have gradually been improved through feedback and external standardization. In particular, when the RCC-M code was published, the DCNS Group endeavoured to bring its own rules into alignment with the code, and ensure overall consistency in terms of the design and fabrication process, while maintaining the specific features of marine propulsion equipment (dimensions, accessibility and dismantling difficulties, stress resistance requirements for equipment in military-type applications, radiation protection requirements due to the crew's constant proximity, etc.).

1.1 USE OF AFCEN CODES AROUND THE WORLD

1.1.2 China

AFCEN codes are widely used in China for the design, construction, preliminary inspection and in-service inspection of Chinese Generation II+ nuclear power plants (based on developments of the M310 technology introduced from France) and Generation III reactors (especially EPR units).

The decision to use AFCEN codes for Generation II+ nuclear projects in China is itself specified by a decision taken by the Chinese Safety Authority (NNSA: National Nuclear Safety Authority) in 2007 (NNSA Decision no. 28).

By the end of 2017, 44 of the 57 units in operation or under construction in China were using AFCEN codes, with 32 in operation and 12 under construction. These units correspond to the M310, CPR-1000, ACPR-1000, HPR-1000, CPR-600 and EPR projects highlighted in blue in the table below.

During 2017:

. Three reactors, two of which designed according to AFCEN codes (Yangjiang 4 and Fuqing 4), have been commissioned.

. One new project has been launched to build the Xiapu CFR-600 MWe (China Fast Reactor).

Type of reactor	Units in operation (no.)	Units under construction (no.)	Total number
300 MWe	Qinshan I (1)		1
M310	**Daya Bay (2)** **Ling'Ao (2)**		**4**
CPR1000 & ACPR1000	**Ling'Ao (2)** **Hongyanhe (4)** **Ningde (4)** **Yangjiang (4)** **Fangchenggang (2)** **Fuqing (4)** **Fangjiashan (2)**	**Hongyanhe (2)** **Yangjiang (2)** **Tianwan phase III (2)**	**28**
HPR 1000		**Fuqing (2)** **Fangchenggang (2)**	**4**
CPR600	**Qinshan II (4)** **Changjiang (2)**		**6**
CANDU 6	Qinshan III (2)		2
AP1000		Sanmen (2) Haiyang (2)	4
EPR		**Taishan (2)**	**2**
AES-91	Tianwan (3)	Tianwan (1)	4
HTR-PM		Shidaowan (1)	1
CFR-600		Xiapu (1)	1
Total number	**38**	**19**	**57**

LIST OF REACTORS CURRENTLY UNDER CONSTRUCTION OR IN OPERATION IN CHINA AS OF LATE 2017
(REACTORS HIGHLIGHTED IN BLUE ARE THOSE USING AFCEN CODES)

1.1.3 India

PFBR and FBR

The 2002 edition of the RCC-MR code is being used to design and manufacture the major components of India's PFBR reactor (Prototype Fast Breeder Reactor). The 2007 edition of the code is serving as a baseline for the FBR 1 and 2 projects. Feedback from the construction of the PFBR reactor is being incorporated into the RCC-MRx code, which has replaced RCC-MR.

INDIAN PFBR REACTOR

EPR

In 2017, EDF and NPCIL (Nuclear Power Corporation of India) resumed discussions for the supply of six EPR reactors. The technology supplied to NPCIL is based directly on AFCEN codes.

1.1.4 United Kingdom

AFCEN's ambitions for the United Kingdom are tied to the development of EPR projects, starting with the two reactors at Hinkley Point C site (HPC) and two other plants at Sizewell C.

The future operator (NNB: Nuclear New Build) has chosen the following AFCEN codes for designing and building the reactors at HPC and also Sizewell C (based on the same technical choices):

. RCC-M 2007 edition + 2008-2009-2010 addenda

. RCC-E 2012 edition

. ETC-C 2010 edition

. RCC-C 2005 edition

The project's fire protection rules are based on EDF's proprietary specifications and the EPR's specific design requirements (UK version of ETC-F Revision G of 2007), which were subsequently included in AFCEN's collections (ETC-F 2010 edition).

NNB has decided to use the 2010 edition of the RSE-M code for monitoring in-service mechanical components, while adapting certain rules to meet the context and operational requirements specific to the United Kingdom.

The project to build a reactor featuring Chinese technology (UK Hualong) is undergoing the GDA process in the UK (Bradwell B site). The design is mainly based on a reactor that is currently being built in China according to AFCEN codes (FangChenGang 3).

1.1 USE OF AFCEN CODES AROUND THE WORLD

1.1.5 Finland

For Finland's Olkiluoto 3 project, mechanical equipment from the highest safety classes (classes 1 and 2) are being designed and manufactured according to one of the three nuclear codes: RCC-M, ASME Section III and KTA (German Nuclear Safety Standards). The RCC-M code was chosen as a reference for designing and fabricating the main mechanical components, such as the vessel, pressurizer, steam generators, primary circuits, pressure relief valves and severe accident valves.

1.1.6 South Africa and South Korea

The first AFCEN codes were drafted in the 1980s for exports based on feedback from the CP1 design for 900 MWe class PWRs in France.

The first exported CP1 900 MWe class PWR was built in Koeberg, South Africa, and subsequently in Ulchin, South Korea. The RCC-M code has been used in South Africa and South Korea for mechanical engineering works. As for the civil engineering works, the 1980 edition of the RCC-G code (RCC-CW code's predecessor) has been used for containment acceptance testing.

1.2 AFCEN'S ACTIVITIES AROUND THE WORLD

AFCEN's international activities are focused on achieving the following key objectives:

1. Continue developing working platforms for the nuclear industry in each area where its codes are used, mainly the UK and China.
2. Pursue AFCEN's development around the world: Asia (China and India, etc.), the European Union (United Kingdom, Poland, Czech Republic, etc.), South Africa and the Middle East by supporting projects in France's nuclear industry.
3. Build on the industrial practice of international users (United Kingdom and China in particular) and the technical instructions for certifying projects that have used AFCEN codes as a reference (UK for example).
4. Listen to the expectations of the international nuclear community.
5. Continue the policy of comparing AFCEN codes with the other nuclear codes within MDEP (Multinational Design Evaluation Program) and CORDEL (Cooperation in Reactor Design, Evaluation and Licensing).

1.2.1 France

AFCEN pursues an extensive range of rewarding initiatives in France. AFCEN's editorial activities are described in Chapter 2, while training activities are detailed in Chapter 3.

Relationship with France's nuclear Safety Authority

1. Regular meetings between senior executives at AFCEN and ASN:

AFCEN's senior management meets the Nuclear Safety Authority's executives every two years. The last meeting was held on January 5, 2017. AFCEN's Board of Directors met with ASN's Chairman, the Directorate-General, the Nuclear Pressure Equipment Department (DEP) and its technical support orrganization, the French Institute for Radiation Protection and Nuclear Safety (IRSN).

Talks covered the progress of the ESPN program, the challenges of defining codes in France and Europe, and the value of comparing nuclear codes on a global scale.

In conclusion, ASN encouraged AFCEN to continue down the internationalization road and carry on supporting the users of its codes. ASN measured the technical achievements and developments accomplished over the last three years.

2. Incorporation of the ESPN nuclear pressure equipment regulation into the codes:

AFCEN has defined a three-year program (2016-2018) for incorporating the ESPN regulation into the codes in response to a request from the French Nuclear Safety Authority, which subsequently approved the program. The aim of the three-year program is to produce a professional technical standard to address the essential safety requirements of the ESPN regulation of December 30, 2015, which governs the construction, manufacture and installation of nuclear pressure components in France. This standard is based on RCC-M and RSE-M addenda and on a set of guides (AFCEN technical publications) covering the topics addressed by the ESPN Regulation. The program is progressing at a satisfactory pace. The 2018 editions of the RCC-M and RSE-M codes will include all work to date.

ASN has already formally endorsed three topics for N1 equipment (risk analysis, instructions manual and dimensional reference standard). ASN has responded positively to the prospect of granting its full endorsement: "by the end of the three-year program and provided that the program has been carried out correctly, formal endorsement for all the topics covered will be granted when ASN can no longer identify any areas within RCC-M 2018 that fail to comply with regulatory requirements" (Nuclear Valley conference in November 2017).

1.2 AFCEN'S ACTIVITIES AROUND THE WORLD

In 2018, GSEN (Group for Nuclear Equipment Safety) will analyse the extent to which RCC-M 2018 meets the requirements of the ESPN Regulation for N2/N3 equipment.

In addition to the three-year program, AFCEN is also looking into the prospect of:

. creating an oversight group to update the standard following changes to the regulation over time and thereby maintain official endorsement,

. ensuring that the standard is sufficiently stable for implementation in projects. The next step in the ESPN Regulation may involve the possibility of submitting a safety options dossier for N1 equipment to ASN for review and subsequent advisory. The same objective is being pursued for N2/N3 equipment while taking account of the specific challenges involved (especially relating to the amount of equipment involved).

CSFN

In 2015, the CSFN (Strategic Committee of the Nuclear Industry) compiled a list of all professional entities in France (associations, clusters, platforms) specializing in or involved in the nuclear industry.

The CSFN subsequently created its own working group entitled "International Codes, Norms and Standards" (CNSI), and AFCEN has been an active contributor since July 2015.

CNSI is drafting a standardization strategy for the French nuclear industry that focuses on "new nuclear" facilities, the operation of existing plants, the fuel lifecycle and dismantling.

AFCEN biennial conference

In February 2017, AFCEN's International Conference attracted over 200 participants from different countries (China, South Korea, United Kingdom, United States, Belgium, Sweden, Canada, European Union, Germany, Russia, France and Poland). The highlights of the conference included the participation of the French Safety Authority (ASN, Mr. Julien Collet) and the British Safety Authority (ONR, Mr. Shane Turner) during the plenary session, as well as the inauguration of the RCC-CW UK Users Group in the presence of NNB (overall leader of the UK Users Groups) and AMEC (leader of the RCC-CW Users Group). The address by Mr. Steve Vaslet, representing NNB, on the application of the ETC-C code in the HPC project sparked great interest. The conference also gave AFCEN the ideal opportunity to ascertain the views and needs of its members, stakeholders, authorities, customers and projects. During the plenary session and round-table discussion, representatives of the code's main users (FA3 EPR, HPC EPR, Sizewell C EPR, NM EPR, EDF Development Division, ASTRID and ITER) discussed AFCEN's involvement in supporting the various projects. The Subcommittee sessions focused on current developments, the incorporation of feedback and changes to AFCEN's codes to address innovations, safety issues and more generally the needs of the nuclear industry.

1.2.2 European Union

In keeping with its international development strategy, AFCEN launched an exercise in "Europeanizing" codes in 2009 as part of a CEN workshop (WS 64).

The workshop used the case of RCC-MRx to prompt European partners to propose code modifications that would serve their projects. The workshop issued a stream of modification proposals, 20 of which were considered to have sufficient justification for inclusion into the code and constituted the workshop agreement. They were added to the 2012 edition of the code.

Based on what was considered a positive feedback by all partners, a continuation of the CEN/WS 64 workshop was launched in 2014 to investigate the potential needs for creating a code for civil engineering works (see Section 3.2.3) and mechanical works for Gen II to Gen IV reactors. Workshop members submitted several proposed changes to the RCC-M, RCC-MRx and RCC-CW codes to AFCEN, which has responded positively about the prospect of incorporating the majority of the proposals into the codes.

Preparations are currently being made to launch Phase 3 of the workshop. The aim of this phase is to invite proposals for code changes from the operators, the authorities' technical support teams and industry players who could ultimately be involved in evaluating and taking part in nuclear projects using AFCEN codes.

This activity is in line with the general goal of harmonizing industry practices promoted by the European Commission's Directorate-General for Energy, which has lent its support accordingly. Furthermore, AFCEN highlighted the value of this approach when developing the implementation programs during the 2018-2025 period of the European Union's Strategic Energy Technology Plan (SET-Plan). A collaborative process for defining and creating the codes would appear to be a key enabling condition for identifying the potential gains in competitive advantage for European industry and for driving research, innovation and demonstration efforts across the EU.

1.2.3 China

Background

AFCEN's ties with China can be traced back to 1986 with the construction of the two Daya Bay 900 MWe units in the Guangdong province of southern China. At that time, the power plant was based on the Gravelines 5/6 plant design.

AFCEN codes became increasingly widespread in China and gathered pace in 2007 when the Chinese Safety Authority (NNSA) imposed their use (via "Decision no. 28") for Generation II+ nuclear projects. This requirement prompted the CGN Group to translate the available editions of the codes into Chinese following authorization from AFCEN between 2008 and 2012, and this initiative was strongly supported by various Chinese governmental organizations (NEA, NNSA, CMIF, etc.).

In 2008 and 2013, Chinese users adopted the codes: technical seminars were organized between AFCEN and the codes' main users, with discussions to clarify and interpret several aspects of the codes (several hundreds of interpretation requests).

To provide a coordinated response to such a high demand, several agreements and MOUs (memoranda of understanding) were signed in 2014, especially with CGN and CNNC, the two largest nuclear operators, as well as with CNEA, the largest association in China's nuclear industry (featuring operators, engineering firms, manufacturers, and so on). In 2014, these partnerships led to the creation of Chinese Users Groups and the first technical seminar between AFCEN and CNEA, which focused on regulations, codes and standards, qualification of equipment, I&C, etc.

1.2 AFCEN'S ACTIVITIES AROUND THE WORLD

Chinese experts have strengthened their relationship with their French counterparts since 2015 by holding several technical sessions (Chinese Specialized Users Groups or CSUGs) to discuss the contents and interpretation of the codes. There are currently eight CSUGs covering all of AFCEN's technical fields. By September 2017, 29 CSUG meetings had been held in China, during which experts presented and discussed 337 technical topics.

Activities in 2017

As of December 31, 2017, 32 plants in operation and 12 plants under construction in China were using or had used (during construction) AFCEN codes.

In 2017, AFCEN's main actions relating to activities in China were as follows:

a. AFCEN signed a long-term cooperation agreement relating to nuclear standards and codes with NEA (National Energy Administration – Chinese Ministry of Energy) on November 30, 2017, in Beijing. This agreement builds on the joint statement released by the Chinese and French governments in June 2015 in Paris:

"China and France encourage cooperation in terms of harmonizing nuclear codes and standards, and wish to step up the cooperative ties between AFCEN, ISNI [Institute for Standardization of Nuclear Industry, CNNC Group] and SNPI [Suzhou Nuclear Power Research Institute, CGN Group], which will be conducive to reinforcing the good lessons learned on an international level from the experience acquired in the French and Chinese nuclear industries. The uptake, consultation and use of the respective standards by both parties will be supported to improve reciprocal recognition of French and Chinese standards."

The agreement signed on November 30, 2017, marks a milestone in AFCEN's development in China. It gives Chinese standardization bodies official permission to use AFCEN codes as a reference for drafting the country's future nuclear standards, while allowing for their translation into Chinese. The agreement also encourages regular technical discussions between China and France with a view to working together in enhancing the nuclear codes and standards by incorporating the highly dynamic feedback from the nuclear industries in both countries.

b. During its conference at the end of February 2017 in Lyon, AFCEN played host to a major Chinese delegation from NEA (National Energy Administration), CGN, CNNC and industrial groups (23 participants). This delegation took part in AFCEN Subcommittee meetings and technical workshops. During the General Meeting, an AFCEN award was bestowed on Mr. Xiaozhen Wu, Director of the CGN Standards Development Office, in recognition of his significant contribution towards AFCEN's development in China, especially in his role as Secretary-General of AFCEN-CUG (China Users Group).

SPEECH BY MR. XIAOZHEN WU (CGN-SNPI) DURING THE AFCEN CONFERENCE IN 2017 IN LYON

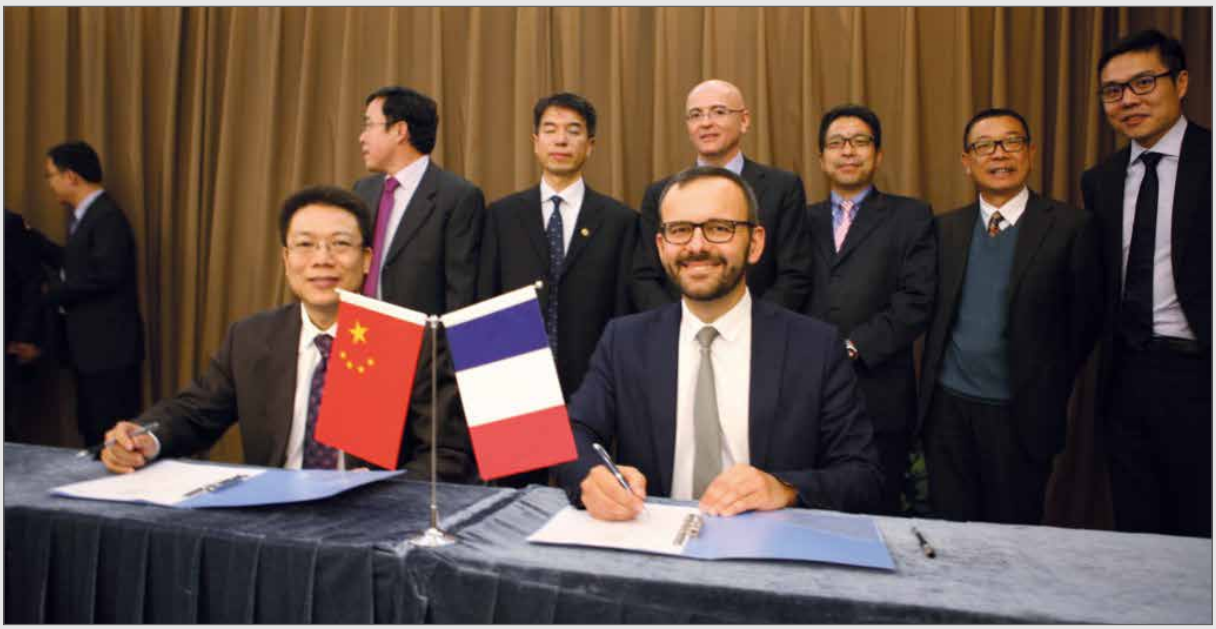
c. In May, June and subsequently in October 2017, further meetings were held between AFCEN's experts and members of the Chinese Specialized Users Groups (CSUGs) in Suzhou, Shanghai and Beijing. AFCEN's experts and their counterparts continued discussing the content and interpretation of all the codes, as well as their use in China.

The different meetings were attended by several dozens of Chinese experts from engineering firms (particularly CGN and CNNC), industry and China's Safety Authority.

d. Zhejiang JIULI High-tech Metals Co. Ltd joined AFCEN in 2017 and became the third Chinese corporate member within AFCEN (after CGN and CNNC in 2011 and 2014 respectively).

e. After AFCEN had formally certified the Chinese-language RCC-M course in 2016, which was subject to an agreement between SNPI and AFCEN, two new RCC-M training sessions were held in Suzhou in 2017. AFCEN training completion certificates were issued to the trainees who passed the final exam.

f. AFCEN and ISNI (CNNC) renewed their cooperative ties in 2017 for a further three years until 2020. This new MOU effectively guarantees the necessary resources to support AFCEN's activities in China in the years ahead.



SIGNING OF THE RENEWED MOU WITH CNNC-ISNI

1.2 USE OF AFCEN CODES AROUND THE WORLD

Outlook for AFCEN in China in 2018

In 2018, AFCEN will pursue its policy of developing cooperation on codes and standards, and will continue honouring its commitments towards its Chinese partners. The main milestones and prospects are as follows:

a. In the wake of the MOU with NEA, set up a committee to oversee all cooperation actions, define the governance rules and terms of operation for the expert working group, and organize a first steering committee meeting.

b. Participation of AFCEN's Chinese members in the AFCEN Day event in Paris in 2018, including the Subcommittee meetings and technical breakout sessions.

c. Organize new meetings of the Chinese Specialized Users Groups to promote dialog on the use of AFCEN's codes in China, while encouraging technical discussions with particular emphasis on clarifying and interpreting specific aspects of the codes.

d. Extend the agreement with SNPI concerning AFCEN-certified Chinese-language training courses and develop a course for a new code in addition to RCC-M.

e. As part of the CUGs, launch an International Working Group with Chinese and French experts collaborating on a technical topic of joint interest before future-proofing the organization to allow for Chinese best practices to be introduced into AFCEN's codes.

f. Adapt AFCEN's IT tools and systems to suit the local context in China.

1.2.4 United Kingdom

Background and general objectives

AFCEN codes are being used in the United Kingdom as a reference for the design, construction and in-service inspection of the following EPR reactor projects:

. Hinkley Point C (HPC): two units (detailed design and construction phases),

. Sizewell C: two units (project phase - design identical to HPC).

The EPR design passed the GDA in the United Kingdom in 2013, and the AFCEN codes were approved by the British Safety Authority (ONR – Office for Nuclear Regulation). The final investment decision (FID) for the HPC project was taken in September 2016, paving the way for engineering and construction of the power plant. There are plans to build two reactors at the Sizewell C site based on the same design as the two HPC units.

The reactors' future operator (NNB – Nuclear New Build) is liaising with the regulator. Following completion of the GDA (Generic Design Assessment), ONR approved the use of AFCEN codes for mechanical components (RCC-M 2007 edition + 2008-2010 addenda), electrical equipment (RCC-E 2012 edition), civil engineering works (ETC-C 2010 edition) and fire protection (ETC-F revision G of 2007). NNB has decided to use the RSE-M code for in-service monitoring of mechanical components, while adapting certain rules to meet the context and operational requirements specific to the United Kingdom. A group of independent experts, which NNB commissioned to address ONR's concerns about the code, endorsed the methods for analysing the impacts of defects detected during operation (Appendix 5.4, also used during the design phase) against current practices in the United Kingdom (R6 Rules).

The dissemination of AFCEN's code culture within British industry is essential for facilitating the understanding and use of the codes in projects and aligning them with local regulations and industry

practices. With this aim in mind, the AFCEN code Users Groups (UK Users Groups) comprise companies concerned by the use of AFCEN codes, and representatives from NNB and AFCEN. These Users Groups have the following missions:

. facilitate uptake of AFCEN codes among industry and partners by minimizing deviations caused by poor interpretation of the codes as early as possible during projects,

. collect users' requests and proposals (interpreting and modifying codes, drafting guides or local appendices), building on industrial practices and making AFCEN codes even more robust,

. determine training needs and facilitate appropriate solutions,

. establish effective communication channels with AFCEN's Subcommittees.

A Steering Committee led by NNB oversees all the groups.

The project to build a PWR reactor featuring Chinese technology (UK Hualong) is undergoing the GDA process in the UK in anticipation of installing two units at the Bradwell B site. The design of this project is mainly based on a reactor that is currently being built in China (Fangchenggang 3) according to some of the AFCEN codes. The GDA for this reactor will take advantage of the lessons learned from the EPR project and incorporated into the AFCEN codes.

Activities in 2017

The RCC-M Users Group has been coordinated by TWI (The Welding Institute) since 2013. This group currently has approximately 20 members representing manufacturers, engineering firms, consultants, inspection and training organizations, institutes, etc. AFCEN's experts and the member companies have addressed the following key technical issues: materials sourcing and manufacture, quality requirements, and requirements for nuclear pressure components. In addition, work has started on producing guidelines for applying RCC-M, which is mainly focused on the use of RCC-M for the HPC project. In December 2016, the RCC-M UK Users Group was invited by Doosan Babcock to attend a meeting in Glasgow.

Following the kick-off meeting in November 2016, the Users Group on civil engineering codes held two meetings in 2017 (June and December). Led by WOOD PLC (formerly AMEC-FW), the group includes the main companies involved in the HPC project. The Users Group was officially launched during the AFCEN Conference in February 2017.

The creation of an RCC-E Users Group will be examined in 2018.

The RCC-F code already has a UK-specific appendix to incorporate British fire protection regulations. There is no plan to create a Users Group for this code.

1.2 USE OF AFCEN CODES AROUND THE WORLD

1.2.5 India

After participating in the international India Nuclear Energy show in Mumbai in 2016, AFCEN has continued its policy of developing cooperative ties with India.

On November 10, 2017, AFCEN participated in the supply chain event organized by the JNPP project.

A seminar on AFCEN's codes was held in New Delhi for the first time on December 12, 2017. The event was organized in partnership with EDF, the French Embassy in New Delhi and the Federation of Indian Chambers of Commerce & Industry (FICCI). The focus for this inaugural seminar was to present the RCC-M (mechanical components) and RCC-CW codes (civil engineering). During the event, experts from AFCEN's members (including AREVA NP, EDF and WOOD PLC (AMEC FW)) shared their experiences with Indian companies.

Over the next two days in Mumbai, AFCEN, EDF and the French Embassy staged three bilateral meetings with NPCIL (Nuclear Power Corporation of India Ltd), Larsen & Toubro and Reliance Infrastructure.

These sessions were aimed at reinforcing collaborative ties between France and India ahead of the JNPP project (Jaitapur Nuclear Power Project).

AFCEN has already forged ties with India's nuclear industry, especially through the use of the RCC-MR code (predecessor of the RCC-MRx code) during the design of the PFBR (Prototype Fast Breeder Reactor), which is currently undergoing construction in Kalpakkam.

In 2018, AFCEN is determined to pursue its policy of building cooperation with India.

AFCEN-NPCIL MEETING IN MUMBAI

MEETING AT THE FRENCH EMBASSY IN NEW DELHI

afcen

Shaping the rules for a sustainable nuclear technology

2

EDITORIAL ACTIVITY REVIEW

2.1 CODES AND OTHER EDITORIAL ACTIVITY PRODUCTS

AFCEN's editorial activities involve authoring and updating codes.

In a number of cases, preliminary technical studies are required before codes can be revised. Such studies are performed as part of a collaborative effort.

Finally, AFCEN produces code-related documents:

. criteria, which present the reasons for the choices in the codes,

. guides, which explain how to use the codes, especially according to applicable legislation.

2.1.1 AFCEN codes

AFCEN's design and construction codes are generally prefixed with RCC-, while in-service codes are prefixed with RSE-.

AFCEN currently publishes seven codes, including six RCC- codes and one RSE- code.

In some cases (civil engineering and fire), RCC- codes were preceded by EPR design specifications developed and used by EDF.

THE SEVEN CODES CURRENTLY PUBLISHED BY AFCEN

There are several reasons for updating AFCEN codes: the need to incorporate feedback, R&D work, changes to legislation and standards, and extension of the subject matter covered by the codes.

Incorporation of feedback

Incorporating feedback is a major reason for updating codes. Several examples will be provided in the following sections which describe each of the codes, but one notable example is the change to the "Metal liners" chapters in the RCC-CW code to reflect feedback from the Flamanville 3 plant.

New developments, scientific breakthroughs and R&D work

These also represent major reasons for updating the codes.

For example, the 2016 edition of the RSE-M code has been updated to describe the loading history effect on the resistance to the cleavage brittle fracture of RPV steel by taking account of the warm pre-stressing phenomenon (WPS) as well as the associated criteria that were proposed and which are currently being defined within a probationary phase rule (RPP2).

To drive the continual improvement process, AFCEN is involved in a R&D focus group within the CEN/WS 64 workshop for three codes (RCC-M, RCC-MRx and RCC-CW), with the aim of producing proposals for Gen II-III mechanical engineering, Gen IV mechanical engineering and civil engineering works.

Regulatory changes

Changes to regulations in the various countries in which the codes are used constitute a major reason for updating the codes.

Depending on the type of change, regulatory-related modifications are either introduced into the body of the text or as an appendix specific to the country in question.

For example, efforts are being made to ensure that the mechanical codes can be applied to guarantee compatibility with the essential safety requirements of French regulations governing nuclear pressure equipment (ESPN Regulation). AFCEN's work on France's nuclear pressure equipment regulation will either lead to modifications to the body of the code (such as the toughness of thin-walled materials) or the creation of a French appendix.

Another example is RCC-F, which includes appendices focusing specifically on the requirements of fire protection regulations in France and the UK.

Changes in standards

AFCEN codes are updated to reflect changes to the standards on which they are based. International standards are the first to be called when available, followed by EN European standards.

AFCEN regularly analyses the standards to determine whether any revisions have been made and update the codes accordingly.

For example, RCC-E was overhauled in 2016 to take account of changes to IAEA requirements (SSR-2/1, SSG-24, SSG-39, etc.) and IEC standards relating to the SC 45 Technical Committee, while the RCC-CW code was revised in 2017 to ensure alignment with the construction rules for concrete structures defined in EN 13670 and the latest revised edition of EN 206.

Extensions of the subject matters

AFCEN codes may be revised if new subject matters are included.

One example is the inclusion of a new chapter in the 2017 edition of RCC-M to cover the qualification of active mechanical components requiring qualification under accidental conditions.

2.1 CODES AND OTHER EDITORIAL ACTIVITY PRODUCTS

2.1.2 AFCEN's technical publications (PTAN): studies, criteria and guides

PTAN: AFCEN's technical publications

AFCEN's Technical Publications (PTAN) include published studies, criteria and guides.

Studies

AFCEN may carry out code-specific studies. Such studies may be aimed at reviewing industry best practices before requirements are integrated into the code. The following publication for civil engineering is just one example: "French experience and practice of seismically isolated nuclear facilities".

Studies may also focus on several codes at the same time. They may describe the editorial rules for drafting AFCEN codes or the technical interfaces between codes (anchoring systems, penetrations, materials, etc.). Other examples include updating codes in the wake of the Fukushima accident and introducing IAEA GS-R-3 safety requirements into the codes, etc.

Criteria

AFCEN is strongly committed to explaining the key reasons underlying the rules in its codes. Therefore, AFCEN aims to publish documents called criteria for each code to clearly explain the reasons for the choices made when preparing the code.

To date, criteria have been published for the RCC-M code and Appendix 5.4 of the RSE-M code.

Guides

Typically a guide is a companion document explaining how to apply a code without necessarily introducing additional requirements.

For example, AFCEN developed and published guides in 2016 that explain the terms for implementing the requirements of the ESPN Regulation for the fields covered by RCC-M and RSE-M.

2.1.3 AFCEN's editorial situation

AFCEN's editorial activities in 2017 were mainly marked by the following events:

. publication of the 2017 edition of the RCC-M code,

. publication of the 2017 edition of the RCC-CW code,

. publication of the 2017 edition of the RCC-C code,

. publication of the 2017 edition of the RSE-M code,

. publication of the 2017 edition of the RCC-F code (the first edition with this label),

. preparation of the 2018 edition of the RCC-MRx code,

. preparation of the 2019 edition of the RCC-E code.

Since 2016, AFCEN has been committed to releasing an annual edition for most of its codes. The modification files approved during the year by the Editorial Committee will be incorporated into each new annual edition, meaning that addenda are no longer published.

The table below summarizes AFCEN's editorial situation and the main objectives pursued as part of AFCEN's editorial program as of late 2017.

The next table lists AFCEN's technical publications.

Appendix B contains a detailed presentation of all the codes and technical publications available for sale as of late 2017.

AFCEN'S EDITORIAL SITUATION AND EDITORIAL PROGRAM

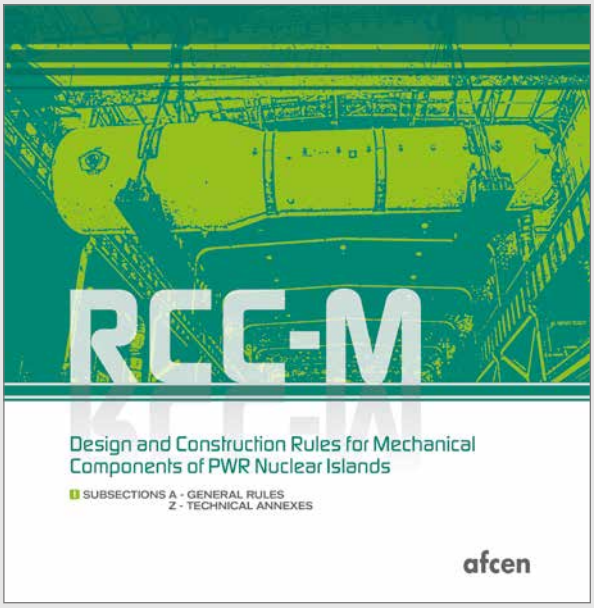
CODE		EDITORIAL SITUATION	EDITORIAL OBJECTIVES (work topics)
RCC-M	Construction of PWR mechanical components	. 2000 and 2007 editions, with addenda . 2012 edition, with addenda in 2013, 2014 and 2015 . 2016 and 2017 editions . Next edition: 2018 (ESPN)	. Incorporation of the requirements of France's nuclear pressure equipment regulation (ESPN) . Non-linear mechanical analyses . Flanged connection design . Seismic design of pipelines
RSE-M	In-service inspection for PWR mechanical components	. 2010 edition, with addenda in 2012, 2013, 2014 and 2015 . 2016 and 2017 editions . Next edition: 2018 (ESPN)	. Incorporation of the requirements of France's nuclear pressure equipment regulation (ESPN) . Spare parts . Internationalization (UK) . Mechanical analysis methods and associated material data . New inspection techniques . NDT qualification
RCC-E	Electrical and I&C systems and equipment	. 2012 edition . 2016 edition . Next edition: 2019	. Feedback from the application of RCC-E 2016 . Measurement, inspection and control systems . Design extension situations . IT security
RCC-CW	Civil engineering	. ETC-C editions 2010 and 2012 . RCC-CW editions 2015, 2016 and 2017 . Next edition: 2018	. Composite steel and concrete structures . Pile foundations . Improved reinforcement rates . Maintenance . Anchor channels . Tolerances
RCC-C	Fuel	. 2005 edition, with addenda in 2011 . 2015 and 2017 editions . Next edition: 2018	. New products (hafnium control rods, etc.) . Changes in manufacturing and inspection processes . Qualification of scientific computing tools for first barrier safety demonstrations . Fuel performance criteria
RCC-F	Fire	. 2010 edition, then 2013 (ETC-F) . RCC-F 2017 edition . Next edition: 2020	. Exhaustiveness of technical methods and solutions . Links with operations . Post-Fukushima considerations
RCC-MRx	Mechanical components in fast neutron, experimental and fusion reactors	. 2012 edition, with addenda in 2013 . 2015 edition . Next edition: 2018	. Feedback from the RJH project . Improved consideration for fast fracture . Progressive deformation methods . Lessons learned from the CEN/WS 64 workshop

2.1 CODES AND OTHER EDITORIAL ACTIVITY PRODUCTS

TECHNICAL PUBLICATIONS AVAILABLE FOR SALE

Subcommittee	PTAN / Criteria / Guide
RCC-M	. CRITERIA RCC-M 2014: Prevention of damage in mechanical components. Introduction to the design, analysis and construction rules of the RCC- M (French and English) . PTAN RCC-M 2015: Radiation protection guide for the design of nuclear pressure components for PWR plants in France (French and English) . PTAN RCC-M 2016: Risk analysis guide for N1 nuclear pressure equipment (French) . PTAN RCC-M 2016: Guide for the contents of the operating instructions for nuclear pressure equipment (French and English) . PTAN RCC-M 2016: Dimensional reference standard of N1 nuclear pressure equipment (French and English) . PTAN RCC-M 2016: Justification for exemption from pendulum impact testing for thin-walled components made from austenitic stainless steel and nickel-based alloys (French) . PTAN RCC-M 2017: Inspectability guide for the design of N1 nuclear pressure equipment in PWR plants in France (French)
RSE-M	. PTAN RSE-M 2016: Principle and substantiation for taking Warm Pre-Stressing (WPS) into account in PWR vessel fast fracture resistance criterion (French and English) . CRITERIA RSE-M 2017: Appendix 5.4 of RSE-M - Principles of and background to the formulation of the analytical methods for calculating stress intensity factors and the J integral for a planar defect (French) . PTAN RSE-M 2017: Guide for periodic requalification of class N2 or N3 ESPN piping (French and English) . PTAN RSE-M 2017: Guide for the dossier of significant repairs/modifications to nuclear pressure equipment (French)
RCC-MRx	PTAN RCC-MRx 2017: Guide for introducing a new material in RCC-MRx – Requirements and recommendations for obtaining the data necessary for preparing the properties groups for the materials in Appendix A3 of RCC-MRx (French and English)
RCC-CW	PTAN RCC-CW 2015: French experience and practice of seismically isolated nuclear facilities (French and English)

2.2 MECHANICAL EQUIPMENT FOR PWR: RCC-M



THE RCC-M CODE

2.2.1 Purpose and scope

AFCEN's RCC-M code concerns the mechanical components designed and manufactured for pressurized water reactors (PWR).

It applies to pressure equipment in nuclear islands in safety classes 1, 2 and 3, and certain non-pressure components, such as vessel internals, supporting structures for safety class components, storage tanks and containment penetrations.

RCC-M covers the following technical subjects:

. sizing and design rating,

. choice of materials and procurement,

. fabrication and control, including:

  . associated qualification requirements (procedures, welders and operators, etc.),

  . control methods to be implemented,

  . acceptance criteria for detected defects,

  . documentation associated with the different activities covered, and quality assurance.

The design, manufacture and inspection rules defined in RCC-M leverage the results of the research and development work pioneered in France, Europe and worldwide, and which have been successfully used by industry to design and build PWR nuclear islands. AFCEN's rules incorporate the resulting feedback.

2.2 MECHANICAL EQUIPMENT FOR PWR: RCC-M

2.2.2 Use and background

Use

The RCC-M code has been used or served as a baseline for the design and/or fabrication of some Class 1 components (vessels, internals, steam generators, primary motor pump units, pressurizers, primary valves and fittings, etc.), as well as Class 2 and 3 components for:

. France's last 16 nuclear units (P'4 and N4),

. 4 CP1 reactors in South Africa (2) and South Korea (2),

. 44 M310 (4), CPR-1000 (28), CPR-600 (6), HPR-1000 (4) and EPR (2) reactors in service or undergoing construction in China,

. 4 EPR reactors in Europe: Finland (1), France (1) and UK (2).

Background

AFCEN drafted the first edition of the code in January 1980 for application to France's second set of four-loop reactors with a power rating of 1,300 MWe (P'4).

Export requirements (South Korea, China and South Africa) and the need to simplify contractual relations between operators and building contractors quickly prompted the code to be translated and used in English, followed by Chinese and Russian.

Subsequently, the code was thoroughly updated and modified to reflect the feedback from France's nuclear industry, as well as through regular interactions with international stakeholders. Six editions ensued (1981, 1983, 1985, 1988, 1993 and 2000) with a number of addenda between each edition.

The 2007 edition took account of changes to European and French regulations (Pressure Equipment Directive 97/23/EC and France's Nuclear Pressure Equipment Regulation), with the harmonized European standards that were subsequently released.

To date, the 2007 edition is widely used in France and China for EPR projects and replacement steam generators.

The 2012 edition, with three addenda in 2013, 2014 and 2015, incorporated initial feedback from EPR projects. The 2013 addendum also included Probationary Phase Rules (RPP) as a way of providing an alternative set of rules in cases where industry feedback has not been sufficiently consolidated for permanent inclusion in the code.

The new information incorporated into the 2016 edition includes the first series of changes resulting from the commissioned studies into the ESPN Regulation (see Section 2.2.5).

2.2.3 Edition available as of early 2018

The 2017 edition is the most recent version of the code. It integrates 36 modification files.

This edition features two significant changes:

. The introduction of a new "Q" subsection in the Probationary Phase Rules (RPP4) to cover the qualification of active mechanical components. Work began on developing this subsection in 2014 with the creation of a new drafting group within the RCC-M Subcommittee to address the functional qualification of active mechanical components (valves and pumps) in close liaison with the RCC-E

Subcommittee. The scope of the code, which is currently restricted to the integrity of pressure-bearing structures, is being broadened to encompass the operability and functionality of so-called “active” mechanical components. The first edition of the Q subsection is restricted to pumps and valves.

. The introduction of a new ZC appendix with details on how to perform non-linear mechanical analyses for verifying design criteria. This non-mandatory appendix provides recommendations for carrying out and exploiting non-linear finite element analyses for dealing with excessive deformation damage, plastic instability, fatigue and fast fracture. This edition does not address progressive deformation.

CONTENTS OF THE 2017 EDITION OF THE RCC-M CODE

SECTION I - NUCLEAR ISLAND COMPONENTS
. SUBSECTION “A”: GENERAL RULES
. SUBSECTION “B”: CLASS 1 COMPONENTS
. SUBSECTION “C”: CLASS 2 COMPONENTS
. SUBSECTION “D”: CLASS 3 COMPONENTS
. SUBSECTION “E”: SMALL COMPONENTS
. SUBSECTION “G”: CORE SUPPORT STRUCTURES
. SUBSECTION “H”: SUPPORTS
. SUBSECTION “J”: LOW PRESSURE OR ATMOSPHERIC STORAGE TANKS
. SUBSECTION “P”: CONTAINMENT PENETRATION
. SUBSECTION “Z”: TECHNICAL APPENDICES

SECTION II - MATERIALS

SECTION III - EXAMINATION METHODS

SECTION IV - WELDING

SECTION V - FABRICATION

SECTION VI - PROBATIONARY PHASE RULES

2.2.4 Next edition

In accordance with the new sales model, AFCEN will now publish annual editions instead of addenda.

The 2018 edition will incorporate a significant change in the code, since it will be compatible with all the findings from the commissioned studies related to the Nuclear Pressure Equipment Regulation. Those findings will be worked into the body of the code, featured in a specific appendix for France or described in technical publications.

This edition, along with its specific appendix and technical publications, will enable French industry to address the requirements of the new Nuclear Pressure Equipment Regulation of December 30, 2015.

The new 2018 edition of the code will also incorporate the feedback on the code’s use in current projects (EPR UK, TSN, FA3, replacement steam generators) and on the results of the development or assessment work carried out in AFCEN’s working groups (France, China Users Groups, UK) by ASN or in international groups (Europe and MDEP).

2.2.5 Publication of interpretation requests

The RCC-M Subcommittee decided to publish the interpretation requests relating to the 2007 and 2012 editions of the RCC-M code and its addenda. This publication is presented as a compilation of anonymous interpretation requests arranged by edition and topic.

RCC-M users can download this document free of charge from the AFCEN website.

The scope of this publication will be extended in 2018.

2.2 MECHANICAL EQUIPMENT FOR PWR: RCC-M

2.2.6 Proof of compliance with the PED Directive / France's Nuclear Pressure Equipment Regulation

The Editorial Committee has launched 17 working groups to demonstrate how the RCC-M code can be used to meet the essential safety and radiation protection requirements stipulated in France's Nuclear Pressure Equipment Regulation and the European PED Directive.

These groups have the following missions:

. risk analyses,

. inspectability and vulnerability criteria,

. uncertainties and safety factors,

. the dimensions required to ensure conformity with requirements,

. fatigue damage,

. specific evaluations for nuclear components,

. toughness of low-thickness materials,

. unacceptable defects (including defects beneath the cladding and sequential penetration),

. visual inspections during fabrication,

. proof of compliance with essential safety and radiation protection requirements,

. definition of a component's admissible limits,

. instructions manuals,

. fabrication of assemblies,

. developments in technologies and practices,

. safety devices and pressure accessories,

. technical qualification,

. code compliance for N2 and N3 equipment.

The mission facing the last group is to extend the previous topics to encompass N2 and N3 equipment, since work initially focused on N1 equipment. The group began to work late 2015 and features AFCEN members who manufacture N2 and N3 equipment in order to draw on their feedback and deliver an appropriate and graded response for this type of equipment compared to the responses provided for N1 equipment. The results of the group's work on N1 equipment were submitted to ASN. The results of the group's work on N2 and N3 equipment were submitted to GSEN (Group for Nuclear Equipment Safety).

The groups' findings were published in 2016 as:

. generic modifications introduced into the body of the code,

. modifications specific to French and European regulations and introduced in non-generic appendices ZY and ZZ exclusively for France,

. technical publications in the form of guides and criteria.

The aim of the working groups is to produce all the requested changes and evidence to ensure that the 2018 edition of RCC-M conforms to the requirements of France's nuclear pressure equipment regulation ("three-year program"). By the end of 2017, the program had progressed according to the anticipated schedule. ASN has already formally endorsed three topics for N1 equipment (risk analysis, instructions manual and sizing standard). ASN has responded positively to the prospect of granting its full endorsement: "by the end of the three-year program and provided that the program has been carried out correctly, formal endorsement for all the topics covered will be granted when ASN can no longer identify any areas within RCC-M 2018 that fail to comply with regulatory requirements" (Nuclear Valley conference in November 2017).

In addition to the three-year program, AFCEN is also looking into the prospect of:

. creating an oversight group to update the standard following changes to the regulation over time and thereby maintain official endorsement,

. ensuring that the standard is sufficiently stable for implementation in projects. The next step in the ESPN Regulation may involve the possibility of submitting a safety options dossier for N1 equipment to ASN for review and subsequent advisory. The same objective is being pursued for N2/N3 equipment while taking account of the specific challenges involved (especially relating to volume).

2.2.7 Preparation of future changes to the code

In addition to the ESPN program, several focus groups have been set up since 2015 to pave the way for the code's significant changes:

. Appendix ZC addressing non-linear finite element analyses was prepared by 14 experts from 7 member companies and incorporated in the 2017 edition. However, this appendix does not cover progressive deformation damage. The appendix is therefore being revised to include this type of damage.

. A working group comprising 18 experts from 9 companies is currently carrying out a complete overhaul of the design rules for flanged connections (including Appendix ZV of RCC-M). This work will range from updating sizing rules through to joint characterization testing.

. A new appendix on the seismic design of pipelines has been prepared and is currently being analysed by a working group of subject-matter experts.

2.2.8 PTAN (AFCEN Technical Publications)

Guides

In 2015, AFCEN published a radiation protection guide for the design of nuclear pressure components in PWR plants in France. In 2018, the guide will be updated to take account of the latest feedback.

2.2 MECHANICAL EQUIPMENT FOR PWR: RCC-M

Commissioned studies into the ESPN Regulation led to a series of guides, some of which were published in 2016 and 2017:

. a guide featuring a set of methods for preparing risk analyses for N1 ESPN equipment, focusing specifically on steam generators,

. a guide for defining dimensions in accordance with ESPN requirements and measuring dimensions while quantifying uncertainties for N1 ESPN equipment,

. a methodological guide specifying the contents for instructions manuals in keeping with the guide defining risk analyses,

. a guide for examining inspectability during equipment design in relation to the risk analysis performed according to the AFCEN guide and based on revised sheet COLEN 37 issued by the Nuclear Pressure Equipment Liaison Committee.

Commissioned studies related to the ESPN Regulation should lead to an update of certain PTANs to include feedback from users and the publication of new PTANs in 2018:

. a guide defining the visual inspections to be carried out during final verification,

. a guide covering visual examinations during fabrication in association with the risk analysis,

. a guide for defining dimensions in accordance with ESPN requirements and measuring dimensions while quantifying uncertainties for N2 or N3 nuclear pressure equipment,

. two methodological guides to accompany the risk analysis guide for identifying the admissible limits of a given item of equipment (the first guide covers N1 nuclear pressure equipment while the second guide concerns N2 and N3 nuclear pressure equipment),

. a risk analysis guide for N2 nuclear pressure equipment,

. a guide for justifying SRMCR (Safety Related Measurement Control and Regulation) for N2 and N3 equipment,

. a guide for carrying out specific evaluations for N2 and N3 nuclear components,

. supporting documents to address corrosion and ageing when carrying out specific evaluations for N2 and N3 nuclear pressure components.

RCC-M criteria

The RCC-M code criteria, prepared by Jean-Marie Grandemange and approved by the Subcommittee members, were published late 2014.

This 550-page document, produced in both English and French, takes a look back at the code's background since the decision was taken for its creation.

The technical origins of the code and the changes made to the recommendations until publication of the 2007 edition are explained from the point of view of an engineer who was required to draft a design specification in alignment with the RCC-M code.

Some criteria were also published in 2016 to justify the absence of any requirements for measuring resilience in austenitic stainless steels and nickel-based alloys, and their welds as defined in RCC-M for products less than 5 mm thick.

2.2.9 International challenges

The RCC-M Subcommittee is continuing to scale up its activities on an international level by arranging events, carrying out communication initiatives and taking part in technical work sessions within the different organizations influencing the standardization process.

Events in 2017:

. On February 27, 2017, two seminars specializing in non-destructive testing and non-linear analyses in the nuclear sector were organized in the run-up to the AFCEN Conference. The seminars were attended by experts from across Europe, the United States, Russia and Asia, who reviewed the latest technologies and state of the art in these two highly active nuclear fields. Experts fielded questions from over 70 auditors in the audience, which not only generated instructive technical discussions but also simplified networking on an international level.

The ensuing AFCEN Conference set aside a whole day to discuss the changes to the three mechanical codes (RCC-M, RCC-MRx and RSE-M), while offering a global insight into all active work projects (Appendix ZC for carrying out non-linear analyses and a new Probationary Phase Rule for qualifying active mechanical components).

. Four experts from the RCC-M Subcommittee traveled to China in May and October 2017 to answer questions from the Chinese Specialized Users Groups (CSUGs). The two-day meetings each attracted over 70 Chinese members from various local companies and allowed the experts to answer several dozens of questions which, where applicable, resulted in code interpretation or modification requests.

AFCEN's determination to meet with representatives from the Chinese nuclear industry elicited a positive response from all parties and led to a visit to Jiuli's facilities near Suzhou in May 2017.

. In December 2016, the RCC-M UK Users Group was invited by Doosan Babcock to attend a meeting in Glasgow, which was led by TWI. In addition to presentations by NNB and AFCEN, and a question and answer session with the 20 companies represented, work continued on preparing an RCC-M application guide, which is mainly focused on the use of RCC-M for the Hinkley Point C project.

MEETING OF THE RCC-M CSUG

2.2 MECHANICAL EQUIPMENT FOR PWR: RCC-M

VISIT TO JIULI'S FACILITIES BY THE RCC-M CSUG

In 2017, the RCC-M Subcommittee also took part in several international working groups and participated in the associated events:

. RCC-M experts play an active role in the Convergence Board of Mechanical Standards Developing Organizations (SDO Convergence Board) during the ASME Code Week. Members are currently taking an in-depth look at several topics for harmonization.

. Representatives from the SDO Convergence Board met the Nuclear Safety Authorities during the fourth MDEP Conference in September and again during a joint meeting with the MDEP Codes & Standards Task Force (CSWG-MDEP) in November in Phoenix, which was also attended by the CORDEL/WNA Codes & Standards group.

. AFCEN presented its approach for addressing the issue of Safety and Quality Management Systems in the nuclear industry during the IAEA Technical Meeting in November 2017 (GSR Part 2 "General Safety Requirements: Leadership and Management for Safety").

. At the European level, the organizations taking part in the GEN II/III Prospective Group (PG1) of CEN Workshop WS 64 - Phase 2 issued several modification requests for the RCC-M code. With Phase 2 due to end in 2017, the Workshop decided to extend the phase by one year.

In 2018, there are plans to maintain international initiatives:

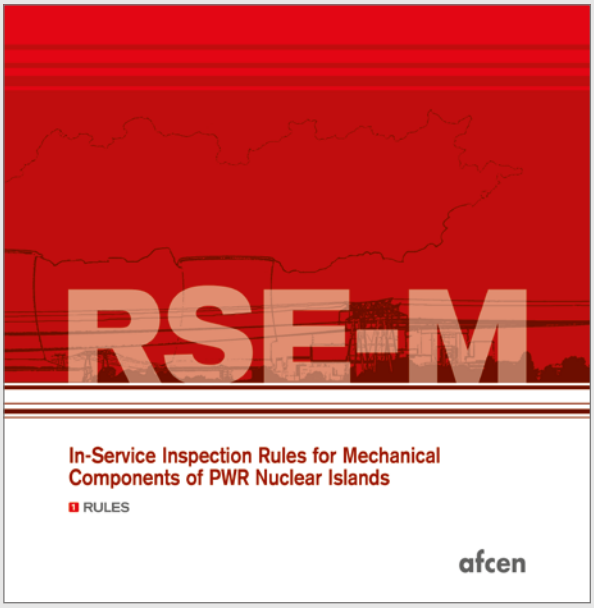
. focusing on international comparisons by publishing the studies launched by CORDEL and the SDO Convergence Board in line with the expectations of the other SDOs,

. taking part in IAEA discussions about the standards on safety and quality management systems, thereby incorporating GSR Part 2 into the code,

. furthering the aims of OECD/NEA by continuing relevant work on equivalent codes and regulations alongside the Safety Authorities in the CSWG,

. by leading AFCEN's Chinese and UK Users Groups, and the corresponding international training courses.

2.3 IN-SERVICE INSPECTION OF MECHANICAL EQUIPMENT: RSE-M



THE RSE-M CODE

2.3.1 Purpose and scope

The RSE-M code defines in-service inspection operations. It applies to pressure equipment used in PWR plants, as well as spare parts for such equipment.

The RSE-M code does not apply to equipment made from materials other than metal. It is based on the RCC-M code for requirements relating to the design and fabrication of safety mechanical components.

2.3.2 Use and background

Use

The inspection rules specified in the RSE-M code describe the standard requirements of best practice within the French nuclear industry, based on its own feedback from operating several nuclear units and partly supplemented with requirements stipulated by French regulations.

To date:

. The 58 units in France's nuclear infrastructure enforce the in-service inspection rules of the RSE-M code.

. Operation of 30 commissioned units in China's nuclear infrastructure, corresponding to the M310, CPR-1000, ACPR-1000 and CPR-600 reactors, is based on the RSE-M code (since 2007, use of AFCEN codes has been required by NNSA for Generation II+ reactors).

Background

AFCEN drafted and published the first edition in July 1990.

This initial edition served as a draft for preparing the 1997 edition, which extended the code's scope to encompass elementary systems and supporting structures for the mechanical components concerned.

This edition was updated on a number of occasions (in 2000 and 2005) before undergoing a complete overhaul in 2010.

The 2010 edition is supplemented by addenda in 2012, 2013, 2014 and 2015.

2.3 IN-SERVICE INSPECTION OF MECHANICAL EQUIPMENT: RSE-M

The 2016 edition is in keeping with the work that has been pursued since the 2010 edition by continuing to update the existing version and incorporating EPR aspects (FLA3).

The changes made to this new edition mainly involve:

1. Restructuring Sections A/B/C/D: Section A still contains the rules that apply to all pressure equipment, while Sections B, C and D describe the specific rules for components depending on their class.

2. Changes to make the text easier to understand:

. difference between “maintenance operations” and “inspection operations”,

. set of rules relating to cleanliness,

. procedure for performing hydraulic tests,

. surveillance of main primary system leaktightness,

. recommendations for maintenance operations,

. new chapters on spare parts,

. quality system requirements,

. requalification hydraulic test methods,

. classification method for maintenance operations,

. inspection of safety devices,

. classification of maintenance operations.

3. Enhancement of the code for simplified implementation with EPR projects (FLA3).

AFCEN is aiming to prioritize development of the RSE-M code in the following directions:

. incorporate developments in technology and legislation,

. factor in the constraints facing operators-partners,

. deliver support for all international practices.

2.3.3 Edition available as of early 2018

The 2017 edition is the most recent version of the RSE-M code.

It builds on the technological, legislative and international developments that occurred in 2016. The changes made to this new edition mainly involve:

. further clarification regarding the limits of main secondary systems,

. creation of a chapter on the extended shutdown of equipment in the main secondary system (especially steam generators), including the chemical specifications for extended shutdowns,

. alignment of the paragraphs in B 4000 that describe a manual penetrant testing technique for defence-in-depth examinations (hypothetical defects) with MC 4000 in RCC-M,

. creation of two chapters: B 4800 (inspection of piping in the main primary and secondary systems) and B 4900 (global inspection of the main primary system) to ensure consistency with current practices,

. creation of a specific chapter on pre-service inspections, which is neither a periodic requalification nor a periodic inspection, and an update to the text,

. clarification of the existing definition for an essential parameter: removal of the reference to the primary parameter and addition of further information to improve on-site monitoring of these parameters,

. complete update to Chapters II and III in Appendix 4.4 relating to the eddy current examination of steam generator tubes to take account of the new transversal rotating probes and offer a clearer description of the operating modes and the examination by acoustic emission method,
. creation of a new section to introduce Appendix 5 (Appendix 5.0) and provide a detailed explanation of how Appendices 5.1 to 5.8 link together,
. alignment of Appendices 5.3 and 5.4 for calculating Keq according to the theta combination method, clarification when |KII| < 0.02 |KI|,
. integration of the kth2 method in RCC-MRx 2016 (for aligning Appendix 5.4 of RSE-M with Appendix A16 of RCC-MRx),
. update of the inspection tables (complete, partial and EPR pre-service inspection) with references to the examination methods for alignment with new sections B 4800 and B 4900.

2.3.4 Outlook and next edition

2018 edition

The 2018 edition has the objective to consolidate and build on the technological, legislative and international developments that occurred in 2017. With this aim in mind, special attention will be paid to the following points:

. update of the references specified in the list of applicable standards and codes (Appendix 1.3), especially by analyzing any impacts from the changes made to RCC-M,
. examination of the prospect of incorporating the requirements of the French regulation on nuclear facilities into the RSE-M code,
. introduction of an appendix with a safety rating for the modification sheets in RCC-M and an explanation about its use,
. inclusion of changes to the conventional qualification of NDT tests,
. incorporation of regulatory changes as applicable to repairs / modifications (§ 8000 and Appendix 1.6 concerning the associated documents),
. development of the section covering spare parts,
. introduction of changes resulting from work on the three-year program for the ESPN Regulation (introduction of a new volume covering installations and references to the corresponding PTANs).

Work relating to France's Nuclear Pressure Equipment Regulation (ESPN)

As part of its involvement in France's ESPN Regulation, the RSE-M Subcommittee has commissioned studies on the following topics:

. guide to classifying repairs / modifications / installations on nuclear pressure equipment (excluding Class 1 equipment),
. documentation associated with repaired / modified N2/N3 nuclear pressure equipment,
. methodology for verifying the measures taken to protect against admissible limits being exceeded for circuits manufactured according to the old regulations,
. guide to the procurement of the main pressure parts for main primary / secondary systems,
. methodology for the periodic requalification of N2 or N3 piping,
. guide for equipment not subject to in-service inspections,
. installation of nuclear systems.

2.3 IN-SERVICE INSPECTION OF MECHANICAL EQUIPMENT: RSE-M

2.3.5 AFCEN criteria and technical publications for RSE-M

"WPS" criteria (relating to Probationary Phase Rule 2 of RSE-M)

The purpose of this publication is to describe the loading history effect on the resistance to the cleavage brittle fracture of RPV steel by taking account of the warm pre-stressing phenomenon as well as the associated criteria that were proposed and which are currently being defined within a probationary phase rule (RPP2) in RSE-M.

"Appendix 5.4" criteria

These criteria were published in 2017.

AFCEN's members have made major changes to the mechanical fracture methods specified in the appendix. As part of the Hinkley Point C EPR project in the United Kingdom, an Independent Expert Working Group (IEWG) carried out a thorough review and decided that the methods were suitable for use.

Criteria and PTAN scheduled for 2018

Other AFCEN criteria and technical publications (PTAN) are being prepared:

. criteria "Appendix 5.5" for offering a clearer insight into the criteria for analysing the impact of planar defects such as described in Appendix 5.5 of the RSE-M code,

. criteria "Appendix 1.4" for helping control the specific provisions for applying RCC-M for modifications / repairs,

. PTAN "Guide for qualification of ultrasonic NDT",

. technical publications associated with work on the ESPN Regulation (see point above).

2.3.6 Discussions with NNB

With respect to the use of the RSE-M code for the Hinkley Point C project, a series of meetings was held in 2017 to produce a UK-specific appendix tailored to UK regulations and the operator's constraints.

To simplify the process of making the code accessible to a global audience, the Subcommittee analysed the sections of the code that could be modified by a foreign operator and the parts that are applicable irrespective of the country. NNB will work with this aim in mind while focusing on in-service inspections.

CONTENTS OF THE 2017 EDITION OF THE RSE-M CODE

VOLUME I - RULES

. SECTION A - GENERAL RULES
. SECTION B - SPECIFIC RULES FOR CLASS 1 COMPONENTS
. SECTION C - SPECIFIC RULES FOR CLASS 2 OR 3 COMPONENTS
. SECTION D - SPECIFIC RULES FOR COMPONENTS NOT ASSIGNED TO RSE-M CLASS

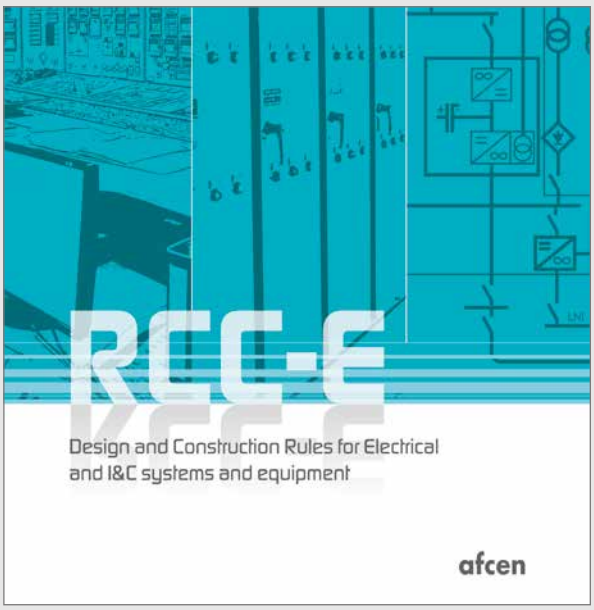
VOLUME II - APPENDICES 1 to 8

. APPENDICES 1.0 to 1.7: supporting appendices for the general requirements
. APPENDIX 2.1: appendix associated with § 2000 Requalifications, and Hydraulic Tests
. APPENDICES 4.1 to 4.4: appendices associated with § 4000 Examination techniques
. APPENDICES 5.0 to 5.8 and RPP2: appendices associated with § 5000 Indication processing
. APPENDICES 8.1 to 8.2: appendices associated with § 8000 Maintenance Operations

VOLUME III - APPENDIX 3

. APPENDIX 3.1 - VISIT TABLES
. APPENDIX 3.2 - INSPECTION PLANS FOR COMPONENTS NOT ASSIGNED TO RSE-M CLASS

2.4 ELECTRICAL AND I&C SYSTEMS: RCC-E



THE RCC-E CODE

2.4.1 Purpose and scope

RCC-E describes the rules for designing, building and installing electrical and I&C systems and equipment for pressurized water reactors.

The code was drafted in partnership with industry, engineering firms, manufacturers, building control firms and operators, and represents a collection of best practices in accordance with IAEA requirements and IEC standards.

The code's scope covers:

. architecture and the associated systems,

. materials engineering and the qualification procedure for normal and accidental environmental conditions,

. facility engineering and management of common cause failures (electrical and I&C) and electromagnetic interference,

. testing and inspecting electrical characteristics,

. quality assurance requirements supplementing ISO 9001 and activity monitoring.

2.4 ELECTRICAL AND I&C SYSTEMS: RCC-E

2.4.2 Use and background

Use

The RCC-E code has been used to build the following power plants:

. France's last 12 nuclear units (1,300 MWe (8) and 1,450 MWe (4)),

. 2 CP1 reactors in South Korea (2),

. 44 M310 (4), CPR-1000 (28), CPR-600 (6), HPR-1000 (4) and EPR (2) reactors in service or undergoing construction in China,

. 1 EPR reactor in France.

The RCC-E code is used for maintenance operations in French power plants (58 units) and Chinese M310 and CPR-1000 power plants.

RCC-E has been chosen for the construction of the two EPR units in Hinkley Point C (UK).

Users include:

. equipment suppliers,

. engineering firms responsible for designing, building and installing equipment and systems,

. control and inspection organizations,

. Nuclear Safety Authorities.

Background

The editions published between 1981 and 2002 address Generation II reactors.

The 2005 edition incorporated the requirements stipulated in the design codes specific to the EPR project - ETC-I and ETC-E, which focus on I&C and electrical systems respectively (ETC: EPR Technical Code Instrumentation and Electrical).

The 2005, 2012 and 2016 editions concern Generation II and III reactors. As from the 2005 edition, project specifications must be written to supplement and implement the rules in the RCC-E code and allow the code to be used in the project.

The various editions of the code have been published in French and English.

The 2005 edition was translated into Chinese and published under CGN's authority in 2009.

2.4.3 Edition available as of early 2018

The RCC-E 2016 edition is the most recent version. French and English versions of the code have been available since early 2017.

The following sources are used when revising the RCC-E codes:

. feedback from facilities under construction and in operation,

. the Nuclear Safety Authorities' investigation process,

. user inquiries,

. changes in the standards used and IAEA's requirements,

. changes in industry's maturity.

The 2016 edition:

. represents a departure from previous editions, which have been updates instead of overhauls,

. addresses Generation II, III and IV reactors, research reactors and naval reactors,

. organizes requirements into four key areas for easier identification and greater clarity: monitoring, systems, equipment, and component and systems installation. Each key area covers all lifecycle activities,

. takes account of IAEA requirements as applicable to the scope of the code,

. clearly defines the supplements to the requirements in the chosen IEC standards for I&C systems.

Reasons for overhauling the code include:

. changes to IAEA requirements SSR-2/1, GSR Parts 2 and 4, and recommendations for designing and building electrical and I&C systems (SSG-34 and SSG-39), which are used as inputs to the drafting process,

. the WENRA handbook on the design of new reactors,

. changes to IEC standards relating to the SC 45 Technical Committee and IEC industry standards,

. feedback from current projects: EPR, ITER, RJH and ASTRID,

. lessons learned following the British Safety Authority's investigation into the UK's EPR as part of the generic design assessment into the electrical and I&C systems,

. feedback following Fukushima.

Requirements are:

. adapted so that they can be applied to nuclear projects other than pressurized water reactors,

. harmonized and coordinated with the requirements of the relevant IEC international standards.

CONTENTS OF THE 2016 EDITION OF THE RCC-E CODE

VOLUME 1 - GENERAL REQUIREMENTS AND QUALITY ASSURANCE
VOLUME 2 - SPECIFICATION OF REQUIREMENTS
VOLUME 3 - I&C SYSTEMS
VOLUME 4 - ELECTRICAL SYSTEMS
VOLUME 5 - MATERIALS ENGINEERING
VOLUME 6 - INSTALLATION OF ELECTRICAL AND I&C SYSTEMS
VOLUME 7 - INSPECTION AND TEST METHODS

2.4.4 Technical publications of the RCC-E Subcommittee

Contribution to the ESPN program

The RCC-E Subcommittee commissioned a study on the following topic:

. SRMCR (Safety Related Measurement, Control and Regulation): the purpose of this study is to define the practical rules for designing an SRMCR in compliance with the applicable requirements for safety devices.

2.4 ELECTRICAL AND I&C SYSTEMS: RCC-E

Editions gap analysis

AFCEN has produced:

. a document that compares the 2012 and 2005 editions of the code entitled “Nuclear Codes & Standards: RCC-E 2012 Gap analysis with the RCC-E 2005”,

. a document that compares the 2016 and 2012 editions of the code entitled “Nuclear Codes & Standards: RCC-E 2016 Gap analysis with the RCC-E 2012”.

2.4.5 Outlook

The work topics for the next editions will include:

. feedback from the application of RCC-E 2016,

. measurement, control and regulation systems,

. design extension situations,

. IT security.

2.5 CIVIL WORKS: RCC-CW

THE RCC-CW CODE

2.5.1 Purpose and scope

The RCC-CW code describes the rules for designing, building and testing civil engineering works in PWR reactors.

It explains the principles and requirements for the safety, serviceability and durability of concrete and metal frame structures, based on Eurocode design principles (European standards for the structural design of construction works) combined with specific measures for safety-class buildings.

The code is produced as part of the RCC-CW Subcommittee, which includes all the parties involved in designing and building civil engineering works in the nuclear sector: clients, contractors, general and specialized firms, consultancies and inspection offices.

The code covers the following areas relating to the design and construction of civil engineering works that play an important safety role:

. load cases and combinations,

. geotechnical aspects,

. reinforced concrete structures and galleries,

. prestressed containments with metal liners,

. metal containment and pool liners,

. metal frames,

. anchors,

. concrete cylinder pipes,

. paints and coatings,

. containment leak tests.

The RCC-CW code is available as an ETC-C version specific to EPR projects (European pressurized reactor).

2.5 CIVIL WORKS: RCC-CW

2.5.2 Use and background

AFCEN published the first civil engineering code (RCC-G) in 1980. This edition included feedback from France's 900 MWe nuclear reactors and mainly drew inspiration from the French BAEL regulation (limit state design of reinforced concrete) and BPEL regulation (limit state design of prestressed concrete). It has been used for the Ulchin project in South Korea and the M310 project in China.

AFCEN updated the edition in 1985 and again in 1988 to reflect the latest developments in civil engineering technology.

In particular, the 1988 edition served for France's 1,450 MWe PWRs. In April 2006 in response to the specific needs of its Flamanville 3 EPR project in France, EDF published a reference document called ETC-C for the design and construction of civil engineering works.

The reasons that prompted the development of the ETC-C code are as follows:

. cover both French and German legislative requirements and practices,

. consider new load cases to represent severe accident conditions or events of a more serious nature,

. integrate application of Eurocodes into the design of nuclear structures,

. take account of the latest feedback on the operation of in-service nuclear power plants and updated requirements for safety analyses,

. incorporate the latest knowledge on the behaviour of materials and structures (obtained through laboratory and model testing).

The EDF document was not published by AFCEN, but acted as a blueprint for a civil engineering code that AFCEN produced in 2009 as part of the RCC-CW Subcommittee, which led to:

. Initially, the publication of a specific code for EPR projects: ETC-C edition 2010, followed by ETC-C edition 2012.

. Subsequently, the publication of a generic civil engineering code, called RCC-CW, that is not specific to any given project. Two successive editions of RCC-CW were published in 2015 and 2016.

The ETC-C 2010 edition, which was the first version prepared and published by AFCEN, was used for the generic design assessment of the EPR project in the United Kingdom.

2.5.3 Edition available as of early 2018

In 2015, AFCEN prepared and published the first edition of a generic civil engineering code that does not relate to any specific project. The RCC-CW code no longer adheres to the EPR project and can be used for PWR reactors featuring a prestressed containment with a metal liner. This code is being used for the NM EPR project in France.

The 2015 edition of the RCC-CW code includes all the relevant proposals based on the experience acquired during current projects:

. technical discussions concerning the investigation process for Flamanville 3 and the generic design assessment of the EPR project in the United Kingdom,

. the experience acquired by members through their participation in the Olkiluoto, Flamanville and Taishan projects.

It also takes account of the latest changes in European standards and includes technological openings and improvements:

. bonded prestressing has been supplemented with unbonded prestressing,

. the code covers the design and development of seismic isolation devices,

. the section on external hazards has been updated to include tornadoes,

. the design approach has been expanded to provide greater focus on design extension situations.

The 2016 edition of the RCC-CW code implements the following changes:

. correction of various editorial mistakes,

. thorough revision of the DANCH chapter on anchors and inclusion of the latest changes to EN 1992-4.

The 2017 edition of the RCC-CW code implements the following changes:

. rules for anchor channels and active channels have been worked into the DANCH and CANCH chapters,

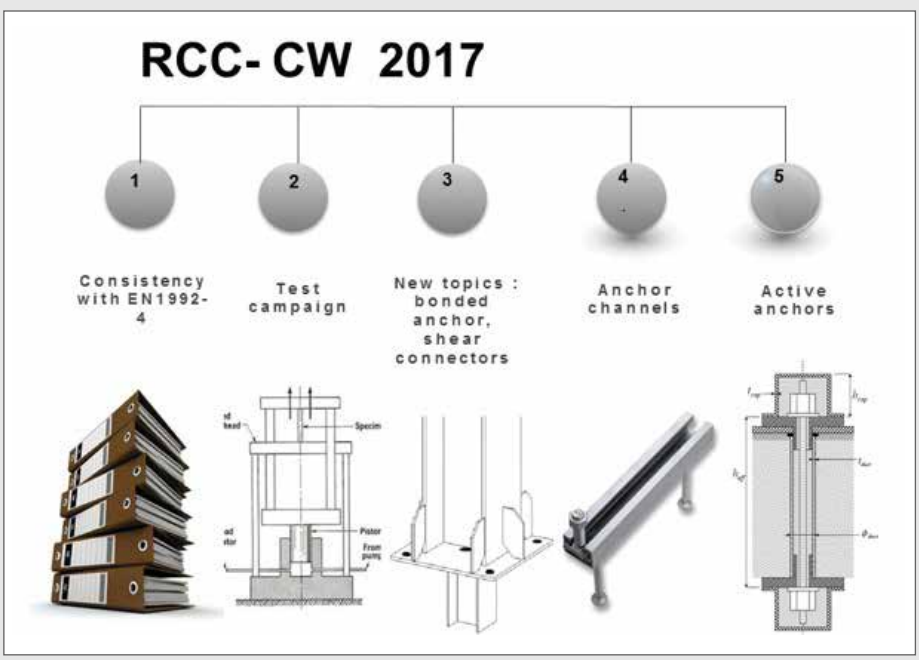
. the CCONC chapter has been completely revised to ensure a better fit with EN 13670 and has been based on the latest version of EN 206,

. a new CCOAT chapter has been created for paints and coatings,

. the actions to be considered in design extension hazards have been amended (DGENR chapter),

. requirements for seismic soil column calculations have been included (Appendix DA).

RCC-CW 2017 COVERS ANCHOR-RELATED TOPICS



2.5 CIVIL WORKS: RCC-CW

CONTENTS OF THE 2017 EDITION OF THE RCC-CW CODE

PART G - GENERAL

. GUSER - NOTE TO THE USER
. GTABL - ORGANISATION OF THE RCC-CW
. GREFD - STANDARDS AND DOCUMENTS REFERRED TO IN THE RCC-CW
. GDEFN - DEFINITIONS, NOTATIONS AND ABBREVIATIONS
. GGENP - GENERAL PROVISIONS
. GA - APPENDICES

PART D - DESIGN

. DGENR - DESIGN GENERAL REQUIREMENTS
. DGEOT - GENERAL RULES FOR GEOTECHNICAL DESIGN
. DCONC - GENERAL RULES FOR CONCRETE STRUCTURES
. DCLIN - METAL PARTS INVOLVED IN THE LEAKTIGHTNESS OF THE CONTAINMENT
. DPLIN - METAL PARTS INVOLVED IN THE WATERTIGHTNESS OF THE POOLS AND TANKS
. DSLTW - GENERAL RULES FOR STRUCTURAL STEELWORK
. DANCH - DESIGN REQUIREMENTS FOR ANCHORS SYSTEMS IN CONCRETE
. DA to DM - APPENDICES

PART C - CONSTRUCTION

. CGEOT - EARTHWORKS AND SOIL TREATMENTS
. CCONC - CONCRETE
. CREIN - REINFORCEMENT FOR REINFORCED CONCRETE
. CPTSS - POST TENSIONING SYSTEM
. CPREF - PREFABRICATED CONCRETE ELEMENTS AND REINFORCEMENT CAGES
. CCLIN - LEAKTIGHT METAL PARTS ON CONTAINMENTS
. CPLIN - POOLS AND TANKS
. CSTLW - STRUCTURAL STEELWORK
. CANCH - CONSTRUCTION REQUIREMENTS FOR ANCHOR SYSTEMS IN CONCRETE
. CBURP - REINFORCED CONCRETE PIPELINES
. CJOIN - JOINT SEALING
. CCOAT - COATINGS AND PAINTS
. CTOLR - SURVEY NETWORKS, TOLERANCES AND MONITORING SYSTEMS
. CA to CI - APPENDICES

PART M - MAINTENANCE AND MONITORING

. MCONT - LEAK RESISTANCE TEST AND CONTAINMENT MONITORING
. MA to MC - APPENDICES

2.5.4 Outlook

As already initiated by AFCEN in preparing the RCC-CW code, the development of the civil engineering code is continuing in the following directions:

. integrate feedback from projects currently under development or construction,

. broaden the scope of robust technologies covered by the code,

. encourage application of the code in the European and international arena by offering greater coverage of the latest international standards and promote the code as a civil engineering benchmark for the Prospective Groups that CEN set up to prepare the future nuclear codes,

. according to AFCEN's requirements and development objectives, develop appendices and addenda specifically addressing how the code can be adapted to the countries targeted by AFCEN.

The work program includes the following core topics:

. composite steel and concrete structures,

. pile foundations,

. improved reinforcement rates,

. maintenance,

. anchor channels,

. tolerances.

2.5.5 Technical publication on seismic isolation

Technical publication "PTAN – French Experience and Practice of Seismically Isolated Nuclear Facilities" was published in 2014.

It presents the best practices and experience of French industry resulting from the last 30 years in designing and installing seismic isolation systems beneath nuclear facilities.

This publication enables European industry to:

. codify the industrial design and construction practices according to AFCEN: in this respect, RCC-CW 2015 includes a section on seismic isolation,

. showcase its experience within international organizations and bodies (IAEA, OECD, WENRA, etc.).

At the same time, experts are working on dissipation systems to reinforce the seismic resistance of existing structures.

2.5.6 International activities

CEN/WS 64

The Subcommittee is involved in the activities of CEN Workshop 64.

The RCC-CW code is being shared with the other European participants.

During the workshop's activities, AFCEN will examine all requests to update the code.

Chinese Users Group (CSUG)

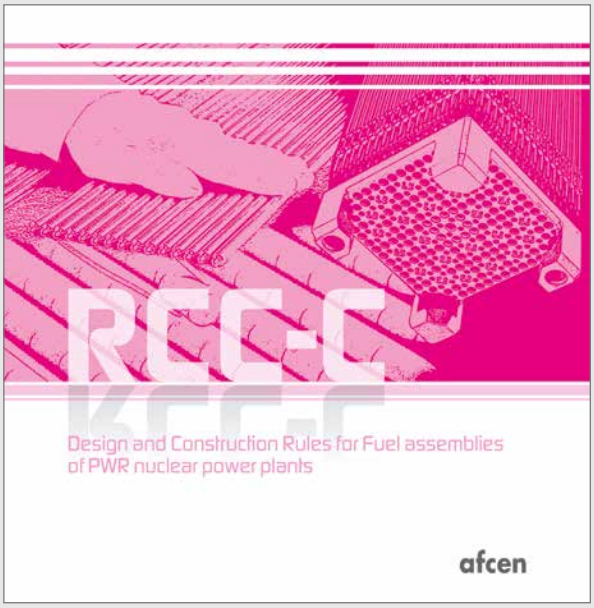
The ETC-C and RCC-CW codes are being shared within the Chinese Users Group, which held meetings in 2015, 2016 and 2017 attended by 20 to 30 Chinese experts.

Any interpretation requests for AFCEN codes issued during the meetings are examined by the Subcommittee.

UK Users Group

The UK Users Group on civil engineering codes includes the main companies involved in the Hinkley Point C project. The Users Group was officially launched during the AFCEN 2017 Conference. Following the kick-off meeting in November 2016, two meetings were held in June and December 2017.

2.6 NUCLEAR FUEL: RCC-C



THE RCC-C CODE

2.6.1 Purpose and scope

The RCC-C code contains all the requirements for the design, fabrication and inspection of nuclear fuel assemblies and the different types of core components (rod cluster control assemblies, burnable poison rod assemblies, primary and secondary source assemblies and thimble plug assemblies).

The design, fabrication and inspection rules defined in RCC-C leverage the results of the research and development work pioneered in France, Europe and worldwide, and which have been successfully used by industry to design and build nuclear fuel assemblies and incorporate the resulting feedback.

The code's scope covers:

. fuel system design, especially for assemblies, the fuel rod and associated core components,

. the characteristics to be checked for products and parts,

. fabrication methods and associated inspection methods.

2.6.2 Use and background

Use

The RCC-C code is used by the operator of the PWR nuclear power plants in France as a reference when sourcing fuel from the world's top two suppliers in the PWR market, given that the French operator is the world's largest buyer of PWR fuel.

Furthermore, fuel for EPR projects is manufactured according to the provisions of the RCC-C code.

The code is available in French and English. The 2005 edition has been translated into Chinese.

Background

The first edition of the AFCEN RCC-C code was published in 1981 and mainly covers fabrication requirements. The second edition of the code was released in 1986 and supplemented the first edition by including design requirements in a specific section at the end of the code. This structure remained unchanged and prioritized the fabrication aspects.

Between 2013 and 2015, the RCC-C Subcommittee was busy overhauling the code to implement a new structure for improved clarity as well as to reflect the requirements of the latest quality assurance standards and describe all technical requirements that have been missing from previous editions. 45 nuclear fuel experts were involved in these activities. The Subcommittee's work culminated in the 2015 French edition, which was translated into English the following year.

CHANGES TO THE CONTENTS OF THE RCC-C CODE, FROM THE 1981 EDITION TO THE 2015 EDITION

Contents of the 1981 code	Contents of the 1986 - 2005 code	Contents of the 2015 code
1 - General provisions 2 - Product and part characteristics 3 - Fabrication and related testing and inspection 4 - Tables of inspection requirements 5 - Inspection methods Appendices	1 - General provisions 2 - Product and part characteristics 3 - Fabrication and related testing and inspection 4 - Tables of inspection requirements 5 - Inspection methods 6 - Design	1 - General provisions 2 - Description of the fuel 3 - Design 4 - Manufacturing 5 - Handling and storage

2.6.3 Edition available as of early 2018

The RCC-C 2017 edition is the most recent version.

The main changes between the 2015 and 2017 versions are as follows:

In terms of the general requirements and description of the fuel:

A customer surveillance section has been added to Chapter 1 that specifies the customer's duty to monitor its fuel suppliers. It sets outs out the reasons and principles for implementing customer surveillance measures as well as the associated objectives. It includes the practice suggested in IAEA Guide NF-G-2.1 concerning quality aspects in nuclear power reactor fuel engineering.

In terms of design:

No changes have been made to the design chapter, insofar as ASN reviewed the fuel performance criteria in the summer of 2017.

The RCC-C code will be modified in 2018 to take account of any changes requested by ASN.

In terms of manufacturing:

The most significant modifications examined by the working group are as follows:

. Conditions for examining welded joints on core components: feedback from the manufacturing process has been taken into consideration for defining the most appropriate examination conditions in terms of magnification.

. Heat treatment of alloy 718: the use of specified heat treatment methods representing an alternative to those defined in the code have been introduced if they improve resistance to stress corrosion cracking. Specific measures relating to the partially recrystallized state have also been introduced.

. Harmonization of provisions relating to heat treatment on nozzles: stress relieving heat treatment is no longer mandatory due to the measures taken during dimensional inspections.

. Need to qualify laser marking: laser marking must be qualified in case of cladding tubes due to the component's criticality.

2.6 NUCLEAR FUEL: RCC-C

. Harmonization of the cobalt content for small components: the requirements of the RCC-M code have been included to specify the maximum cobalt content for the small stainless steel components in the assembly.

. Ultrasonic inspection of cladding tubes: the intervals for verifying ultrasonic inspection equipment have been adjusted to allow sufficient time to perform the inspection.

. Adaptation of the conditions for qualifying skeleton weld joints in terms of corrosion resistance: corrosion testing may be performed during qualification if the supplier continuously monitors the welding parameters during production.

. Declaration of the heat treatment conditions for debris filter plates: the code's provisions for this component have been harmonized with ASTM A638.

. Examination conditions for grid weld joints: if weld parameters are monitored in-line, visual inspections of the beads are no longer required. However, the examination conditions during qualification have been reinforced (high-magnification metallographic inspections).

. Certification of NDT personnel: the US standard SNT-TC-1A used by Westinghouse and AREVA in the United States has been introduced into the code. The list of standard and non-standard processes has been updated.

. Clarification of the conditions for the radiographic inspection of seal weld.

CONTENTS OF THE 2017 EDITION OF THE RCC-C CODE

Next edition

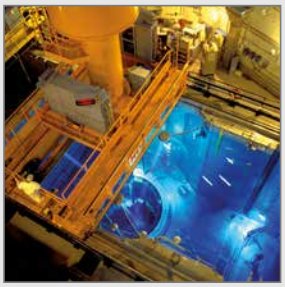
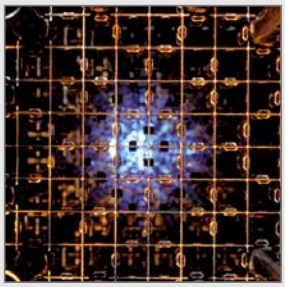
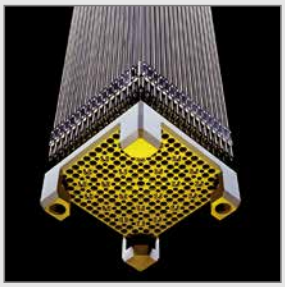
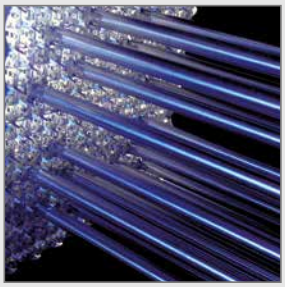
The next edition (in French and English) is scheduled for 2018.

2.6.4 Outlook

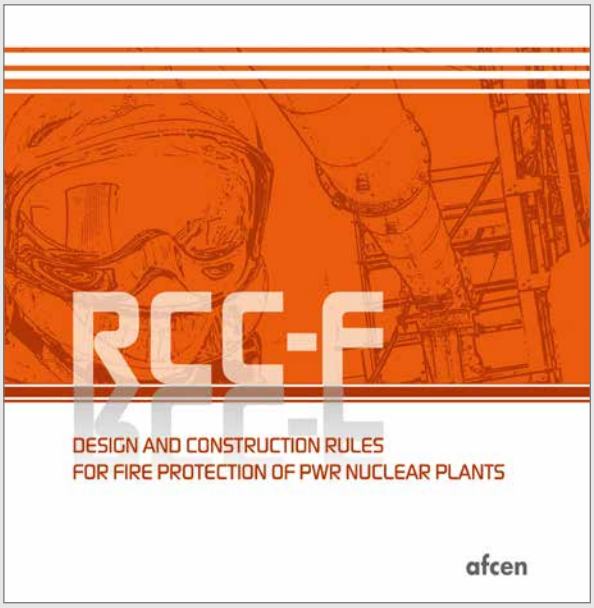
The RCC-C Subcommittee's work on adapting the design requirements will focus on incorporating the conclusions of the French 2017 Groupe Permanent on fuel performance criteria.

The code will also be amended to reflect changes in products. As such, there are plans to incorporate the design and manufacturing requirements for the new hafnium stationary control assemblies that are intended to reduce vessel fluence.

Manufacturing process requirements will be modified according to the proposals and feedback from Subcommittee members. There are also plans to clarify how heat treatment requirements apply to factories.

2.7 FIRE PROTECTION: RCC-F



THE NEW 2017 EDITION OF THE RCC-F CODE

2.7.1 Purpose and scope

The RCC-F code defines the rules for designing, building and installing systems in a PWR nuclear plant for managing the risk of a fire outbreak inside the facility in light of the nuclear hazards involved and thereby control the fundamental nuclear functions. The code also defines the rules for analysing and justifying the means used to create the safety demonstration.

This code's target readership is therefore:

. engineering firms responsible for designing, building and installing the buildings constituting a PWR,

. engineering firms responsible for analysing fire hazards and establishing the safety demonstration from a fire hazard perspective,

. engineering firms responsible for designing the means to prevent and protect against fires and mitigate the effects of a fire outbreak,

. suppliers of fire protection equipment,

. laboratories carrying out qualification testing of fire protection equipment,

. Nuclear Safety Authorities responsible for approving the safety demonstration.

The code defines the rules for designing and analysing safety demonstrations within a finite scope of service buildings in a light water nuclear power plant.

Design studies can be used to satisfy the code's requirements.

The code provides recommendations for guaranteeing that fire hazards are under control from a safety perspective during the design phase, while incorporating aspects relating to:

. the industrial risk (loss of assets and/or operation),

. personnel safety,

. the environment.

The code is divided into five main sections:

. generalities,

. design safety principles,

. fire protection design bases,

. construction provisions,

. rules for installing the fire protection components and equipment.

The RCC-F code is generally suited to light-water reactors, such as PWRs, as well as EPRs.

2.7.2 Use and background

In response to the needs of its Flamanville 3 EPR project in France, EDF published a reference document called ETC-F for the design of fire protection systems.

The EDF document was not published by AFCEN, but acted as a starting point for a fire protection code that AFCEN produced in 2009 as part of the RCC-F Subcommittee, which led to:

. initially, the publication of the 2010 edition of the ETC-F code similar to the EPR code,

. subsequently, the drafting of the 2013 edition, which gave less focus to the specifics of EPR projects but which still addresses the safety principles in alignment with existing EPR projects; UK regulations were incorporated into this version of the code,

. finally, the publication of the RCC-F 2017 code, which is generally suited to light-water reactors, such as PWRs.

2.7.3 Edition available as of early 2018

The RCC-F 2017 edition is the most recent version.

Amendments have been made based on the ETC-F 2013 edition and concern the following key topics:

1. Removal of the code's adherence to the safety principles for EPR projects

Safety principles (aggravating events, fire combined with thermal-hydraulic transients, combined stresses, fire outbreaks following an earthquake, and so on) are generally specified for each project according to the national and international context. In a code that covers fire hazards such as RCC-F, a concerted effort must be made to define an approach for adapting fire protection measures according to these principles. However, even if the principles used for this purpose correspond to updated best practices, they are mentioned for guidance only so their implementation can be adapted to suit other options by a project using the code. The code contains practical principles with this goal in mind.

2. Improved traceability of requirements

Various improvements have been made to this subject area to satisfy users' need to easily identify the source of the requirements that led to the rules defined within the code.

3. Improved identification of the code's scope

The code's scope is defined in the introductory chapters with a clear distinction between the parts of the installation where the code is fully applicable and the parts where national practices and regulations may take precedence.

2.7 FIRE PROTECTION: RCC-F

4. Update to the appendix on French regulations

Appendix A incorporates the specific changes to French and English regulations. The French appendix has undergone a significant review to incorporate the latest major changes (regulation on nuclear facilities and the ASN decision on the applicable rules for nuclear facilities). One of the consequences is that the body of the text in the code now features the new presentation of defence-in-depth vs. fire hazards in accordance with WENRA safety levels.

Finally, the 2017 edition overhauls the RCC-F code to ensure suitability for a wider range of light-water reactors, such as PWRs, while building on feedback from EPR reactors.

CONTENTS OF THE 2017 EDITION OF THE RCC-F CODE

2.7.4 International activities

In 2017, the RCC-F Subcommittee held a meeting with the CSUG (Chinese Specialized Users Group). The Chinese working group comprises 19 permanent members and was created during the first meeting in March 2015. Every year, a meeting is organized in China to improve interaction and help address the interpretation and/or modification requests issued by the CSUG.

Two meetings have been scheduled for 2018: one in June to coincide with the AFCEN Day event in June and the other in October in China.

A publication about RCC-F was released during the SMiRT 24 conference (15th International Post-Seminar on Fire Safety in Nuclear Power Plants and Installations). A publication is planned for the 26th ICONE Conference in 2018.

2.7.5 Outlook and preparation of the RCC-F 2020 edition

Outlook

AFCEN is aiming to develop the code in the following directions:

. integrate state of the art and feedback from projects currently under development or construction,

. drive the code's application on a European and international level by including international standards and regulations; according to requirements, this may prompt AFCEN to develop appendices and addenda specifically addressing how the code can be adapted to local regulations (refer to the exercise already carried out for the United Kingdom).

RCC-F 2020 edition

The next edition of RCC-F is scheduled for 2020. The content of the planned changes will be defined in 2018.

The general spirit behind these changes is to strengthen the sections that detail the code's application and provide the most extensive coverage possible, including methods, technical solutions and links with operations. The tasks currently on the to-do list will be prioritized, for example:

. integration of methods based on EDF references,

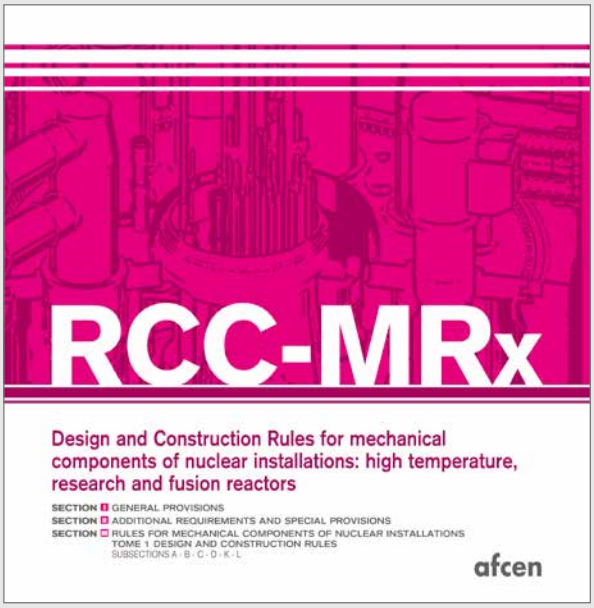
. modification requests issued by the CSUG,

. post-Fukushima considerations,

. comparison with international codes.

Examination of the RCC-F code in France as part of a new concept (EPR2) may give rise to new modification requests.

2.8 MECHANICAL EQUIPMENT FOR HIGH-TEMPERATURE, EXPERIMENTAL AND FUSION REACTORS: RCC-MRX



THE RCC-MRx CODE

2.8.1 Purpose and scope

The RCC-MRx code was developed for sodium-cooled fast reactors (SFR), research reactors (RR) and fusion reactors (FR-ITER).

It provides the rules for designing and building mechanical components involved in areas subject to significant creep and/or significant irradiation. In particular, it incorporates an extensive range of materials (aluminium and zirconium alloys in response to the need for transparency to neutrons, Eurofer, etc.), sizing rules for thin shells and box structures, and new modern welding processes: electron beam, laser beam, diffusion and brazing.

2.8.2 Background and use

Since 2009, the RCC-MRx code created by AFCEN's RCC-MRx Subcommittee has been an inclusion of two documents:

. The RCC-MR code, drafted by AFCEN's RCC-MR Subcommittee together with the Tripartite Committee formed on March 16, 1978 by the Commissariat à l'Energie Atomique, Electricité de France and Novatome, to establish the applicable rules for designing components working at high temperatures. AFCEN published four editions of RCC-MR in 1985, 1993, 2002 and 2007.

. The RCC-Mx code, drafted by the RCC-Mx Approval Committee formed on March 31, 1998 by the Commissariat à l'Energie Atomique, AREVA-TA and AREVA-NP for the specific needs of the RJH project (Jules Horowitz reactor). This code applies to the design and construction of experimental reactors, auxiliary systems and associated experimental devices. It can also be used for the design and construction of components and systems for existing facilities. CEA published two editions of RCC-Mx in 2005 and 2008.

An unpublished preliminary version of RCC-MRx created in 2010 by AFCEN was chosen as the baseline for the CEN CWA European Workshop (entitled “CEN-WS-MRx, Design and Construction Code for mechanical equipment of innovative nuclear installations”), which was intended to familiarize European partners with the RCC-MRx 2010 code and propose modifications to satisfy the needs of their projects. The results of the workshop were incorporated into the 2012 edition of RCC-MRx published by AFCEN.

The RCC-MR code was used to design and build the prototype Fast Breeder Reactor (PFBR) developed by IGCAR in India and the ITER Vacuum Vessel.

The RCC-Mx code is being used in the current construction of the RJH experimental reactor (Jules Horowitz reactor).

The RCC-MRx code is serving as a reference for the design of the ASTRID project (Advanced Sodium Technological Reactor for Industrial Demonstration), for the design of the primary circuit in MYRRHA (Multi-purpose hYbrid Research Reactor for High-tech Applications) and the design of the target station of the ESS project (European Spallation Source).

2.8.3 Edition available as of early 2018

CONTENTS OF THE 2015 EDITION OF THE RCC-MRx CODE

The 2015 edition is the most recent version

This edition reflects feedback on the use of the 2012 edition and/or its 2013 addendum, especially in current projects and mainly the Jules Horowitz reactor and the ASTRID project. Examples include the inspection and welding procedures for aluminium, as well as the code’s improvements and new structure relating to components used at high temperatures (design rules, welded assemblies and material properties).

2.8 MECHANICAL EQUIPMENT FOR HIGH-TEMPERATURE, EXPERIMENTAL AND FUSION REACTORS: RCC-MRX

Initial feedback on the code's application also helped analyse and integrate additional data on the Eurofer material used by the fusion community.

Furthermore, this edition pays special attention to ensuring consistency between RCC-MRx and the other reference documents that interact with the code, including RCC-M, European and international standards.

2.8.4 Outlook

In 2017, efforts focused on preparing the new edition of RCC-MRx, which is scheduled for publication in 2018. This edition will include:

. the findings of Workshop 64 (CWA),

. the results of the commissioned study aimed at improving the rules to take account of irradiation: the study led to two modifications relating to an adjustment of the toughness values for 316L(N) and the fields to which the code applies in respect of irradiation,

. a new organization for the chapters addressing fast fracture,

. a new organization for the chapters addressing progressive deformation,

. feedback from the RJH project.

2.8.5 Technical studies

In 2016, work was finalized on the commissioned study entitled "Terms for introducing a new material into RCC-MRx". This study led to the publication of a methodological guide (AFCEN/RX.17.004 "Guide for introducing a new material in RCC-MRx"), which explains, when introducing a non-coded material into RCC-MRx, the definition of the methods for obtaining the characteristics in Appendix A3 (expected / possible tests, meaning of the data).

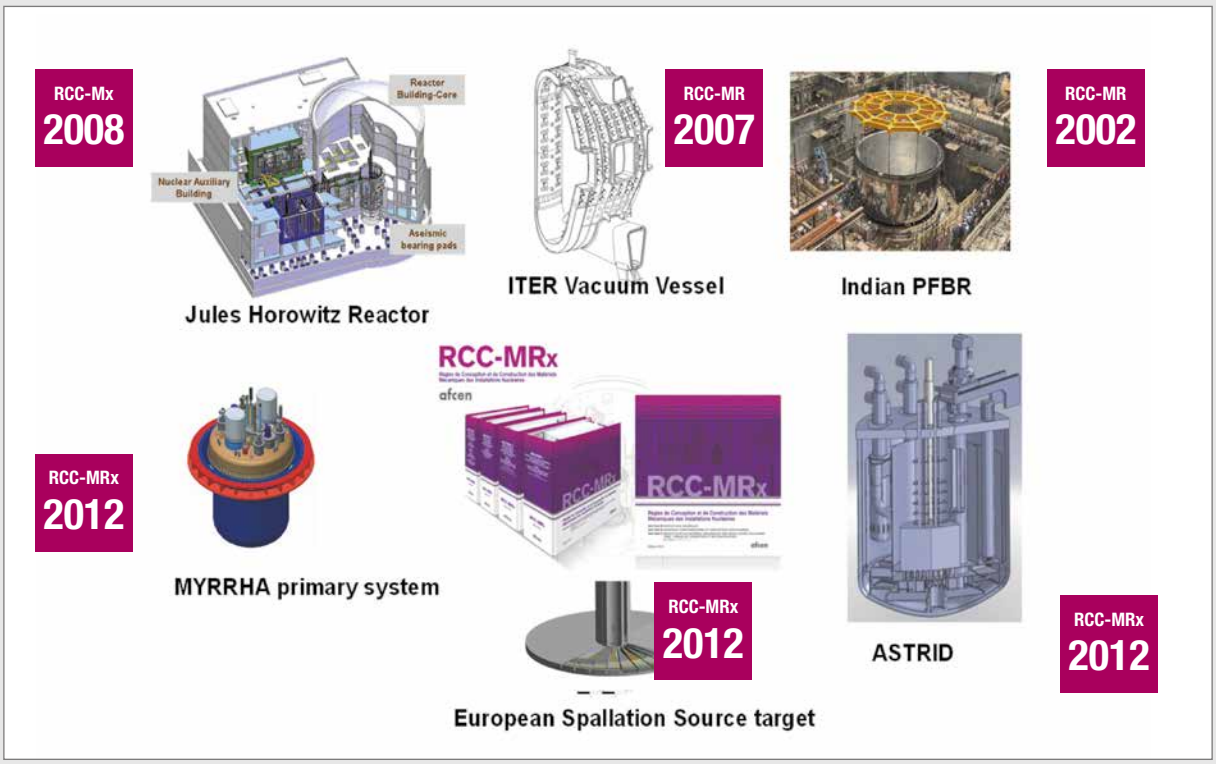
The RCC-MRx Subcommittee launched three commissioned studies in 2017:

. Fast fracture analysis: this commissioned study also involves the RCC-M code. The aim is to standardize practices between the RCC-M and RCC-MRx codes and clarify the approach for identifying areas where fast fracture analyses must be performed.

. Preparation of a document describing the sources and key reasons underlying Appendix A1 (guide for the seismic analysis of equipment): the aim of this commissioned study is to publish the criteria for Appendix A1 in a PTAN.

. Update of RCC-MRx – Section II – Part REC 3000 (Special instructions for equipment subject to regulations): the purpose of this commissioned study is to update the sections on French regulations in line with the work carried out for RCC-M.

USE OF THE RCC-MX CODE IN HIGH-TEMPERATURE, EXPERIMENTAL AND FUSION REACTORS



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3

HARMONIZATION AND COOPERATION

3.1 STANDARDS

AFCEN codes are based on standards. When drafting codes, ISO international standards are the first port of call when available, otherwise European EN standards are used.

If there are no existing ISO and/or EN standards for a given field, the codes use other standards as their reference.

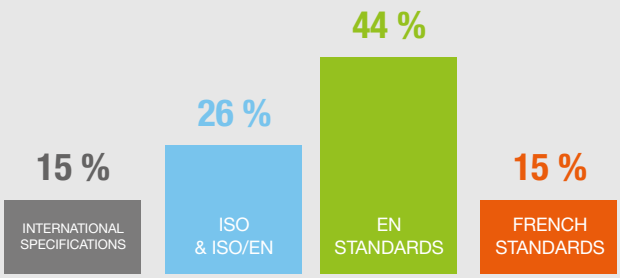
The standards used by a code are specified in one of the code's chapters.

The Subcommittees occasionally analyse the standards to determine whether any revisions have been made in order to ensure that codes are up-to-date. In addition, AFCEN makes a point of determining how many of its expert members take part in the standardization bodies that produce standards with a potentially significant impact on its codes and subsequently increasing their presence if necessary.

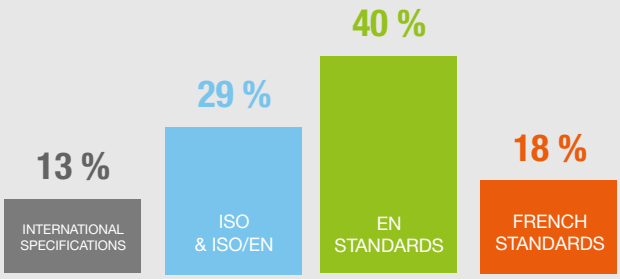
The two diagrams below illustrate AFCEN's approach for prioritizing the use of international or European standards in the RCC-M 2012 and RCC-CW 2015 codes.

USE OF STANDARDS IN THE RCC-M 2012 AND RCC-CW 2015 CODES

234
STANDARDS AND SPECIFICATIONS
DIRECTLY REFERENCED IN **RCC-M CODE**
70% : ISO, ISO/EN AND EN



227
STANDARDS AND SPECIFICATIONS
DIRECTLY REFERENCED IN **RCC-CW CODE**
69% : ISO, EN/ISO AND EN



3.2 HARMONIZATION AND COOPERATION INITIATIVES

A major force in the nuclear codes sector around the world, and as part of its determination to continually incorporate industry best practice and local regulations for its code users, AFCEN is naturally involved in the harmonization programs either set up by international organizations or created at its own initiative.

For example, AFCEN contributes to the objectives of harmonizing mechanical codes as set forth in the multinational design evaluation program (MDEP) implemented by the Safety Authorities in the main countries using nuclear energy.

Similarly, AFCEN is an observer in the “Codes & Standards” task force of the working group (formed by the World Nuclear Association WNA, which includes industry’s main players) on cooperation in reactor design evaluation and licensing (CORDEL).

In the same spirit, AFCEN’s members are active in various standardization bodies at the European (CEN / CENELEC) and international level (ISO / IEC).

In addition, AFCEN has launched a strategy to examine the needs for Gen II to IV reactors at the European level through Workshop 64 of the European Committee for Standardization (CEN).

3.2.1 MDEP

AFCEN has taken part in the group of Standards Development Organizations (SDOs) ever since it was created by the MDEP (Multinational Design Evaluation Program) Mechanical Codes and Standards Working Group (CSWG) in 2006. With this aim in mind, the “Convergence Board [for nuclear mechanical codes]” was created in 2010 to identify and facilitate the introduction of compatible rules in each of the mechanical codes. AFCEN is a member of the Convergence Board, similarly as ASME, JSME, KEPIC, CSA and NIKIET. The SDO Board holds three meetings a year in addition to the ASME Code Week and reports on its work once a year to MDEP/CSWG.

The different organizations share their views about the technical subject areas that deserve to be compared and potentially made similar or equivalent across the codes: fatigue curves and environmental effects, piping design rules, and the use of finite element analyses for classifying stresses. SDOs take an in-depth look at the work that has already been performed on comparing codes. ASME ST-LLC published a report entitled “Code Comparison Report for Class 1 Nuclear Power Plant Components” in 2012 that identifies the different subject areas for which a code comparison could be beneficial, as well as a comparison of welding practices in 2016. SDOs also draw inspiration from the work performed by WNA/CORDEL.

In 2017, AFCEN took part in the SDO Board meetings, as well as the fourth MDEP Conference in September. Attendees reported on the difficulty involved in strictly harmonizing the codes, and the issue of reconciling or creating equivalent codes remains open. Representatives from the SDO Convergence Board met the Nuclear Safety Authorities during a joint meeting with the MDEP Codes & Standards Task Force (CSWG-MDEP) in November in Phoenix, which was also attended by the CORDEL/WNA Codes & Standards group.

In 2018, AFCEN has every intention of pursuing its involvement within the SDO Board. However, the prospect of annexing the SDO Board to MDEP/CSWG may be challenged and referred to the OECD.

3.2 HARMONIZATION AND COOPERATION INITIATIVES

3.2.2 CORDEL

WNA (World Nuclear Association) created the CORDEL working group (Cooperation in Reactor Design, Evaluation and Licensing) in 2007 to stimulate dialog between the international nuclear industry and Safety Authorities.

AFCEN's RCC-M Subcommittee is invited to voice its opinion about the work of the Mechanical Codes & Standards Task Force (CORDEL/MCSTF). In 2015, AFCEN endorsed the publication of a document comparing the qualification of non-destructive testing personnel (Qualifications for NDE Personnel, Harmonization of International Code Requirements). In 2016, WNA/CORDEL published a comparative study on welding practices commissioned by the SDO Convergence Board featuring input from AFCEN's members. In 2017, WNA/CORDEL published a code comparison report on non-linear analysis design rules and is continuing to work on a set of benchmarks based on test cases featuring contributions from AFCEN code users. The project aimed at comparing different fatigue analysis practices was submitted to AFCEN, which will check the elements presented in the RCC-M and RCC-MRx codes.

CORDEL is a useful platform for AFCEN and its members to harmonize best practices in nuclear codes at the international level.

3.2.3 CEN WORKSHOP 64

A proposal was initially made within CEN to set up a workshop to encourage the different organizations and stakeholders in the ESNII (European Sustainable Nuclear Industrial Initiative affiliated with SNETP and covering Generation IV fast neutron reactors) to help with enhancing the draft version of the RCC-MRx code. The European Commission has been associated with AFCEN's initiative since day one and has lent its support ever since. This proposal was accepted by CEN and joined by 14 European organizations.

Workshop 64 (WS 64), named "Design and Construction Code for mechanical components of innovative nuclear installations", was created on February 3, 2011. Its terms of reference were compared to those in force within AFCEN's Subcommittees. The workshop ran until October 2012 and produced 33 modification proposals for the RCC-MRx code, 20 of which were incorporated into the published edition. Furthermore, 8 of the 13 other proposals, which could not be converted into modification sheets due to a lack of technical justification, highlighted the need for mid-term changes to the code.

Feedback on the first initiative was considered to be highly satisfactory and rewarding by all stakeholders. Spurred on by these results, AFCEN took the initiative of continuing this action by fine-tuning objectives according to two focus areas:

. invite short-term project leaders to come and work directly in the Subcommittee in order to enhance the code with the driving force adapted to their requirements,

. prepare the future codes within external prospective groups, where parties potentially using codes for medium and long-term projects can express their technical requirements, discuss which supporting evidence is required, any R&D actions needed and the installations where such actions can be carried out.

As part of the first focus area, AFCEN gained three new European members.

The second focus area prompted AFCEN to propose a second phase for Workshop 64 with a broader scope than for Phase 1; in other words, in addition to mechanical engineering for Gen IV nuclear facilities, Phase 2 includes mechanical components for current reactors (based on the RCC-M code) and civil engineering works (based on the RCC-CW code).

This proposal was again accepted by CEN and has currently been joined by 15 organizations.

Workshop 64 – Phase 2, entitled "Design and Construction Code for mechanical and civil engineering for Gen II to IV nuclear facilities (pilot case for process for evolution of AFCEN codes)", was created on June 6, 2014 for a three-year term, which may be renewed if necessary according to the participants' needs and interests. Since the workshop's participants experienced difficulties in assimilating the codes, which in turn put the workshop's production phase behind schedule, members formally agreed during the plenary meeting on June 8, 2017 to extend Phase 2 by one year. This extension will enable participants to fully implement the process for ensuring continuous coordination with AFCEN, such as stipulated in the business plan.

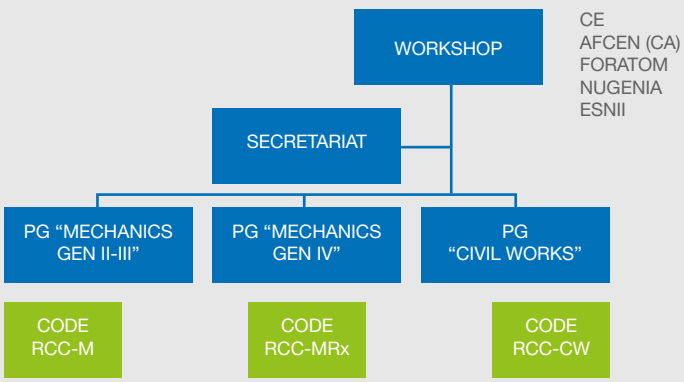
The workshop comprises three "prospective groups", each of which covering one of the aforementioned fields (Gen II-III mechanical engineering, Gen IV mechanical engineering and civil engineering works) and led by renowned experts from organizations that are not AFCEN members.

In each group, AFCEN has delegated a representative from the relevant Subcommittee to guide the group's work and provide information on the codes and the methods for updating the codes.

Early 2017, AFCEN sent its response to the workshop concerning the 13 proposals issued in 2016. AFCEN agreed to incorporate ten of the proposals without any changes, while agreeing in principle to two other proposals subject to having the necessary time to give the proposals due consideration. However, AFCEN saw no merit in accepting the workshop's proposal of supplementing the codes with requirements relating to independent inspection organizations and explained its reasons accordingly.

Based on the performance of this first stage, AFCEN has proposed continuing this initiative with Phase 3. Phase 3 is aimed at inviting proposals for code changes from the operators, the authorities' technical support teams and industry players who could ultimately be involved in evaluating and taking part in nuclear projects using AFCEN codes.

ILLUSTRATION OF AFCEN'S PARTICIPATION IN CEN



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4

SUPPORT THROUGH TRAINING

The Training Committee ensures that certified training is available to users of AFCEN codes.

AFCEN does not personally run training courses, so that its experts can remain focused on drafting codes.

By delegating training to external providers, the Training Committee is responsible for assessing their ability to provide such training.

To do so, the Training Committee relies on the relevant Subcommittees wherever practicable.

It establishes partnership agreements with training organizations and manages all the aforementioned aspects.

Partnership agreements

AFCEN has signed partnership agreements with 12 organizations that are qualified to provide technical training:
VINCOTTE ACADEMY, APAVE, AREVA UNIVERSITY, BUREAU VERITAS, CETIM, PONT FORMATION CONSEIL, EFECTIS, INSTITUT DE SOUDURE GROUP, INSTN, NUCLEXPERT, SICA NUCLEAIRE AND SNPI (CGN GROUP)

PARTNERSHIP AGREEMENTS SIGNED BY AFCEN AND TRAINING ORGANIZATIONS BY THE END OF 2017

4.1 CERTIFIED TRAINING

Following proposals from the training officers, the Committee has certified the content of 25 training courses to date.

When certifying courses, AFCEN validates the teaching aids and materials, and trainers are first audited and approved by specialists from the field in question.

Organizations that have signed a partnership agreement are authorized to provide trainees with certificates of attendance signed jointly by AFCEN.


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Logo Organisme

ATTESTATION

de suivi de la session de formation

« TITRE DE LA FORMATION »

Titre du Code

Délivré à : M./Mme Prénom Nom

de la société : Société

***Session réalisée* : du** jj **au** jj mmm 20xx **à** lieu **– (durée** XX **heures)**

Domaines techniques couverts par le stage : Contenu de la formation en termes de domaines du code couverts.

Fait à Lieu, le jj mmm 20xx

Pour l'AFCEN

Le Correspondant Formation CODE

Nom, Prénom

Pour l'organisme

Le Responsable de la Formation

XXXXXX

www.afcen.com

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AFCEN CERTIFICATE OF ATTENDANCE

AFCEN TRAINING CATALOG AS OF LATE 2017 (DETAILS IN APPENDIX C)

Code	Type of training	Duration	Language	Partnership
RCC-M	Introduction & further study of the code	2 to 5 days	FR / EN / CH	Seven partner companies
	Structure and application of the code	3 days	FR	One partner
	Procurement and materials according to the code	1 day	FR	One partner
	Quality assurance	1 day	FR	One partner
	Examination methods	2 days	FR	One partner
	Design and sizing	2 days	FR	One partner
	Fabrication - Welding	2 days	FR	One partner
RSE-M	Introduction to the code	3 days	FR	Two partners
RCC-E	Introduction to the code	1 day	FR/EN	One partner
	Comprehensive code training	4 days	FR	One partner
	Qualification and long-term fabrication of components qualified under accidental conditions	3 days	FR	One partner
RCC-CW	General introduction	1 day	FR/EN	One partner
	Construction	2 days	FR/EN	One partner
	Design	3 days	FR/EN	One partner
RCC-F	Comprehensive code training	4 days	FR/EN	One partner
RCC-MRx	Introduction to the code	3 days	FR/EN	Three partners

AFCEN makes a point of notifying all training organizations that have signed a partnership agreement of any changes and modifications made to the codes. Teaching sequences for the code in question are updated and defined in mutual agreement with AFCEN.

4.2 TRAINING COURSES DELIVERED IN 2017

In 2017, 76 training sessions were held and covered all codes, representing 495 trainees and 1,908 days of training. Training quality was assessed per code and organization, with specific attention to ensure that all associated messages related to nuclear safety were effectively delivered.

By the end of 2017, the certified training catalogue was stable. Course content was updated to reflect the technical changes made to the new editions of the codes. To support the three-year program relating to the ESPN Regulation, AFCEN and its partners are developing courses focusing on the ESPN documentation (guides, changes to the RCC-M code, etc.), which should be available in 2018.

Taking part in the various breakout sessions and workshops during the Nuclear Valley conference in November 2017 offered a very clear insight into industry's specific needs, which AFCEN is now seeking to address through a series of action plans for its members.

4.3 INTERNATIONAL TRAINING

The Training Committee also implemented the appropriate processes to allow AFCEN certified training to be carried out abroad. The courses organized by international training providers that have signed partnership agreements with AFCEN, irrespective of the country or the language used, therefore offer the level of quality expected by the Subcommittees that produce the codes.

In 2017, courses were delivered in Germany, Belgium and the United Kingdom.

A partnership agreement has been signed in China with SNPI (CGN Group). The RCC-M training course provided by this organization was certified in 2016. In 2017, 127 trainees completed the RCC-M course.

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A

ORGANIZATION AND OPERATION OF AFCEN

APPENDIX

A.1 AFCEN'S MISSION

AFCEN is an association whose primary purpose is to:

. produce up-to-date codes offering accurate and practical rules for the design, construction and in-service inspection of components for use in industrial or experimental nuclear facilities (RCC- and RSE- codes),

. ensure certified and readily-available training programs enabling code users to achieve a high level of expertise, knowledge and practical skills in using AFCEN codes.

AFCEN codes form a consistent set of rules that:

. encompasses a broad spectrum of technical fields, including mechanical engineering, electricity and I&C systems, nuclear fuel, civil engineering works and fire protection systems,

. has been evolving over the last 35 years to reflect changes in safety requirements, technological progress and international feedback based on users' practices,

. offers an overarching approach to nuclear facility design and construction without specifically targeting a given type of project,

. can adapt to the specific local regulations applicable in different countries,

. helps unify and rally a country's entire nuclear industry around the same reference framework.

Codes are continually updated to incorporate feedback from international industry best practices and changes to regulations, while striving to achieve harmonization with the other nuclear codes used around the world.

This ongoing activity is driven by an organizational and operational structure in response to AFCEN's Quality Management Policy, whose key goals are to:

. prioritize the quality of its publications, which contribute to the safety and economic performance of sustainable nuclear facilities,

. deliver a fast response to inquiries made by users and interested parties,

. encourage members and customers to adopt a safety culture,

. disseminate and promote uptake of the codes, especially through training and information systems.

AFCEN codes are published in English and French.

To improve distribution and uptake by industry in certain countries, editions of AFCEN codes have been translated into Chinese and Russian with AFCEN's consent.

A.2 ORGANIZATION AND OPERATION

A.2.1 General organization

General organization

AFCEN is an international association. Its members are companies from the nuclear or conventional energy sector (when operating in the nuclear sector), whose activities are related to the technical fields covered by AFCEN codes.

AFCEN organizes one General Meeting a year for its members, during which its general strategic directions and budget are approved.

AFCEN is managed by a Board of Directors, which defines and ensures compliance with the association's strategic objectives and provisional budget once adopted by the General Meeting.

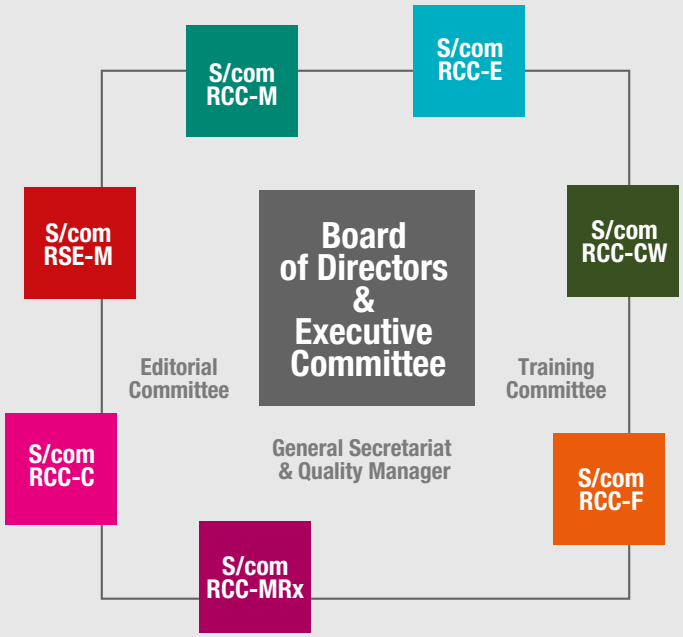
To achieve its work program, the Board is supported by an Executive Committee comprising designated members from the association. The Executive Committee is assisted by a General Secretariat, which is responsible for the general coordination of the association's activities, a Training Committee, an Editorial Committee and Subcommittees, each of the Subcommittees covering a technical field associated with a specific code.

AFCEN does not have any regular employees. Its work is entrusted to experts who have been designated and made available by its members. The organization and operation of AFCEN's different entities reflect this particular situation.

In some countries, such as China and the United Kingdom, AFCEN has set up local structures to help the Subcommittees more easily understand the codes and incorporate national issues into their work.

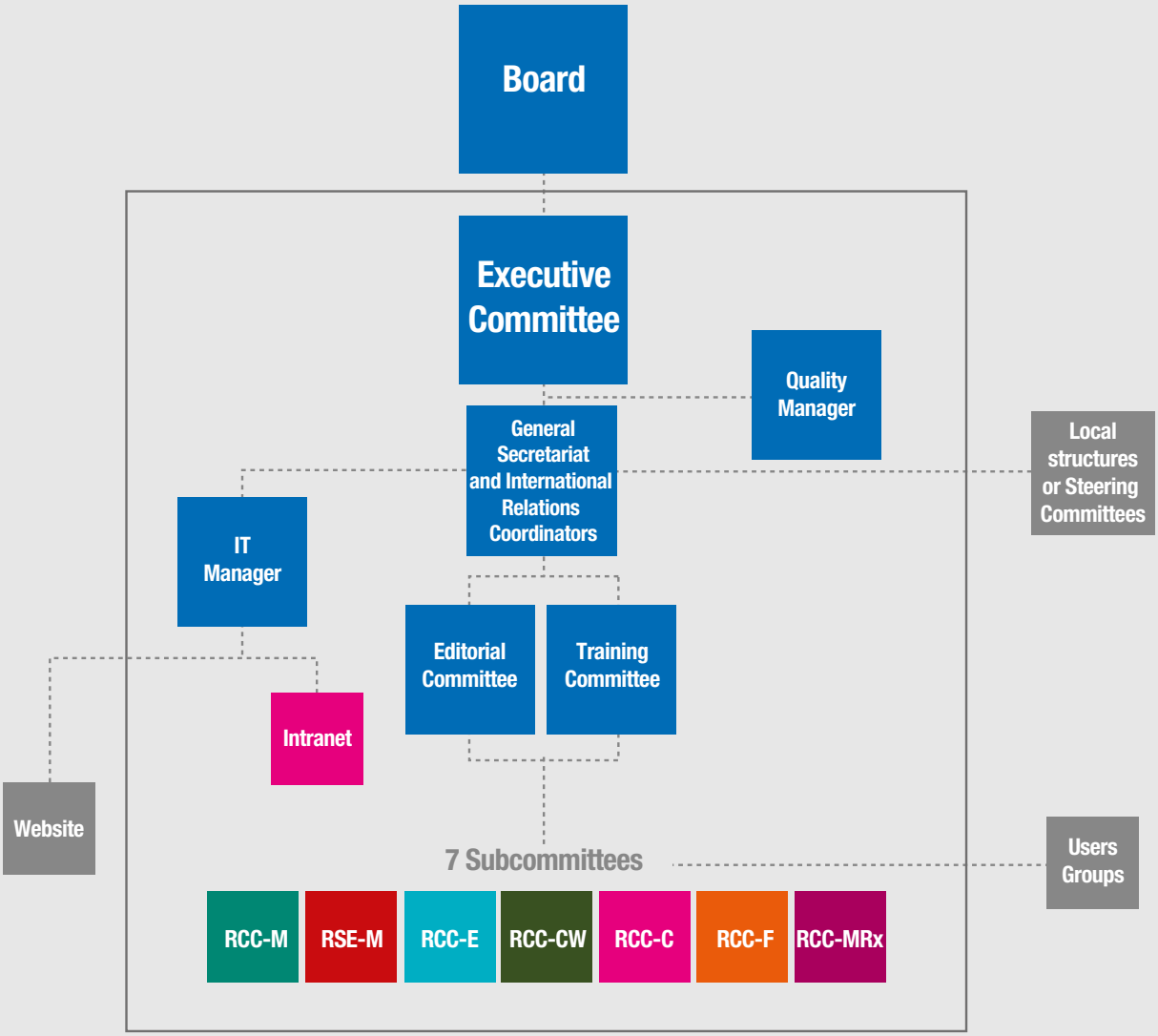
These local structures usually comprise Users Groups. Users are not necessarily AFCEN members. Each Users Group is associated with a code.

Each Users Group is chaired by an AFCEN member as part of an agreement. In cases where a country has several Users Groups, a Steering Committee is created to coordinate their activities.



AFCEN'S ORGANIZATIONAL STRUCTURE

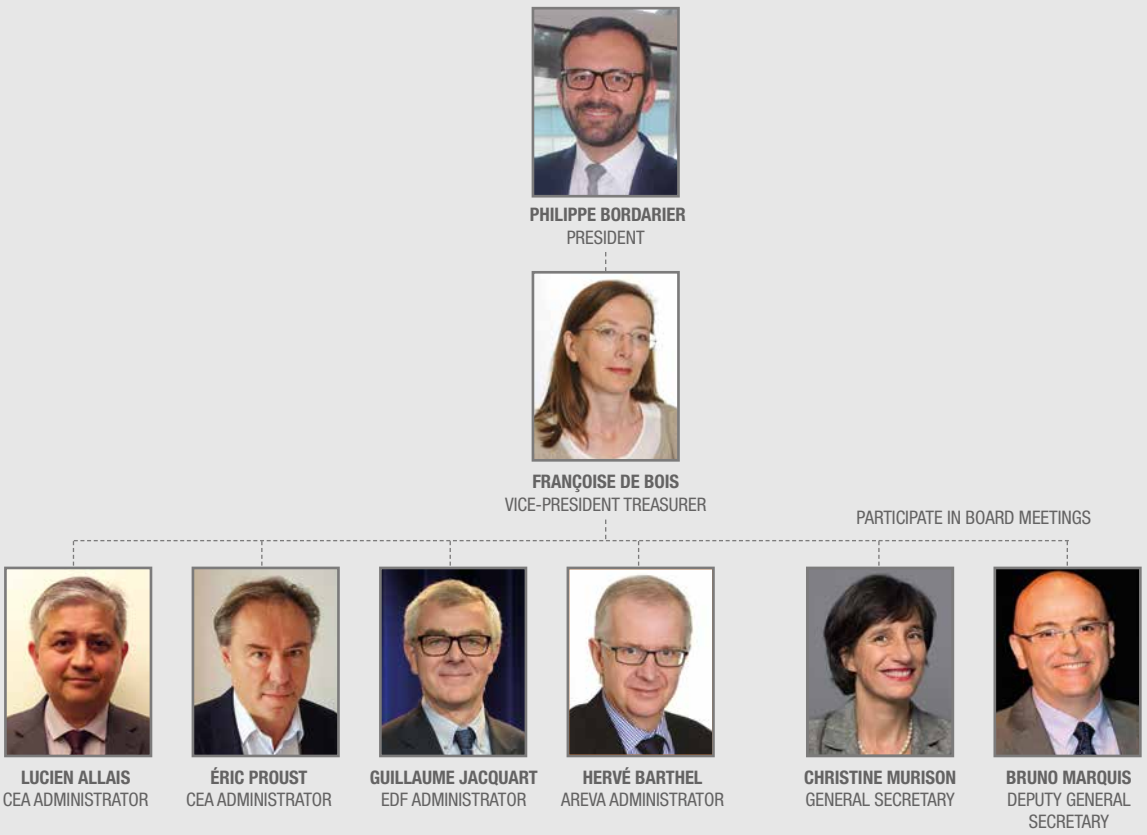
A.2 ORGANIZATION AND OPERATION



GENERAL ORGANIZATION OF AFCEN

A.2.2 General Meeting and Board of Directors

AFCEN is managed by a Board of Directors, whose members are appointed according to its articles of association and which reports on its activities to the members of the association during the General Meeting.



AFCEN'S BOARD OF DIRECTORS

A.2 ORGANIZATION AND OPERATION

The activity of the Board of Directors and the General Meeting in 2017 is summarized in the box below.

ACTIVITY OF THE BOARD OF DIRECTORS AND THE GENERAL MEETING IN 2017

The Board of Directors held three meetings in 2017, while the Executive Committee held six meetings.

During the General Meeting on March 2, 2017, members approved the following operational objectives for 2017:

. continue the process of updating the codes to satisfy the industrial needs of its members to improve safety and achieve a competitive advantage,

. in France, pursue work on the three-year program to bring the mechanical codes into alignment with the level required by the ESPN Regulation,

. continue its international development policy in China and Europe, and promote AFCEN's codes and their national appendices in countries of strategic value to its members,

. continue opening AFCEN to new members and reinforcing their participation in the technical working groups,

. strengthen and develop training solutions to meet the needs of the nuclear industry,

. reinforce the sales model to safeguard the association's revenue,

. obtain ISO 9001:2015 certification.

In 2017, EDF appointed two new administrators on AFCEN's Board of Directors: Philippe Bordarier (incumbent) and Guillaume Jacquart (deputy). CEA appointed Lucien Allais as administrator (incumbent).

Philippe Bordarier was named AFCEN's President by the administrators during the Board meeting on September 14, 2017.

As part of the asset transfer from AREVA NP to New NP following moves to restructure the French nuclear industry, an extraordinary general meeting was held on December 21, 2017, to approve the motion to transfer the status of founder member from AREVA NP to New NP, which has been renamed Framatome. Article 6 of the Articles of Association that defines the founding members has been amended accordingly.

The Board of Directors also approved the following appointments in 2017:

. Frédéric Beaud (EDF) was appointed Chair of the Editorial Committee on September 1, 2017, taking over from Denis Buisine.

. Cédric Couffignal was appointed Deputy Chair of the Editorial Committee and Head of the ESPN program on September 1, 2017.

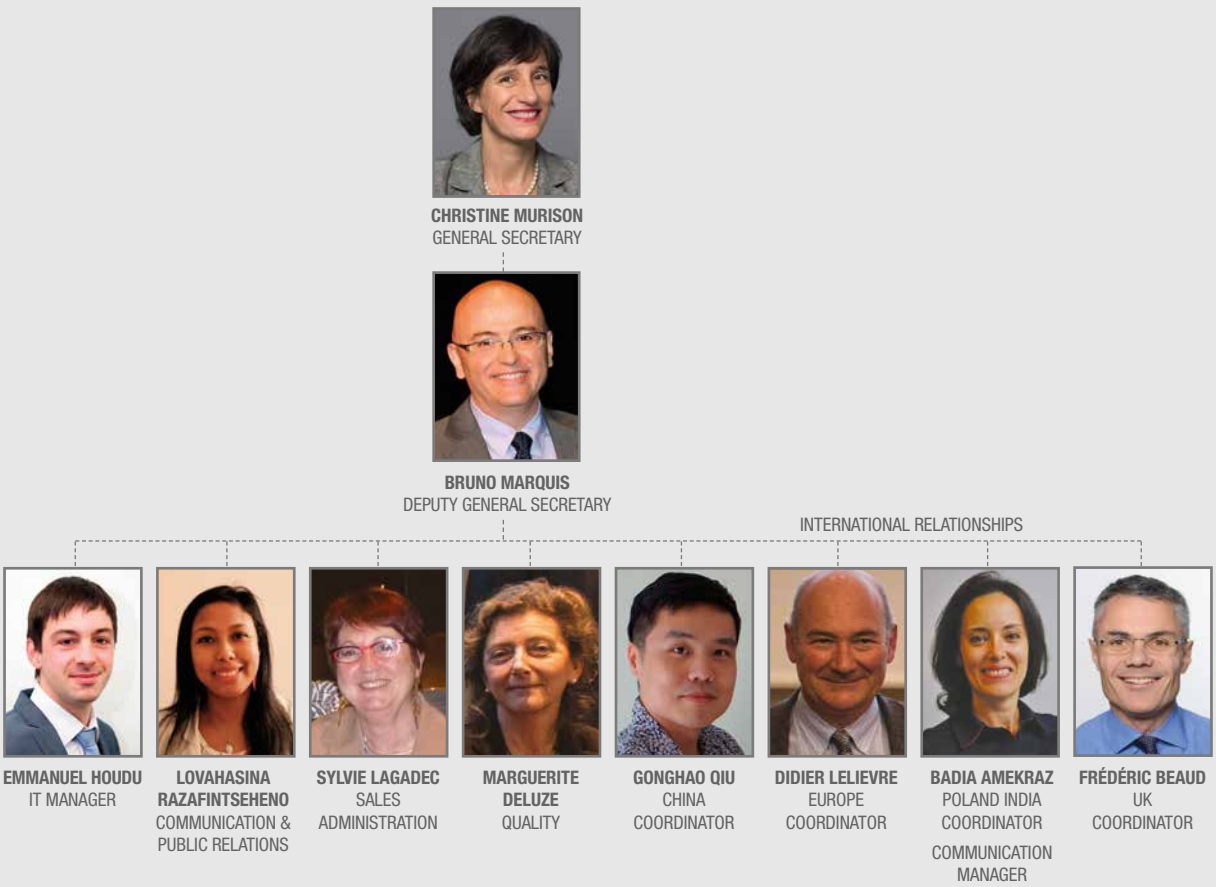
. Emilie Samain was appointed Deputy Chair of the RSE-M Subcommittee.

A.2.3 General Secretariat

The General Secretariat oversees AFCEN's operation, proposes strategic directions to the Board of Directors and implements the actions chosen by the Board. The Secretary-General and Deputy Secretary-General are appointed by the Board of Directors.

It organizes and coordinates all AFCEN activities deployed by the Editorial and Training Committees.

On an international level, the General Secretariat is supported by International Relations Coordinators and local representatives if applicable.



AFCEN'S GENERAL SECRETARIAT

The General Secretariat provides AFCEN's constituent entities and their members with a collaborative work tool called "AFCEN-Core".

This tool simplifies interaction between experts on a national and international level, while providing them with the data required for their work and enabling them to archive their work in accordance with confidentiality and intellectual property rules.

A.2 ORGANIZATION AND OPERATION

Access to this tool by members and their designated representatives is subject to AFCEN membership and compliance with such confidentiality rules.

For everyday communication with code users and more generally with interested parties, AFCEN offers a website **(www.afcen.com)** containing information on the codes and their environment, membership forms and the sale of its publications, as well as forms for submitting interpretation and modification requests to AFCEN.

For the routine management of AFCEN's activities, the General Secretariat holds weekly conference calls that are open to the Committee Chairs and Deputy Chairs and the International Relations Coordinators.

A.2.4 Editorial Committee

The Editorial Committee Chair is appointed by the Board of Directors. The Editorial Committee is attended by the Chairs from each Subcommittee. The Secretary-General and the Deputy Secretary-General are invited to attend Editorial Committee meetings. International stakeholders and the IT Manager are also invited, depending on the meeting agenda.

The Editorial Committee is responsible for authoring and updating the codes published by AFCEN, as well as carrying out the associated technical studies. The committee defines AFCEN's editorial program, monitors and guides the work of the Subcommittees and approves the code editions and modifications prior to publication.

The Editorial Committee oversees the quality of AFCEN's publications. The quality of publications contributes to the safety and availability of nuclear facilities and takes account of the economic aspect of building and operating such facilities by leveraging feedback from international industry best practices.

The editorial program is aimed at responding to the needs of AFCEN's members.

Standard practice is for members to express their needs by means of code Requests for Modification (RM) or Requests for Interpretation (RI). Such needs may also be voiced during general meetings or any events organized by AFCEN. The various international schemes set up by AFCEN are ultimately intended to ascertain potential requirements.

As such, the Editorial Committee guides the work of each Subcommittee and proposes how all cross-functional tasks are to be distributed.

The Editorial Committee is also the preferred means for circulating information to and fro between the executive bodies and the experts.

The general activity of the Editorial Committee in 2017 is summarized in the box opposite.

FRÉDÉRIC BEAUD
CHAIRMAN OF THE EDITORIAL COMMITTEE

GENERAL SECRETARY
AND DEPUTY GENERAL SECRETARY

CLAUDE DUVAL
DEPUTY

CÉDRIC COUFFIGNAL
DEPUTY

STÉPHANE MARIE
CHAIRMAN
OF THE RCC-M
SUBCOMMITTEE

BERTRAND ROBAULT
CHAIRMAN
OF THE RSE-M
SUBCOMMITTEE

PIERRE CHAMPEIX
CHAIRMAN
OF THE RCC-E
SUBCOMMITTEE

CLAUDE DUVAL
CHAIRMAN
OF THE RCC-CW
SUBCOMMITTEE

MARC TON-THAT
CHAIRMAN
OF THE RCC-C
SUBCOMMITTEE

RICHARD TULINSKI
CHAIRMAN
OF THE RCC-F
SUBCOMMITTEE

CÉCILE PETESCH
CHAIRMAN
OF THE RCC-MRx
SUBCOMMITTEE

AFCEN'S EDITORIAL COMMITTEE

General activity of the Editorial Committee in 2017:

The Editorial Committee held 4 meetings. The main items addressed during the meetings were as follows:
a. Latest news (conferences, international activities, relations with Safety Authorities, feedback, etc.)
b. Changes in the organization and practices
c. Commissioned studies
d. Subcommittee reports
The Editorial Committee approved the publication of five 2017 editions for the RCC-M, RSE-M, RCC-CW, RCC-C and RCC-F codes.

The process of incorporating the essential safety and radiation protection requirements stipulated in European and French regulations (PED Directive / ESPN Nuclear Pressure Equipment Regulation) continued unabated, with the publication of guides and addenda for the RCC-M and RSE-M codes ahead of the 2018 editions, with the aim of obtaining endorsement from ASN and GSEN that the provisions conform to the requirements of the regulation.

In addition to amending the codes in the permanent working groups within each Subcommittee, dedicated working groups were regularly set up to develop specific technical subject areas. These groups may operate within a given Subcommittee or focus on several codes at the same time at the request of the Editorial Committee.

For example, efforts are being directed at designing mechanical and electrical equipment to withstand extreme natural hazards.

A new series of dedicated work programs was launched in 2017, including improved fast fracture resistance (RCC-M/RCC-MRx), qualification of scientific computing tools (RCC-C), containment penetrations (RCC-CW/RCC-M/RCC-E) and non-destructive testing and inspections (RCC-M / RSE-M).

A.2 ORGANIZATION AND OPERATION

A.2.5 Training Committee

The Training Committee ensures that certified training is available in each field for AFCEN code users.

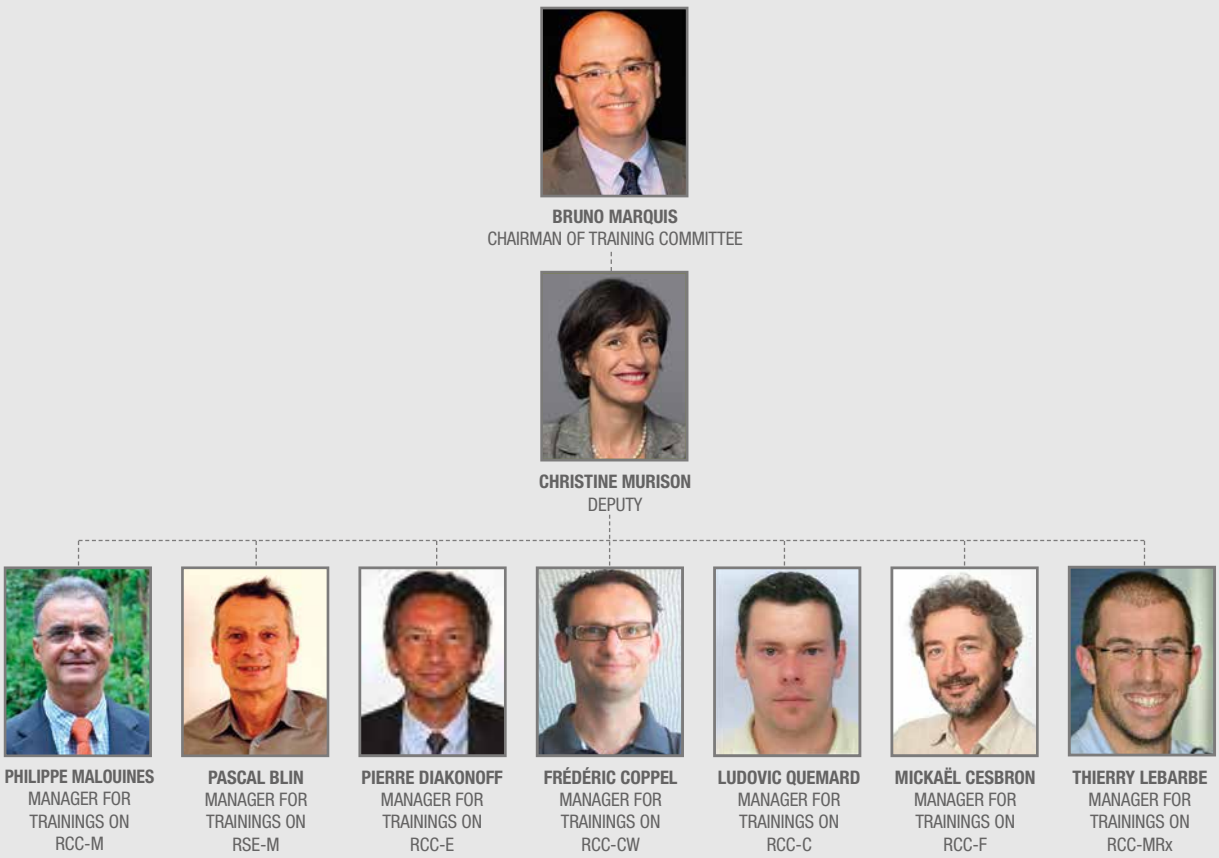
Training programs bearing the AFCEN hallmark guarantee a high level of service quality and thereby allow users to gain a clear insight, knowledge, uptake and proficiency in the requirements and practices for using the codes published by AFCEN.

The Training Committee assesses the ability of prospective providers to implement AFCEN courses and approves the training aids that they consequently need to use.

It establishes partnership agreements with training organizations and manages all the aspects specified in those agreements.

To raise the profile of the range of certified training courses, the Training Committee publishes an AFCEN certified training catalogue on the www.afcen.com website. The website also provides detailed information with interactive links on AFCEN's certified training courses, which are delivered by partner training organizations.

The Training Committee makes a specific point of monitoring AFCEN's certified courses over time and updating courses to reflect changes in the codes.



AFCEN'S TRAINING COMMITTEE

The Training Committee Chair is appointed by the Board of Directors.

The Training Committee includes a representative from each Subcommittee, called a “Subcommittee Training Officer”.

The general activity of the Training Committee is summarized in the box below:

GENERAL ACTIVITY OF THE TRAINING COMMITTEE IN 2017

General activity of the Editorial Committee in 2017:

The Training Committee held four meetings in March, June, September and December. These regular meetings enabled members to discuss:

a. General information and latest news (conferences, international activities, organization and quality, etc.)

b. Certified training (review of all agreements signed and certifications pending, number of training sessions delivered, etc.)

c. Subcommittee reports (certified training strategy, in-class evaluations, feedback from trainees, etc.)

The Training Committee consolidated 25 training courses and issued 495 certificates of attendance for courses on AFCEN codes.

It pursued its strategy of developing international courses, particularly in China (a certified Chinese-language course on RCC-M) and the United Kingdom (one course on RCC-M), attended by approximately 150 trainees in all.

It also maintained its focus group to examine the possibility of specialized training modules. Specialized courses are available for the RCC-M code. The committee has also started work on creating a training program on the documentation associated with the ESPN Regulation, with courses due to be released in 2018.

A.2.6 Subcommittees

The Subcommittees are responsible for carrying out AFCEN’s technical activities, with each Subcommittee covering a field associated with a given code (box below).

AFCEN SUBCOMMITTEES IN 2017

In 2017, seven Subcommittees were active:

. **RCC-M:** Design and construction rules for mechanical components of PWR nuclear islands
. **RSE-M:** In-service inspection rules for mechanical components of PWR nuclear islands
. **RCC-E:** Design and construction rules for electrical and I&C systems and equipment
. **RCC-CW:** Rules for design and construction of PWR nuclear civil works
. **RCC-C:** Design and construction rules for fuel assemblies of PWR nuclear power plants
. **RCC-F:** Design and construction rules for fire protection of PWR nuclear islands
. **RCC-MRx:** Design and construction rules for mechanical components of nuclear installations: high-temperature, research and fusion reactors

A.2 ORGANIZATION AND OPERATION

The Subcommittees are responsible for:

. working as part of the Editorial Committee and drafting the rules corresponding to the field covered by the Subcommittee, and continuously updating those rules to reflect feedback from industry best practices and changes to international legislation,

. supporting the Training Committee with certifying training courses and selecting providers to deliver such courses,

. supporting and interfacing with international Users Groups.

Changes to codes are initiated or prompted by Requests for Modification submitted by users.

Each Subcommittee comprises:

. a Subcommittee General Assembly,

. a Subcommittee Board,

. Working Groups.

The Subcommittee Board represents the Subcommittee's decision-making and arbitration body, and features a Chair, a Vice-Chair and a restricted number of experts appointed by the Subcommittee Chair based on their skills. The Subcommittee Chair designates the working group leaders from the experts in the Subcommittee Board.

Working groups focus on one of the Subcommittee's sub-fields and are responsible for:

. drafting and continually improving the parts of the code corresponding to the sub-fields,

. investigating and responding to Requests for Modification and Interpretation submitted by code users.

Working groups investigate Requests for Modification which, if necessary, are openly discussed during a Subcommittee meeting attended by all representatives appointed by AFCEN members. Decisions are taken by the Subcommittee Board.

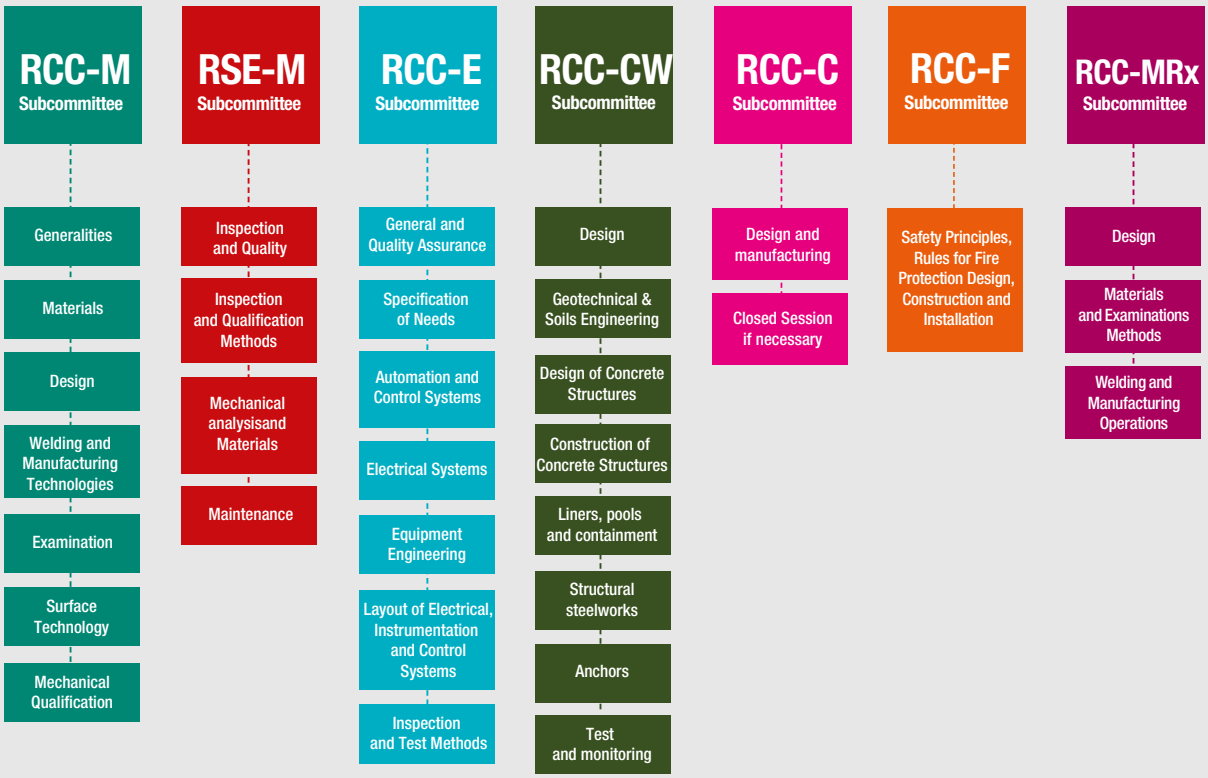
Texts approved by the Subcommittee Board are submitted to the Editorial Committee by the Subcommittee Chair for the prospect of being published by the Secretary-General.

In 2017:

32 permanent working groups were active.

The Subcommittees held between one and seven plenary sessions, depending on the Subcommittee.

GENERAL ACTIVITY OF THE SUBCOMMITTEES IN 2017



AFCEN'S SUBCOMMITTEES AND WORKING GROUPS

A.2.7 Users Groups

Users Groups are local structures, at a country scale, that are responsible for coordinating local activities within the scope of the relevant Subcommittee.

Users Groups' missions involve:

. pre-investigating Requests for Modification and Interpretation submitted by local AFCEN code users,

. informing users about the activities of AFCEN's Subcommittees and any changes to the corresponding codes,

. sharing feedback from the country's nuclear industry,

. facilitating adaptation of AFCEN codes to the local context (especially the country's regulations and industry best practices),

. helping to provide training for the AFCEN code users in their country,

. assisting with identifying communication needs (seminars, conferences, etc.) and their implementation in the country,

. helping ensure consistency in the various multi-lingual versions of the codes.

A.2 ORGANIZATION AND OPERATION

In 2017:

In the United Kingdom:

. The RCC-M Users Group, which is coordinated by member TWI (The Welding Institute), did not have the opportunity to get together after the spate of meetings between 2014 and 2016, which were attended by approximately 15 representatives from the UK nuclear industry.

. After a preliminary session in November 2016, the RCC-CW UK Users Group held two meetings in 2017 (June and December).

In China, two sessions of the Chinese Specialized Users Groups (CSUG) each attracted over 150 participants:

. The CSUG for RCC-M (design), RCC-M (manufacturing), RSE-M, RCC-E and RCC-CW held a meeting in May 2017, chaired by CGN and CNNC.

. A CSUG meeting was organized in October 2017 for RCC-M (design), RCC-M (manufacturing), RSE-M, RCC-E, RCC-MRx, RCC-C and ETC-F.

GENERAL ACTIVITY OF THE AFCEN CODE USERS GROUPS IN 2017

Steering Committees are local structures that are responsible, at a country level, for coordinating and prioritizing the activities of all Users Groups according to the challenges specific to their country.

Steering Committees are governed by agreements with AFCEN.

At least, Steering Committees comprise:

. one representative from AFCEN's General Secretariat: the designated International Relations Coordinator,

. the Chairs of each Users Group in the country.

In 2017:

The Steering Committees in the United Kingdom and China, chaired by NNB and CGN respectively, each held one meeting during the year. Preliminary meetings between AFCEN and the Steering Committee Chairs or Secretaries were held in the run-up to the AFCEN Conference early March 2017. The Steering Committee in China held its meeting on October 25, 2017 in Beijing. For the first time, a representative from NEA (National Energy Administration) attended the entire meeting.

GENERAL ACTIVITY OF THE STEERING COMMITTEES IN 2017

A.3 AFCEN QUALITY MANAGEMENT

AFCEN has implemented a process-based management system covering the main missions that essentially rely on its members' participation in its purpose and which are based on the internal activities supporting those missions.

This process-based organization enables AFCEN to:

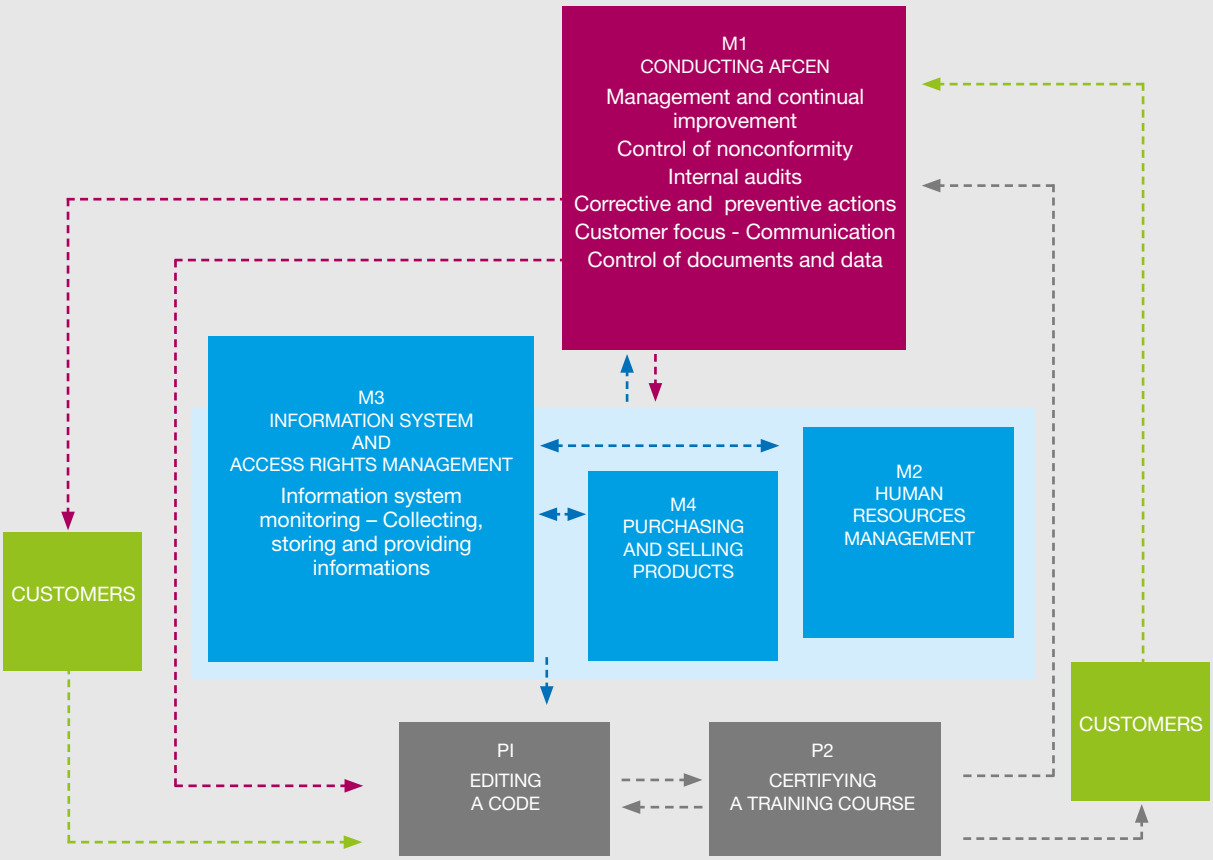
. supervise AFCEN's operation from a cross-functional perspective,

. manage the interfaces and resources,

. clearly define the responsibilities.

This process-driven organization includes coordinating actions on an international level and the goal of providing a framework geared towards the individual context in each country.

AFCEN's management system identifies two production processes and four support processes.



PROCESS MAP

Management of AFCEN is described in process M1.

Production processes P1 and P2 refer to the processes of producing codes and approving / certifying the associated training programs.

The identified support processes concern AFCEN general management (M1), skills management (M2), information system operation and access (M3), the purchase of services by AFCEN and the sale of AFCEN's products (M4).

A.3 AFCEN QUALITY MANAGEMENT

The Quality objectives associated with the processes are subject to periodic reviews to enable AFCEN to achieve its objectives and improve performance.

The Secretary-General acts as AFCEN's Quality Manager.

AFCEN was awarded ISO 9001 certification by Bureau Veritas in January 2014. In 2017, AFCEN migrated its quality management system to the 2015 version of ISO 9001, as confirmed by the successful follow-up audit in November 2017.

AFCEN's general quality management activities in 2017 are summarized in the box below.

Four internal audits were conducted in 2017 into the management of the association, the training certification process, skills management and the system implemented for purchasing and selling AFCEN products.

The AFCEN management review was conducted in two stages: February 7 and July 4, 2017. It enabled the association to:

. fine-tune the Quality indicators of the production processes in alignment with the objectives of AFCEN's management policy,
. check the actions taken to resolve any identified nonconformities and implement the associated corrective actions,
. identify the interested parties and assess their expectations,
. examine the risk assessments for the six processes and decide which actions need to be implemented to mitigate such risks, while considering the opportunities for improving process performance,
. gather and analyse feedback from the Conference held in Lyon in February 2017,
. check that the customer focus principle is correctly applied when dealing with requests from AFCEN members, and the French and English Safety Authorities.

In response to the customer focus principle, AFCEN agreed to:

. pursue its undertaking towards ASN to align with the ESPN Regulation by producing guides and local appendices specific to France,
. establish and publish criteria for the codes,
. disseminate the safety culture at the international level via the Users Group meetings in China and the United Kingdom,
. certify a training course on the RCC-M code in China,
. encourage partner organizations to develop training courses to support the ESPN Regulation,
. ramp up its communication using the website, presentations at conferences, participation in the ASME Code Week ASME events, etc.,
. carry on with the European workshop,
. upgrade its sales model and expand its code dissemination platform.

Certification follow-up audit:

On November 13 and 14, 2017, AFCEN passed the audit for migrating its management system to ISO 9001:2015. The auditor reported a number of strengths, including the effective identification of its interested parties and their challenges, the implementation of a risk analysis method with a scoring system and a threshold above which action must be taken, the arrangements that AFCEN is currently making to broaden dissemination of its products, and increased monitoring of its suppliers with changes to its relationship with its suppliers if necessary.

AFCEN'S GENERAL QUALITY MANAGEMENT ACTIVITIES

A.4 RESOURCES (MEMBERS, RESOURCES PER SUBCOMMITTEE)

AFCEN enlists the expertise of its members to carry out the activities inherent in the association's purpose.

A.4.1 AFCEN members in 2017

By the end of 2017, AFCEN had 67 members:

1	ADOLF-WUERTH GmbH & Co.KG - GER	23	GENERAL ELECTRIC - FR	45	SCK CEN - BELGIUM
2	AMEC - UK	24	GEODYNAMIQUE ET SRTUCTURE - FR	46	SITES - FR
3	APAVE - FR	25	GIS MIC NUCLEAIRE - FR	47	SNCT - FR
4	AREVA NP - FR	26	HALFEN GMBH - GER	48	SNPI (Groupe CGN) - CHINA
5	ASAP - FR	27	HILTI France - FR	49	SPXFLOW - FR
6	BOUYGUES TP - FR	28	INSTITUT LAUE LANGEVIN - FR	50	TECHNICATOME - FR
7	BUREAU VERITAS - FR	29	INTERCONTROLE - FR	51	TRACTEBEL Engineering - FR
8	CEA - FR	30	ITER - FR	52	TWI LTD - UK
9	CETIM - FR	31	JORDAHL - GER	53	UGITECH - FR
10	CNIM - FR	32	KAERI - SOUTH KOREA	54	VALINOX NUCLEAIRE - FR
11	CNNC - CHINA	33	LISEGA SAS - FR	55	VATTENFALL FORSMARKS - SWEDEN
12	DAHER VALVES - FR	34	NAVAL GROUP (ex DCNS) - FR	56	VELAN SAS - FR
13	DEXTRA MANUFACTURING - THAIL.	35	NFM TECHNOLOGIES - FR	57	VINCI CONSTRUCTION - FR
14	DOOSAN - FR	36	NNB - UK	58	VINCOTTE SA - BELGIUM
15	EDF - FR	37	NUCLEXPERT - FR	59	WESTINGHOUSE FR - FR
16	EFECTIS France - FR	38	NUVIA PROTECTION - FR	**NEW MEMBERS IN 2017**	
17	EGIS INDUSTRIES - FR	39	ONET TECHNOLOGIES - FR	**60**	**ENSA (EQUIPOS NUCLEARES S.A, SME) - SPAIN**
18	EIFFAGE GC - FR	40	OXAND - FR	**61**	**ESI GROUP - FR**
19	EMERSON PROCESS MANAGEMENT - FR	41	PETERCEM - FR	**62**	**FUSION FOR ENERGY - SPAIN**
20	ENDEL - FR	42	ROLLS ROYCE CN SAS - FR	**63**	**SICA NUCLEAIRE - FR**
21	ESS ERIC - SWEDEN	43	SAMT - FR	**64**	**SIGEDI - FR**
22	FLOWSERVE SAS - FR	44	SCHNEIDER ELECTRIC - FR	**65**	**TUV UK Ltd - UK**
				66	**WEIR POWER & INDUSTRIAL France - FR**
				67	**ZHEJIANG JIULI HI-TECH METALS CO LTD (JIULI) - CHINA**

AFCEN MEMBERS IN 2017

A.4 RESOURCES (MEMBERS, RESOURCES PER SUBCOMMITTEE)

A.4.2 Member involvement in the Subcommittees

In 2017, AFCEN members were involved in the Subcommittees as described in the box below.

RCC-M (33 members)

APAVE, AREVA NP, ASAP, BUREAU VERITAS, CEA, CETIM, CNNC, DAHER VALVES, DOOSAN, EDF, EMERSON PROCESS MANAGEMENT, ENDEL, FLOWSERVE SAS, GIS MIC NUCLEAIRE, LISEGA SAS, NAVAL GROUP, NNB, NUCLEXPERT, ONET TECHNOLOGIES, SNCT, SNPI (CGN Group), SPXFLOW, TECHNICATOME, TWI LTD, VALINOX NUCLEAIRE, VELAN SAS, VINCOTTE SA, WESTINGHOUSE FR, ENSA, ESI GROUP, SIGEDI, TUV UK Ltd, JIULI.

RSE-M (19 members)

APAVE, AREVA NP, ASAP, BUREAU VERITAS, CEA, CNNC, DOOSAN, EDF, ENDEL, INTERCONTROLE, NAVAL GROUP, NNB, ONET TECHNOLOGIES, SNPI (CGN Group), TECHNICATOME, TWI LTD, WESTINGHOUSE FR, ESI GROUP, WEIR POWER & INDUSTRIAL France.

RCC-E (15 membres)

APAVE, AREVA NP, CEA, CNNC, EDF, EMERSON PROCESS MANAGEMENT, GENERAL ELECTRIC, NNB, PETERCEM, ROLLS ROYCE CN SAS, SCHNEIDER ELECTRIC, SNPI (CGN Group), TECHNICATOME, WESTINGHOUSE FR, SICA NUCLEAIRE.

RCC-CW (26 members)

ADOLF-WUERTH GmbH & Co.KG, AMEC, AREVA NP, BOUYGUES TP, CEA, CNNC, DEXTRA MANUFACTURING, EDF, EGIS INDUSTRIES, EIFFAGE GC, GEODYNAMIQUE ET STRUCTURE, HALFEN GMBH, HILTI France, JORDAHL, NFM TECHNOLOGIES, NNB, OXAND, SAMT, SITES, SNPI (CGN Group), TECHNICATOME, TRACTEBEL Engineering, UGITECH, VATTENFALL FORSMARKS, VINCI CONSTRUCTION, FUSION FOR ENERGY.

RCC-F (6 members)

AREVA NP, CEA, CNNC, EDF, SNPI (CGN Group), WESTINGHOUSE FR.

RCC-C (7 members)

AREVA NP, CEA, CNNC, EDF, EFECTIS France, NUVIA PROTECTION (formerly MECATISS), SNPI (CGN Group).

RCC-MRx (19 members)

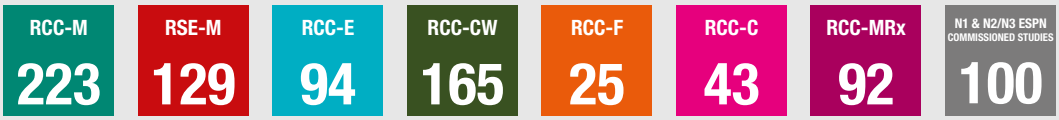
APAVE, AREVA NP, BUREAU VERITAS, CEA, CNIM, CNNC, EDF, ESS ERIC, INSTITUT LAUE LANGEVIN, ITER, KAERI, ONET TECHNOLOGIES, SCK CEN, SPXFLOW, TECHNICATOME, VALINOX NUCLEAIRE, VINCOTTE SA, ENSA, FUSION FOR ENERGY

AFCEN MEMBER INVOLVEMENT IN THE SUBCOMMITTEES IN 2017

A.4.3 Participation of member-appointed experts in AFCEN's work

AFCEN members were actively involved in the work of the Subcommittees (working groups and plenary sessions), as can be seen by the number of experts made available by the members (this number was up from 2016).

In 2017, over 750 experts contributed to AFCEN's work as follows:



EXPERTS' PARTICIPATION IN THE WORK OF AFCEN'S SUBCOMMITTEES AND USERS GROUPS

Note also the participation of foreign experts in the Users Groups.

China: 250 experts - UK: 58 experts

A.4.4 Oversight of AFCEN resources

AFCEN's resources and skills are managed according to processes M1 and M2.

Within each Subcommittee, the experts in the Subcommittee Board are appointed by the Subcommittee Chair based on their skills. Justification for each appointment is compiled in a skills record.

The resources corresponding to AFCEN's senior managers (Committee and Subcommittee Chairs, International Coordinators, etc.) are generally subject to an annual skills review and are continually monitored by the Board of Directors to anticipate any movements and replacements without disrupting AFCEN's operation.

Furthermore, in the event of a difficulty, the Subcommittees' resource requirements are escalated to the Board of Directors by the Chairs of the relevant Committees when such requirements cannot be satisfied by the members participating in the Subcommittees.

A.5 INFORMATION AND SALES SYSTEM

A.5.1 AFCEN-Core collaborative workspace

All AFCEN members have personalized and secure access to the AFCEN-Core collaborative workspace, which hosts all the work of the working group members in AFCEN's Subcommittees and Users Groups. The workspace improves interaction and provides all members with a portal featuring the latest information from their community. New workspaces are created as new working groups and Users Groups are formed.

A.5.2 The AFCEN.com website

AFCEN.com presents AFCEN's organization, activities and latest news.

The website also supports the AFCEN sales model. The e-shop sells AFCEN's publications with access via the online library.

A.5 INFORMATION AND SALES SYSTEM

A.5.3 Changes to the sales model for AFCEN's publications

In October 2015, AFCEN switched over to an online purchase and access model using the new e-shop platform on AFCEN.com.

AFCEN continues taking user feedback on board to make the model even easier to use. The changes are aimed at:

. prioritizing AFCEN's members by offering access to its publications at even more attractive prices,

. driving subscription renewals from one year to the next to give users unlimited access to the latest updates and publications,

. allowing multi-user corporate subscriptions, offering solutions better suited to companies with several AFCEN users across different geographic sites.

AFCEN is looking to offer its users greater simplicity and an even broader array of services through its code subscription solutions:

. access to the digital versions of its publications,

. unlimited and anywhere access to its online library,

. access to the most recent versions of the codes upon publication,

. access to the technical publications and criteria associated with the codes,

. access to the code history and versions in the different languages published.

To provide industry players operating across several sites with easier access to the codes, AFCEN has implemented an "unlimited subscription" service with an attractive pricing policy for each code. When customers sign up for the three-year subscription plan, they receive a 60% discount for the first year of their subscription, provided that they do not violate copyright and intellectual property rights. The price per code is summarized in Appendix B.

A.5.4 Distribution agreement with AFNOR

In October 2017, AFCEN and AFNOR signed a non-exclusive agreement to distribute AFCEN's codes using its "WEBPORT" web solution.

This solution is specifically aimed at large industrial organizations and is designed to provide users at one or more sites with access to all the codes.

Visit www.afcen.com to find out more!

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B

CATALOG OF AFCEN CODES AND DOCUMENTS AVAILABLE

APPENDIX

A.B PUBLICATIONS PRICES

Codes and publications	Description	Available lang.	Paper book format (€ excl tax)	PDF single format (€ excl tax)	Subscription format ** (€ HT)
Subscription RCC-M + RCC-M 2007	Publications included in the subscription: RCC-M 2017 / RCC-M 2016 / RCC-M 2012 + add 1, 2, 3 / RCC-M 2007 + add 1, 2, 3 / RCC-M 2000 + add 1 / PTAN RCC-M 2015 - Guide de Radioproteciton / PTAN RCC-M 2016 - 1 - Analyse de Risques / PTAN RCC-M 2016 - 2 - Guide Notice d'Instructions / PTAN RCC-M 2016 - 3 - Guide RDE / PTAN RCC-M 2016 - 4 - KV faibles épaisseurs / PTAN RCC-M 2017 - Guide inspectabilité / CRITERIA RCC-M 2014 / ERRATA APPENDIX ZG - Ed 2000 addenda 2007 and following editions	•	/	/	2600
RCC-M 2017	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR	2 950	/	Cf. Subscription
RCC-M 2016	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	2950	/	
RCC-M 2012 + add 1, 2, 3 add 1, 2, 3 = addendum 2013, 2014, 2015	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	2820	/	
RCC-M 2007 + add 1, 2, 3 add 1, 2, 3 = addendum 2008, 2009, 2010	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	/	1620	
RCC-M 2000 + add 1 add 1= addendum 2002	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR	/	1620	
CRITERIA RCC-M 2014	Prevention of damages in mechanical components. Introduction to the design, analysis and construction rules of the RCC-M	FR, EN	1590	1540	
PTAN Radioprotection	Radiation protection guide for the design of Nuclear Pressure Equipment for PWR plants in France	FR, EN	/	30	
PTAN Risk	Guide ADR (Analyse de risques) pour ESPN N1	FR	/	200	
PTAN Instructions	Guide for the contents of the operating instructions for nuclear pressure equipment	FR, EN	/	65	
PTAN Dimensional Ref	Dimensional reference standard of N1 nuclear pressure equipments	FR, EN	/	85	
PTAN KV Impact Test	KV faibles épaisseurs- Justification de l'exemption d'essai de flexion par choc pour les composants de faible épaisseur en aciers inoxydables austénitiques et les alliages base nickel	FR	/	70	
PTAN Inspectability	Guide de l'inspectabilité pour la conception des équipements sous pression nucléaires de niveau N1 des centrales REP installées en France	FR	/	40	
Subscription RSE-M	Publications included in the subscription: RSE-M 2017 / RSE-M 2016 / RSE-M 2010 + add 1, 2, 3, 4 / PTAN WPS 2016 / PTAN Requalification Tuyauteries ESPN niveaux N2 N3 / PTAN Annexe 5.4 du RSE-M / PTAN RS 16 010	•	/	/	1600
RSE-M 2017	In-Service Inspection Rules for Mechanical Components of PWR Nuclear Islands	FR	1760	/	Cf. Subscription
RSE-M 2016	In-Service Inspection Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	1760	/	
RSE-M 2010 + add 1, 2, 3, 4 add 1, 2, 3, 4 = addendum 2012, 2013, 2014, 2015	In-Service Inspection Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	1760	/	
PTAN WPS	Principle and substantiation for taking Warm Pre-Stressing (WPS) into account in PWR vessel fast fracture resistance criterion	FR, EN	/	85	
PTAN Requalif. Pipes	Guide pour la Requalification Périodique des Tuyauteries ESPN de niveau N2 ou de niveau N3	FR	/	45	
PTAN Annexe 5.4	Annexe 5.4 du RSE-M : Principes et historique de l'élaboration des méthodes analytiques de calcul des facteurs d'intensité de contrainte et du paramètre J pour un défaut plan	FR	/	210	
PTAN RS 16 010	Guide pour le dossier de réparation/modification classée notable d'un ESPN	FR	/	140	
Subscription RCC-E	Publications included in the subscription: RCC-E 2016 / RCC-E 2012 / Gap analysis RCC-E 2005 - 2012 / Gap analysis RCC-E 2012 - 2016	•	/	/	950
RCC-E 2016	Règles de Conception et de Construction des Systèmes et Matériels Electriques et de Contrôle Commande	FR, EN	1000	/	Cf. Subscription
RCC-E 2012	Design and construction rules for electrical equipment of nuclear islands	FR, EN	625	/	

Codes and publications	Description	Available lang.	Paper book format (€ excl tax)	PDF single format (€ excl tax)	Subscription format ** (€ HT)
Subscription RCC-CW + ETC-C	Publications included in the subscription: RCC-CW 2017 / RCC-CW 2016 / RCC-CW 2015 / ETC-C 2012 / ETC-C 2010 / PTAN RCC-CW 2015	•	/	/	1430
RCC-CW 2017	Rules for design and construction of PWR nuclear civil works	EN	1500	/	Cf. Subscription
RCC-CW 2016	Rules for design and construction of PWR nuclear civil works	FR, EN	1500	/	
RCC-CW 2015	Rules for design and construction of PWR nuclear civil works	FR, EN	1500	/	
ETC-C 2012	EPR Technical Code for Civil Works	FR, EN	1060 Only in english	1010	
ETC-C 2010	EPR Technical Code for Civil Works	FR, EN	820	780	
PTAN Seismic Isolation	French Experience and Practice of Seismically Isolated Nuclear Facilities	FR, EN	/	190	
Subscription RCC-C	Publications included in the subscription: RCC-C 2017 / RCC-C 2015 / RCC-C 2005 + add 1	•	/	/	820
RCC-C 2017	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	Cf. Subscription
RCC-C 2015	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	
RCC-C 2005 + add 1 add 1 = addendum 2011	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	725	/	
Subscription RCC-F	Publications included in the subscription: RCC-F 2017 / ETC-F 2013 / ETC-F 2010	•	/	/	380
RCC-F 2017	Design and Construction rules for fire protection of PWR nuclear plants	EN	400	/	Cf. Subscription
ETC-F 2013	EPR technical code for fire protection	FR, EN	400	/	
ETC-F 2010	EPR technical code for fire protection	FR, EN	275	/	
Subscription RCC-MRx + RCC-MR	Publications included in the subscription: RCC-MRx 2015 / RCC-MRx 2012 + add 1 / RCC-MR 2007 / PTAN RCC-MRx 2017	•	/	/	2670
RCC-MRx 2015	Design and Construction Rules for Mechanical Components of nuclear installations : high-temperature, research and fusion reactors	FR, EN	2940	/	Cf. Subscription
RCC-MRx 2012 + add 1 add 1 = addendum 2013	Design and construction rules for mechanical components of nuclear installations	FR, EN	2880	/	
RCC-MR 2007	Design and construction rules for mechanical components of nuclear installations	FR, EN	/	2140	
PTAN New Material	PTAN Guide for introducing a new material in the RCC-MRx	FR, EN	/	100	

• Access to the publications in all available languages
* For the launch of the new AFCEN sales model, the subscription to the code is at the same price as the pdf single purchase and offers many more benefits.
** The subscription period is one year.

Nota: For clients who already purchased the basic edition and previous addendum :
. The last published addendum are still on sale
. The Add 3 (2015) of RCC-M 2012 and Add 4 (2015) of RSE-M 2010 are available
> To place an addendum order, please write to the following address : publications@afcen.com

Prices as of 02/07/2018

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TRAINING CATALOG

APPENDIX

A.C CATALOG OF CERTIFIED TRAININGS

Domaine	Référence	Code	Title of training	Duration	Language	Organisme
Mechanical field for PWR	M-001	RCC-M	Supply and materials according to RCC-M	1 d	French	APAVE
	M-002		Quality assurance according to RCC-M	1 d	French	APAVE
	M-003		Control methods according to RCC-M	2 d	French	APAVE
	M-005		Introduction to the RCC-M	2 d	French / English	Nuclexpert
	M-006		Understanding of the code RCC-M	2 d	French	APAVE
	M-007		Design of class 2 & 3 equipments	2 d	French	APAVE
	M-008		Fabrication - Welding - Monitoring according to the code RCC-M	2 d	French	APAVE
	M-009		Discovery of the code RCC-M	3 d	French	IS Groupe
	M-010		RCCM - Construction code for nuclear pressure equipment	3 d	French	Bureau Veritas
	M-011		Architecture and application of the code RCC-M	3 d	French	APAVE
	M-012		Nuclear pressure equipments - Discovery of the code RCC-M	3 d	French	VINCOTTE Academy
	M-013		Discovery of the code RCC-M	4 d	French / English	AREVA University
	M-014		RCC-M Code	5 d	Chinese	SNPI (CGN Group)
	EM-001	RSE-M	Introduction to the use of the code RSE-M	3 d	French	CETIM
	EM-002		Training to the code RSE-M	3 d	French	Bureau Veritas
	MRx-001	RCC-MRx	Discovery of the code RCC-MRx	3 d	French / English	AREVA University
	MRx-002		Training to RCC-MRx	3 d	French / English	Bureau Veritas
	MRx-003		Discovery of the code RCC-MRx	3 d	français	INSTN
Civil work	CW-001	RCC-CW	Civil engineering for nuclear (ETC-C and RCC-W): Construction	2 d	French / English	Ponts Formation Conseil
	CW-002		Civil engineering for nuclar (ETC-C and RCC-CW): Design	3 d	French / English	Ponts Formation Conseil
	CW-003		Civil engineering for nuclear (ETC-C and RCC-CW): General introduction	1 d	French / English	Ponts Formation Conseil
Electrical and I&C systems	E-001	RCC-E	Introduction to the code RCC-E (Design and construction rules regarding electric material)	1 d	French / English	AREVA
	E-002		RCC-E 2012 - Qualification and manufacturing of safety classified products RCC-E 2012 - Optional day EDF Monitoring	3 d 1 d	French	SICA Nucléaire
	E-003		Use of the RCC-E	4 d	French	APAVE
Fire protection	F-001	RCC-F	ETC-F : fire protection conception and construction rules	4 d	French / English	EFECTIS

Note:

The trainings certified by AFCEN are delivered by a partner organization. Locations and dates appearing in this catalog were provided from them. The AFCEN does not warrant that these informations include the latest updates.

Find all our trainings on www.afcen.com

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