afcen

Shaping the rules for a sustainable nuclear technology

COLLABORATION

ACCOUNTABILITY

EXPERTISE

ANNUAL REPORT

2019

DO YOU KNOW AFCEN?

Scan the QR code to find out more!

CONTENTS

FOREWORD
BY AFCEN'S PRESIDENT

Philippe BORDARIER,
President

"2019 was a shining testament to the nuclear sector's ability to successfully reach a number of industrial milestones while maintaining the highest levels of safety and keeping its activities under control. Examples that come to mind include the launch of the second EPR in Taishan, China, and the clean bill of health given to the Tricastin 1 power plant, in France, following its fourth 10-yearly inspection. In the UK, the liner section for reactor building 1 (the «basin») was craned onto the foundation raft right on schedule. 2019 also revealed a number of weaknesses and shortcomings in our sector, meaning that further efforts will be required to exercise greater control and guarantee our industry's long-term prospects.

The underlying factor that these success stories or difficulties share in common is the nuclear sector's ability to keep a handle on its industrial activities. As far as AFCEN is concerned, this driving force can be credited to our authors and users, and their capacity to define, understand and implement the codes and standards that elevate safety to the highest levels. Codes and standards must be written, understood and put into practice as part of the constant determination to ensure that the systems and products designed and manufactured by industry conform to specifications.

We are only too aware of our responsibility, so this year we stepped up our efforts to produce clear and explicit codes that fully incorporate all the feedback received following their implementation. We have continued focusing our attention on AFCEN's development by launching our strategic plan, which champions our guiding values, namely expertise, collaboration and responsibility.

As with every year, I would like to pay tribute to our experts' engagement and offer my heartfelt thanks to our members for actively participating in our endeavors. AFCEN is your association, so I would like to take this opportunity to thank you for your involvement in its development, thereby building a safe and competitive nuclear industry. I look forward to seeing you all during our AFCEN Day event on June 22, 2020, and I would be delighted to meet you at the 2020 WNE exhibition alongside the members of the Board and General Secretariat."

MESSAGE
FROM AFCEN'S VICE-PRESIDENT

Françoise DE BOIS,
Vice-President

"On October 17, 2019, the French Nuclear Safety Authority (ASN) sent a brief letter to AFCEN in response to the association's work between 2015 and 2018. The letter's conclusion was as follows: In light of AFCEN's work and the difficulties that were identified in 2015 regarding compliance with regulatory standards, ASN believes that the results of the work carried out, which have been incorporated into the 2018 edition of the RCC-M code, effectively address the difficulties encountered, which had prompted ASN to impose a transitional period. As such, applying the 2018 edition of the RCC-M code provides a solid foundation for implementing the ESPN Regulation.

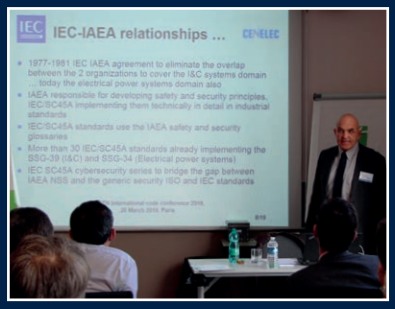
AFCEN has played a considerable role in bringing greater stability to the regulatory and industrial framework that the nuclear sector needs. This achievement paints a clear picture of how our belief in "Responsibility" translates into action. In 2020, AFCEN will continue heading in the same direction."

SIGNIFICANT EVENTS
2019

In 2019, AFCEN held its fifth International Congress

The fifth consecutive edition of its congress in Paris – Noisy le Grand gave AFCEN the ideal opportunity to meet its stakeholders.

The three-day event featured a number of presentations and meetings during AFCEN's roundtables. Discussions centered on support for nuclear activities in France, international projects and experts' involvement in standardization work. Technical breakout sessions on the development of codes and standards offered participants a host of insightful discussions.



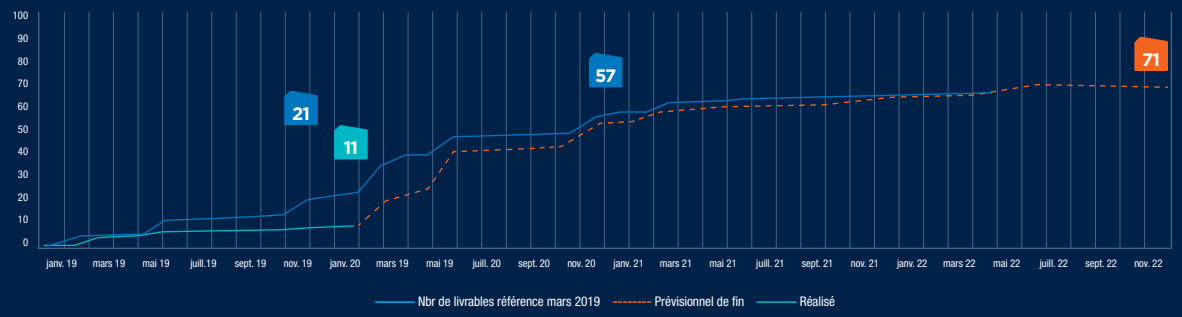
Scan QR codes
and find the videos
experts' opinion

SIGNIFICANT EVENTS
2019

In 2019, AFCEN defined the objectives for the four-year program relating to the ESPN Regulation and received a letter from ASN on the 2018 edition of the RCC-M code

AFCEN is building the four-year roadmap for the RCC-M and RSE-M mechanical codes in relation to the ESPN Regulation with the aim of consolidating and future-proofing the insights featured in the professional technical standard addressing the essential safety requirements of the ESPN Regulation in the 2018 edition of both codes.

On October 17, 2019, AFCEN received an advisory from ASN on the 2018 edition of the RCC-M code.



PROGRESS CURVE FOR THE DELIVERABLES OF THE FOUR-YEAR ESPN PROGRAM

In 2019, AFCEN published one major change to the RCC-E code, two enhanced editions of the RCC-C and RCC-CW codes, and English translations of the RCC-M 2018 and RSE-M 2018 codes

The major 2019 edition of the RCC-E code includes the outcome of three years of development and feedback. The 2019 annual editions of the RCC-C and RCC-CW codes have been updated in response to recent changes and developments. The major 2018 editions of the RCC-M and RSE-M codes are now available in English.

During the year, AFCEN also released 19 technical publications (PTAN).

EDITIONS PUBLISHED IN 2019

SIGNIFICANT EVENTS
2019

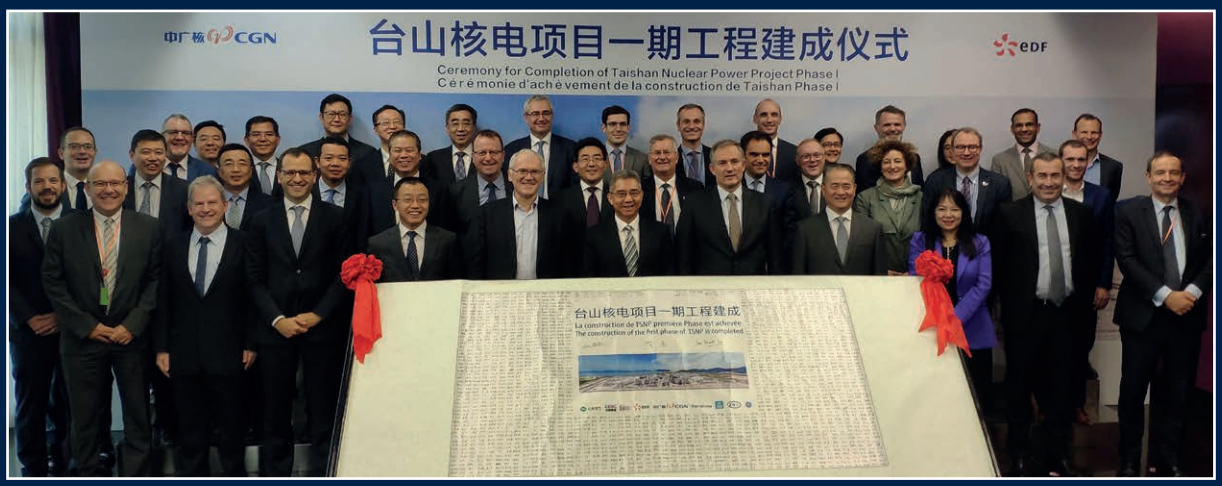
In 2019, AFCEN lent its support to nuclear reactor construction projects in the UK and China

AFCEN codes underlie the HPC project. Construction work is continuing on the classified civil structures. The milestone of the first nuclear concrete pour was achieved in 2019. Work will begin on assembling the electromechanical systems for the nuclear island in 2020. Projects managers are collaborating with AFCEN via the civil and mechanical engineering Users Groups.

HPC PROJECT PROGRESS

Commissioning of the second unit of the TAISHAN EPR (AFCEN codes underlie the technical standards used as a blueprint for the plant's design) heralded a new success for AFCEN and collaboration between France and China. The Zhangzhou project (first concrete pour in October 2019) in China's Fujian province comprises two HPR-1000 reactors built by CNNC and is also based on AFCEN codes.

Cooperation in China paved the way for nine work sessions of the Users Groups in 2019, as well as implementation of the Project Groups, which are stipulated in the NEA-AFCEN collaborative agreement on codes and standards.

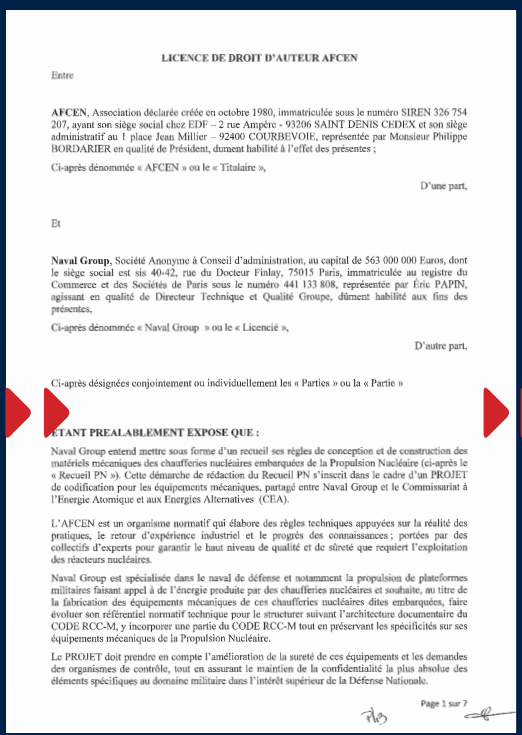


CELEBRATING THE END OF CONSTRUCTION FOR TAISHAN PHASE 1

SIGNIFICANT EVENTS
2019

In 2019, AFCEN and Naval Group signed an agreement to assign usage rights for the RCC-M code

Naval Group will strengthen its presence in the RCC-M subcommittee and will give AFCEN access to certain modifications introduced in the nuclear propulsion compendium.



LICENCE DE DROIT D'AUTEUR AFCEN

Entre

AFCEN, Association déclarée créée en octobre 1980, immatriculée sous le numéro SIREN 326 754 207, ayant son siège social chez EDF – 2 rue Ampère - 93206 SAINT DENIS CEDEX et son siège administratif au 1 place Jean Millier – 92400 COURBEVOIE, représentée par Monsieur Philippe BORDARIER en qualité de Président, dument habilité à l'effet des présentes ;

Ci-après dénommée « AFCEN » ou le « Titulaire »,

D'une part,

Et

Naval Group, Société Anonyme à Conseil d'administration, au capital de 563 000 000 Euros, dont le siège social est sis 40-42, rue du Docteur Finlay, 75015 Paris, immatriculée au registre du Commerce et des Sociétés de Paris sous le numéro 441 133 808, représentée par Éric PAPIN, agissant en qualité de Directeur Technique et Qualité Groupe, dûment habilité aux fins des présentes,

Ci-après dénommée « Naval Group » ou le « Licencié »,

D'autre part,

Ci-après désignées conjointement ou individuellement les « Parties » ou la « Partie »

ETANT PREALABLEMENT EXPOSE QUE :

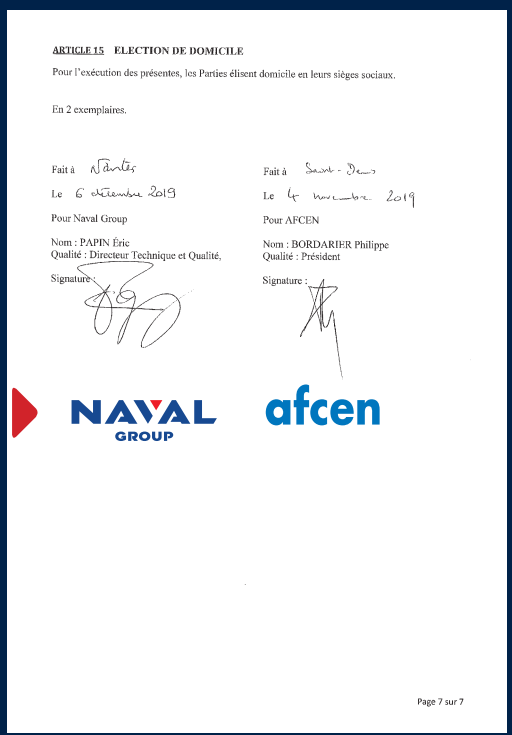
Naval Group entend mettre sous forme d'un recueil ses règles de conception et de construction des matériels mécaniques des chaufferies nucléaires embarquées de la Propulsion Nucléaire (ci-après le « Recueil PN »). Cette démarche de rédaction du Recueil PN s'inscrit dans le cadre d'un PROJET de codification pour les équipements mécaniques, partagé entre Naval Group et le Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA).

L'AFCEN est un organisme normatif qui élabore des règles techniques appuyées sur la réalité des pratiques, le retour d'expérience industriel et le progrès des connaissances ; portées par des collectifs d'experts pour garantir le haut niveau de qualité et de sûreté que requiert l'exploitation des réacteurs nucléaires.

Naval Group est spécialisée dans le naval de défense et notamment la propulsion de plateformes militaires faisant appel à de l'énergie produite par des chaufferies nucléaires et souhaite, au titre de la fabrication des équipements mécaniques de ces chaufferies nucléaires dites embarquées, faire évoluer son référentiel normatif technique pour le structurer suivant l'architecture documentaire du CODE RCC-M, y incorporer une partie du CODE RCC-M tout en préservant les spécificités sur ses équipements mécaniques de la Propulsion Nucléaire.

Le PROJET doit prendre en compte l'amélioration de la sureté de ces équipements et les demandes des organismes de contrôle, tout en assurant le maintien de la confidentialité à la plus absolue des éléments spécifiques au domaine militaire dans l'intérêt supérieur de la Défense Nationale.

Page 1 sur 7



ARTICLE 15 ELECTION DE DOMICILE

Pour l'exécution des présentes, les Parties élisent domicile en leurs sièges sociaux.

En 2 exemplaires.

Fait à Nanterre
Le 6 octobre 2019
Pour Naval Group
Nom : PAPIN Éric
Qualité : Directeur Technique et Qualité,
Signature :

Fait à Saint-Denis
Le 4 novembre 2019
Pour AFCEN
Nom : BORDARIER Philippe
Qualité : Président
Signature :

NAVAL GROUP

afcen

Page 7 sur 7

In 2019, AFCEN launched a new CEN workshop phase on European-level codes

In 2019, AFCEN and CEN launched Phase 3 of CEN/WS 64 on opening AFCEN codes to European needs

With a revamped business plan paving the way for work on a fourth code (RCC-E), Workshop 64 is ramping up its activities and attracting stakeholders from the European nuclear industry, who are interested in the prospect of benefitting operators by opening up the codes for even broader use across Europe.

KICK-OFF MEETING FOR WS 64 - PHASE 3

afcen

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 and structures in over 100 power plants currently in operation (98), under construction (13) or in planning stages (14) 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 mechanical components and 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 and main reactors in China, including different EPRs around the world.

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		Series of 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	x	x	x	x	x		
Type CP1	South Africa			2	2	2		x			x			
	South Korea			2	2	2		x			x			
M310	China			4	4	4	4	x	x	x	x			
CPR 1000 & ACPR1000	China		4	24	28	28	28	x	x	x	x			
CPR 600	ChinA			6	6	6	6	x	x	x	x			
EPR	Finland		1		1	1		x						
	France		1		1	1	1	x	x	x	x	x	x	
	China			2	2	2	2	x	x	x	x	x	x	
	UK	2	2		4	4	4	x	x	x	x	x		
	India	6			6	6	6	x	x	x	x	x	x	
HPR1000	China	2	8		10	10	10	x	x	x		x	x	
	UK	2			2	2		x		x		x	x	
PFBR	India		1		1	1								x
RJH	France		1		1	1								x
ITER	France		1		1	1								x
ASTRID	France	1			1	1								x
		14	15	98	130	86	117							

SUMMARY OF THE USE OF AFCEN CODES AROUND THE WORLD

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 G of 2006), which were subsequently included in AFCEN's collections (ETC-C 2010 edition).

EPR2

The EPR2 project is modeled on the EPR design, but builds on the feedback from the design and construction of the Flamanville 3 and Taishan 1-2 projects. Recent editions of AFCEN codes are being used, which have been updated to reflect feedback from previous EPR projects.

ASTRID

The 2012 edition of the RCC-MRx code has been chosen for France's ASTRID reactor project (Advanced Sodium Technological Reactor for Industrial Demonstration). This code proved to be the obvious choice due to its close links with the RCC-MR code, which France's nuclear industry has used as a reference for its sodium-called fast reactors, and also because it incorporates all the feedback and R&D breakthroughs achieved by CEA, Framatome and EDF.

1.1 USE OF AFCEN CODES AROUND THE WORLD

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.

The 2012 edition of the RCC-MRx code is serving as a reference for experimental reactors.

ITER

ITER used the 2007 version of the RCC-MR code as a reference for its vacuum vessel. 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). RCC-MRx is also being used for the other components.

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), is based on a technical reference system known as the PN Compendium. It is structured identically to the RCC-M code since Naval Group's internal rules are technically very close to those of the RCC-M. This particular organisation is related to the history of nuclear propulsion: the skills of this industry were quickly codified into instructions and procedures that were progressively enriched by feedback and external normalisation. In particular, since the publication of the code RCC-M, Naval Group has ensured the consistency of its rules with those of the code, and the overall consistency of design / manufacturing 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.). In order to improve the clarity of these rules, it became logical to adopt the editorial structure of the RCC-M.

AFCEN and Naval Group signed an agreement in 2019 to develop a code for marine propulsion systems, while maintaining interaction with the RCC-M Subcommittee. Naval Group will bolster its presence in the RCC-M Subcommittee and give AFCEN access to some of the modifications introduced into the marine propulsion code.

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 and Hualong HPR-1000 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 2019, 48 of the 63 units in operation or under construction in China were using AFCEN codes, with 36 in operation and 12 under construction. These units correspond to the M310, CPR-1000, ACPR-1000, HPR-1000, CPR-600 and EPR projects in blue font in the table below.

During 2019:

. Taishan 2, the world's second EPR unit based on AFCEN codes, was commissioned.

. In addition to the two units of the Taishan EPR, six new reactors, one of which designed according to AFCEN codes (Yangjiang 6), were commissioned.

. Work has been launched on six new nuclear units as part of a drive that has not been seen since 2015, especially the Zhangzhou (Hualong) and Taipingling (Hualong) reactors.

Reactor type	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 (6) Fangchenggang (2) Fuqing (4) Fangjiashan (2)**	**Hongyanhe (2) Tianwan phase III (2)**	**28**
HPR 1000		**Fuqing (2) Fangchenggang (2) Zhangzhou (2) Taipingling (2)**	**8**
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 (4)		4
HTR-PM		Shidaowan (1)	1
CFR-600		Xiapu (1)	1
CAP1400		Shidaowan (2)	2
Total number	**47**	**16**	**63**

LIST OF REACTORS CURRENTLY UNDER CONSTRUCTION OR IN OPERATION IN CHINA AS OF LATE 2019
(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 reported to be 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

1.1 USE OF AFCEN CODES AROUND THE WORLD

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 under construction at the Hinkley Point C site (HPC) and two other reactors in the planning stages at Sizewell C (SZC).

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

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

. RCC-E 2012 edition

. ETC-C 2010 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 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 or HPR-1000) 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 (Fangchenggang 3). and is modelled on AFCEN codes.

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), Europe and the UK, 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.
4. Listen to the proposed changes to the codes voiced by participants in CEN WS 64, which contains leading players in Europe's nuclear industry looking to improve their expertise in AFCEN's codes.
5. Continue the policy of comparing and harmonizing AFCEN codes with the other nuclear codes within the SDO Convergence Board and in liaison with the OECD/NEA/CNRA (Working Group on Codes & Standards, safety authority entities) and the WNA/CORDEL association (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

AFCEN holds monthly meetings with ASN's Nuclear Pressure Components Division for the purpose of incorporating the ESPN Regulation into its mechanical codes. This relationship of trust between both organizations is instrumental in the success of the three-year ESPN program, which is covered by the 2018 editions of the RCC-M and RSE-M codes.

The AFCEN Congress (March 26 to 28, 2019)

In March 2019, AFCEN's International Congress attracted over 250 participants from different countries (China, South Korea, United Kingdom, United States, Belgium, Switzerland, Germany, Spain, Italy, France and India).

AFCEN's directors sent out a clear, forward-looking message that gave all participants an overview of the progress achieved in 2018, AFCEN's vision for the future and its different milestones. Françoise de Bois reviewed the success of the three-year ESPN program, which drew to an end in 2018 and culminated in the publication of the RCC-M 2018 and RSE-M 2018 codes. She also invited participants to lend their support in championing AFCEN's values, i.e. Responsibility, Collaboration and Expertise. Philippe Bordarier took a closer look at AFCEN's strategic plan. Aimed at transforming the association, this plan is gradually shaking things up in a number of fields as part of AFCEN's shared vision of tomorrow's world.

Executives from organizations using AFCEN codes attended a roundtable Laurent Arnold - EPR2 industrial architect, Denis Bourguignon - Nuclear Technical Director at Bureau Veritas, Frédéric Witters - Technical Director for the RJH project, and Philippe Canaux - Senior Maintenance Delegate at EDF's DPN division, confirmed their engagement with AFCEN. They were unanimous in emphasizing how the same framework shared within industry and ASN represents an undeniable asset for nuclear projects and the nuclear industry as a whole. Mechanical codes and their publications in France are supporting industry's efforts to implement the ESPN Regulation. Executives gathered in a roundtable discussion recommend codes that feature the best available techniques and which also bring greater stability to projects.

In terms of international projects, the roundtable was attended by Ian Cameron (HPC Project), François Verdiel (EDF Development Division), Qing Mao (CGN/GNS), Pascal Aurillard (JAITAPUR project configurator) and David Tersigni (CEO of ATMEA). They underlined the structuring dimension in selecting

1.2 AFCEN'S ACTIVITIES AROUND THE WORLD

a code for a nuclear project, it involves the teams in charge of design as well as all the suppliers. Where an old version is chosen due to the need for reproducibility, AFCEN should provide support in the form of training. Projects are also expecting AFCEN to provide guidance in understanding the modifications introduced into the latest versions of the codes.

The third roundtable zeroed in on interaction between AFCEN codes and international standards, and was attended by Nathalie Baumier (Chair of the Electrotechnologies Strategic Committee), Stéphane Dupré La Tour (Chair of the Standardization Coordination and Steering Committee), Vincent Verneyre (Managing Director of UNM, Standardization Bureau for the mechanical engineering and rubber industry), Franck Lignini (Framatome Codes & Standards), Cécile Pétesch (CEA – Standardization Expert) and Alexander Wigg (EDF – Standardization Expert). Standardization stakeholders have encouraged AFCEN's experts to take part in standardization activities where France can exert an influence. To achieve that aim, experts have advised that time and a clear mandate are required. This prospect gives AFCEN the opportunity of organizing its contribution and influence to greater effect.

The fourth and final roundtable during the plenary session was attended by four Subcommittee Chairs (RCC-M, RCC-CW, RCC-E and RSE-M) and two major code users: EDVANCE, represented by its Engineering & Works Director (Gerald Tessari), and UTO, represented by its CTO (Christophe Trollat), to discuss which codes need preparing for nuclear projects and the nuclear industry as a whole. Users sent out a strong signal concerning their expectations: industry-level codes supported by standards to bring stability and deliver the best technical and economic performance.

The other key moments of the congress included experts focusing on a range of technical issues, which were discussed in 18 breakout sessions involving seven AFCEN codes:

. RCC-C: four presentations on the range of training courses, fuel performance criteria, the qualification of scientific computing tools, and 2019 modifications to the code,

. RCC-F: a session on the detailed studies into fire risks,

. RCC-CW: two sessions, one of which on geotechnical engineering with guests from the international community, and the other on the incorporation of modifications to subsequent editions of the code,

. RCC-M: a session on the Nuclear Pressure Equipment (NPE) policy applicable to the HPC project,

. RCC-E: a session on the interface with the teams responsible for preparing IEC standards,

. RSE-M: three sessions on in-service inspection practices in the UK, indication processing and the keys for effectively navigating through the code,

. RCC-MRx: a session on feedback from code users.

Finally, the congress contains many breakout sessions covering several codes at the same time (RCC-E & RCC-F, RCC-M & RSE-M, RCC-M & RCC-MRx, RCC-M & RCC-E), which helped paint a clear picture of the interactions, synergies and consistency between AFCEN codes.

Note that this edition of the congress included a number of significant improvements to the logistical side, with a simultaneous English and French translation booth and innovative interactions with the hall using an online question app.

AFCEN CONGRESS

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 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 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.

Phase 3 of the workshop was launched in January 2019. This phase brings together operators, the authorities’ technical support teams and industry players from various European countries. Some could ultimately be involved in evaluating or taking part in nuclear projects using AFCEN codes to gather proposals for code changes. Phase 3 has four key objectives:

. Strengthen synergistic ties between European experts on nuclear codes to minimize fragmented best practices across the nuclear industry and give international rules greater emphasis while promoting European requirements and practices.

. Allow future nuclear project leaders to raise awareness of their project’s constraints and suggest changes to the codes.

. Engage operators and manufacturers with a collaborative process for preparing and defining a standard for managing ageing facilities, sourcing spare parts and extending the service life of nuclear power plants.

. Raise awareness of AFCEN’s codes among entities potentially involved in evaluating nuclear reactors during an invitation to tender for the purpose of developing new nuclear production assets as part of the long-term plan to renew Europe’s existing nuclear infrastructure.

In addition to the three codes already involved, Phase 3 includes a fourth “Prospective Group” that also comprises electrical experts to take part in the process based on the RCC-E code.

Twenty-one European stakeholders, representing 10 countries and the European Commission, are taking part in WS 64. Four safety authorities or their technical support teams are participating.

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 driving research, innovation and demonstration efforts across the EU.

1.2 AFCEN'S ACTIVITIES AROUND THE WORLD

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.).

Between 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.

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 December 2019, 47 CSUG meetings had been held in China, during which experts presented and discussed approximately 500 technical topics.

In 2017, AFCEN and NEA signed a long-term memorandum of understanding relating to nuclear standards and codes, which took AFCEN's codes one step closer to mainstream use in China. The agreement gives Chinese standardization bodies official permission to use AFCEN codes as a reference for drafting the country's future nuclear standards (NB 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.

Activities in 2019

Taishan 2 enters active service

After Taishan 1 was commissioned in 2018, another highlight came in 2019 when the second EPR unit at the Taishan site entered industrial service. This is the second EPR to be commissioned in the world.

SITE OF THE TAISHAN NUCLEAR POWER PLANT IN CHINA

These success stories can be credited to the close working ties between the French and Chinese nuclear industries, especially the TNPJVC joint venture (Taishan Nuclear Power Joint Venture Co.). AFCEN codes (RCC-M, RSE-M, RCC-E and RCC-C) played a role in this achievement by providing a coherent set of key technical standards for ensuring nuclear safety and spanning each phase of the project, from licensing, design and manufacturing through to installation, testing and operation. Training sessions were also organized with AFCEN's support to improve uptake of AFCEN code requirements among local manufacturers.

Other events

In 2019, AFCEN's main actions relating to activities in China were as follows:

Implementation of the NEA-AFCEN agreement:

AFCEN has provided key information to allow China's experts to accurately translate the RCC codes into Chinese. As such, the version of each code requiring translation and a guide to the essential parts were supplied. This action is a key component of the 2017 AFCEN-NEA agreement.

The operational governance structure for Franco-Chinese cooperation on nuclear codes and standards was formally defined and approved during the CUG Steering Committee meeting in November 2019. In 2018, a Steering Committee and Expert Assembly featuring 30 Chinese experts and 30 AFCEN experts officially inaugurated the implementation of the agreement signed on November 30, 2017. Starting in 2019, technical collaboration between experts on standardization activities, which represents the second key component of the AFCEN-NEA agreement, will be hosted in the CSUGs, and experts will have the possibility of creating formal working groups to address technical subjects of joint interest (Project Groups - PG).

1.2 AFCEN'S ACTIVITIES AROUND THE WORLD

NOV. 2019
CUG MEETING

Visit from a delegation to Paris during the AFCEN Congress:

. To coincide with the AFCEN Day event late March 2019 in Paris, AFCEN received a large Chinese delegation from CGN, CNNC and other industrial groups. The Chinese experts in the delegation made the most of the event to meet their counterparts at AFCEN and make headway on the two key activities for implementing the AFCEN-NEA agreement, namely translating the codes and enabling technical collaboration on standardization activities. The CTO (Chief Technical Officer) for the GDA of the UK HPR-1000, Dr. Qing Mao, joined a roundtable discussion to share his insights into the use of AFCEN codes for the GDA process of the UK HPR-1000.

Users Groups meetings in China, and AFCEN training courses:

. In March, May and subsequently in November 2019, nine further meetings were held between AFCEN's experts and members of the Chinese Specialized User Groups (CSUGs) in Beijing, Qinhuangdao and Suzhou respectively, and then in Beijing, Chengdu, Suzhou and Taishan. 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) and industrial groups, as well as China's Safety Authority and its technical support arm (NNSA and NRSC).

. 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 Wuxi and Suzhou in May and November 2019 respectively. AFCEN training completion certificates were issued to the trainees who passed the final exam.

Outlook for AFCEN in China in 2020

In 2020, AFCEN will pursue its policy of developing cooperation on codes and standards to honor its commitments towards its Chinese partners. The main milestones and prospects are as follows:

. In keeping with the process of creating operational structures for the MOU with NEA and to build a framework for interactions between experts, continue the translations and form Prospective Groups to formalize a new type of technical interaction.

. Participation of Chinese experts in the AFCEN Day event in Paris in June 2020, including the Subcommittee meetings and technical breakout sessions.

. 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.

. Launch a new series of training courses with greater emphasis on design calculations and the mechanical codes (RSE-M and RCC-M), and update the RCC-M training courses according to version 2007 including the addenda up to 2012.

1.2.4 United Kingdom

EPR projects

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 (for the construction phase),

. Sizewell C (SZC): two units (for the project design phase - identical design 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 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). An addendum has been created for the ETC-F code to comply with British fire protection regulations, which AFCEN subsequently added to the code in the form of a UK-specific appendix. NNB has decided to use the 2018 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. This adaptation will be formalized as a UK-specific appendix to the code. Several meetings were held between NNB and AFCEN during 2019 to create a project of an appendix that will initially be focused on the in-service inspection of UK EPRs. In addition, a group of independent experts endorsed the methods for analyzing the impacts of defects detected during operation in RSE-M (Appendix 5.4) against current practices in the United Kingdom (R6 Rules).

Dissemination of AFCEN's code culture within British industry is essential for simplifying understanding and use of the codes in projects and potentially aligning them with local regulations and industry practices. With this aim in mind, the AFCEN code Users Groups (UK Users Groups), which are supervised by an NNB-led Steering Committee, comprise the companies concerned and representatives from NNB and AFCEN. These Users Groups have the following missions:

. facilitate uptake of AFCEN codes among industry and partners by minimizing discrepancies caused by poor interpretation of the codes early into the project,

. 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.

The RCC-M Users Group has been coordinated by an expert from the TWI Institute (The Welding Institute) since 2013. From 2013 to 2016, this group had approximately 15 members representing manufacturers, engineering firms, consultants, inspection and training organizations, institutes, and so on. They addressed the following key technical issues with a helping hand from AFCEN's experts: materials sourcing and manufacture, quality requirements, and requirements for nuclear pressure components. Following the decision to launch the process for sourcing mechanical components for the HPC project, the Users Group was restructured in 2018 and resumed work in 2019.

1.2 AFCEN'S ACTIVITIES AROUND THE WORLD

The Users Group on civil engineering codes was formed in November 2016 and held two meetings in 2017 (June and December), one meeting in 2018 (October) and one meeting in 2019 (October). Chaired by an expert from WOOD company, the group includes the main companies involved in the Hinkley Point C project to address a wide range of technical subjects, such as concrete reinforcement and shrinkage, and offshore structures.

The RCC-E Users Group has not yet been formed.

HPR-1000 project

The project to build a PWR reactor featuring Chinese technology (UK Hualong or HPR-1000) is undergoing the GDA (Generic Design Assessment) process in the UK in anticipation of installing two units at the Bradwell B site. The GDA is being coordinated by an EDF-CGN joint venture (GNS). Step 4 (the final step) of the GDA will more than likely be announced in 2020. The blueprint for this project is mainly based on a reactor that is currently being built in China (Fangchenggang 3) and significantly inspired by AFCEN codes. The GDA for this reactor will take advantage of the lessons learned from the EPR project incorporated into the chosen AFCEN codes.

1.2.5 India

After participating in the international India Nuclear Energy show in Mumbai in 2016 and several events involving Indian suppliers in 2017 in the wake of the Memorandum of Understanding signed by EDF, AFCEN Bureau Veritas and Larsen & Toubro, AFCEN has continued its policy of developing cooperative ties with India, especially in terms of training on the RCC-M code. Discussions are also being held with the prospect of setting up training for the RCC-CW and RCC-E codes in 2020.

These initiatives are 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 2020, AFCEN is determined to pursue its policy of building cooperation with India while supporting the proposal for six EPR units as part of the Jaitapur project.

DESIGN VIEW OF THE JAITAPUR SITE

afcen

Shaping the rules for a sustainable nuclear technology

2 EDITORIAL ACTIVITY REVIEW

2.1 CODES AND OTHER EDITORIAL PRODUCTS

AFCEN's editorial activities involve authoring and approving the publication of codes and other associated technical works. AFCEN keeps a close eye on these different publications and updates them where applicable.

The technical works associated with the codes are as follows:

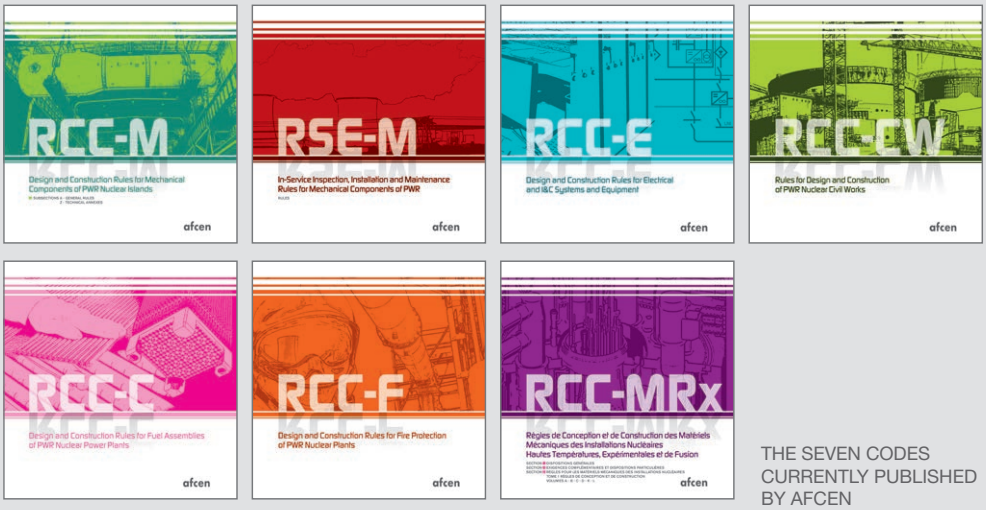
. studies to complement and develop certain topics within the codes,

. criteria, which expand on the reasons for the rules in the codes,

. guides to accompany the use of the codes.

2.1.1 AFCEN codes

AFCEN currently publishes seven codes.



THE SEVEN CODES CURRENTLY PUBLISHED BY AFCEN

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

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

Incorporation of feedback

Incorporating feedback is a major reason for updating codes. Examples include:

. an update to the 2018 edition of RCC-MRx to incorporate feedback from current projects, such as the Jules Horowitz Reactor (RJH) and the ASTRID project, and a wide variety of topics, like the inspection and welding processes for aluminum materials,

. an update to the RCC-CW code to reflect feedback on the FA3 and HPC EPRs (clarification about design methods and best construction practices), and the Fukushima accident (methods for external hazards),

. an update to the RCC-F code to incorporate feedback on the FA3 and HPC EPRs.

Developments prompted by scientific and technical breakthroughs, and R&D work

These also represent major reasons for updating the codes.

Examples include:

. the inclusion of new materials in the mechanical codes (STR in RCC-M, and Eurofer in RCC-MRx),

. improved rules for calculating the minimum reinforcement rate for reinforced concrete (RCC-CW code),

. the incorporation of requirements relating to new fuel fabrication and inspection methods (RCC-C code).

Regulatory changes

Changes to the regulatory framework in the various countries in which the codes are used constitute a major reason for updating the codes. Depending on the type of requirement, regulatory-related modifications are either introduced into the body of the text or as an appendix specific to the country in question.

Examples include:

. developments associated with the need to prove compliance with the essential requirements of the European Pressure Equipment Directive (PED) and France's Nuclear Pressure Equipment Regulation (ESPN) have been integrated into the 2018 editions of the RCC-M code (Appendices ZY and ZZ) and RSE-M code (Appendix 1.8),

. appendices focusing specifically on the requirements of fire protection regulations in France and the UK (RCC-F code),

. recommendations on the measures that need to be taken to demonstrate qualification of the scientific computing tools (SCTs) for fuel core studies (RCC-C code) in response to Guide 28 issued by the French Nuclear Safety Authority.

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 standards.

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

Examples include:

. alignment of the RCC-CW code with the construction rules for concrete structures defined in EN 13670,

. amendments after comparing the rules in the RCC-M code against European standards on piping and vessels (EN 13480 and EN 13445) in relation to the need to prove compliance with the essential requirements of the European Pressure Equipment Directive.

Extension to the fields covered by the codes

AFCEN codes may be revised by extending the subject matter.

Examples include:

. the inclusion of a new chapter in the RCC-M code (RPP no. 4 - Probationary Phase Rules, 2017 edition) to cover the qualification of active mechanical components requiring qualification under accidental conditions, as well as chapters addressing N1 and N2/N3 assemblies (RPP no. 5 and 6, 2018 edition),

2.1 CODES AND OTHER EDITORIAL PRODUCTS

. the incorporation of rules for post-installed anchors in the RCC-CW code,

. the addition of technical requirements and specifications for hazards relating to lightning and electromagnetic interference in the RCC-E code.

2.1.2 AFCEN's technical publications (PTAN)

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. Studies may also focus on several codes at the same time. They may concern common requirements (such as quality) or technical interfaces between codes (anchoring systems and penetrations).

Examples include:

. "French experience and practice of seismically isolated nuclear facilities" in the RCC-CW code,

. "Study of seismic dissipative devices" in the RCC-CW code.

Criteria

AFCEN is determined to explain 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.

Examples include:

. the RCC-M code criteria,

. the criteria in Appendices 5.4 and 5.5 of RSE-M (methods and criteria for analyzing the impacts of defects).

Guides

Guides may be aimed at publishing recommendations or explaining how the code can be used to comply with regulatory requirements.

Examples include:

. a guide containing a series of recommendations to clarify the provisions of the RCC-MRx code relating to the seismic design rules for components,

. a complete set of guides that explain how to fulfil the essential safety requirements of the ESPN Regulation, to accompany the 2018 editions of the RCC-M and RSE-M codes.

2.1.3 AFCEN's editorial situation

AFCEN's editorial activities in 2019 were marked by the publication of the following codes: RCC-E, RCC-CW and RCC-C.

In 2019, AFCEN formalized its editorial program, which enshrines its four-year development and publication ambitions for each code and each major reason for updating the codes (user and project requirements, feedback from users and projects, scientific progress and R&D efforts, changes in industry practices and standards, changes in safety regulations and standards, harmonized codes, and changes to the fields covered by the codes). The main objectives pursued as part of AFCEN's editorial program are detailed in the sections on each code.

The table below summarizes AFCEN's editorial situation and lists AFCEN's technical publications. Appendix B contains a detailed presentation of all the codes and technical publications available for sale.

AFCEN'S EDITORIAL SITUATION AND EDITORIAL PROGRAM

CODE		EDITIONS AVAILABLE
RCC-M	Construction of PWR mechanical components	. 2000 and 2007 editions, with addenda . 2012 edition, with addenda in 2013, 2014 and 2015 . 2016, 2017 and 2018 editions . Next edition: 2020
RSE-M	In-service inspection for PWR mechanical components	. 2010 edition, with addenda in 2012, 2013, 2014 and 2015 . 2016, 2017 and 2018 editions . Next edition: 2020
RCC-E	Electrical and I&C systems and equipment	. 2012 edition . 2016 edition . 2019 edition . Next edition: 2022

CODE		EDITIONS AVAILABLE
RCC-CW	Civil engineering	. ETC-C editions 2010 and 2012 . RCC-CW editions 2015, 2016, 2017, 2018 and 2019 . Next edition: 2020
RCC-C	Fuel	. 2005 edition, with addenda in 2011 . 2015, 2017, 2018 and 2019 editions . Next edition: 2020
RCC-F	Fire	. 2010 edition, then 2013 (ETC-F) . RCC-F 2017 edition . Next edition: 2020
RCC-MRx	Mechanical components in fast neutron, experimental and fusion reactors	. 2012 edition, with addenda in 2013 . 2015 edition . 2018 edition . Next edition: 2022

TECHNICAL PUBLICATIONS AVAILABLE FOR SALE

CODE	TECHNICAL PUBLICATIONS
RCC-M	CRITERIA RCC-M 2014: Prevention of damage in mechanical components. Introduction to the design, analysis and construction rules of the RCC-M
	PTAN RCC-M 2018: RCC-M editions 2007 and 2012 and their addenda – Responses to Interpretation Requests (IR)
	PTAN RCC-M 2018: Guide specifying the contents for instruction manuals for nuclear pressure equipment.
	PTAN RCC-M 2016: Sizing standard for N1 nuclear pressure components
	PTAN RCC-M 2016 (Criteria): Justification for exemption from pendulum impact testing for low-thickness components made from austenitic stainless steel and nickel-based alloys
	PTAN RCC-M 2018: Radiation protection guide for the design of nuclear pressure components in PWR plants in France
	PTAN RCC-M 2018: Identification of the admissible limits for main primary and secondary systems
	PTAN RCC-M 2018: Identification of the admissible limits for nuclear pressure components (including the main primary and secondary systems)
	PTAN RCC-M 2018: Guide on the terms for carrying out visual inspections during the final examination
	PTAN RCC-M 2018: Guide covering visual examinations during fabrication following the hazard analysis
	PTAN RCC-M 2018: Sizing standard for N1*, N2 or N3 nuclear pressure components
	PTAN RCC-M 2018: Guide specifying the contents for instruction manuals for nuclear pressure equipment.
	PTAN RCC-M 2018: Hazard analysis guide for N1 nuclear pressure equipment
	PTAN RCC-M 2018: Hazard analysis for N2 nuclear pressure equipment manufactured according to RCC-M
	PTAN RCC-M 2018: Guide to designing SRMCRs installed at PWR plants to protect N2 or N3 nuclear pressure equipment
	PTAN RCC-M 2018: Inspectability guide for the design of N1 nuclear pressure equipment in PWR plants in France

2.1 CODES AND OTHER EDITORIAL PRODUCTS

RCC-M	PTAN RCC-M 2018: Inspectability guide for the design of N2-N3 nuclear pressure equipment in PWR plants in France
	PTAN RCC-M 2018: Storage of material resulting from the manufacture of components for N1 nuclear pressure equipment
	PTAN RCC-M 2018: Methodological guide for preparing the specific evaluations for N2/N3 nuclear pressure equipment and the associated supporting documents (corrosion and thermal ageing of austenitic and austenitic-ferritic stainless steels)
	PTAN RCC-M 2018: Analysis of regulations for classifying the different parts of pressure accessories, such as pressure valves, and safety devices, such as relief valves
	PTAN RCC-M 2018: Methodological guide for overseeing the fabrication of components that are not subject to specific technical qualification
RSE-M	RSE-M 2016 CRITERIA (RS.16.018): Principle and justification for including warm pre-stressing (WPS) in the criterion for the fast fracture resistance of a PWR vessel
	RSE-M 2017 CRITERIA (RS.17.019): 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
	RSE-M 2018 CRITERIA (RS.18.026): Principles of and background to the formulation of the criteria in Appendix 5.5 of RSE-M, relating to the fast fracture resistance of pressure equipment presenting an operational planar defect
	PTAN RSE-M 2018 (RS.16.007 index E): Guide for the periodic requalification of N2 or N3 ESPN piping
	PTAN RSE-M 2018 (RS.16.009 index B): Professional guide for repairing and modifying nuclear pressure equipment subject to Points 1 to 4 in Appendix V of the French Nuclear Pressure Equipment Regulation of December 30, 2015 as amended Approved by ASN (decision CODEP-CLG-2019-003687)
	PTAN RSE-M 2018 (RS.16.010 index E): Professional guide for the significant repair/modification dossier for nuclear pressure equipment subject to Points 1 to 4 in Appendix V of the French Nuclear Pressure Equipment Regulation of December 30, 2015 as amended
	PTAN RSE-M 2018 (RS.17.022 index B): Professional guide for designing and fabricating main pressure parts for nuclear pressure equipment in main primary or secondary systems Approved by ASN (decision CODEP-CLG-2019-003685)
	PTAN RSE-M 2018 (RS.18.003 index A): Professional guide on conformity assessment requirements and procedures for a permanent installation assembly for nuclear pressure equipment subject to Point 4.1.a in Appendix V of the French Nuclear Pressure Equipment Regulation of December 30, 2015 as amended Approved by ASN (decision CODEP-CLG-2019-003687)
	PTAN RSE-M 2018 (RS.18.004 index C): Professional guide on the protection methodology for the installation of nuclear pressure equipment Approved by ASN (decision CODEP-CLG-2019-003687)
	PTAN RSE-M 2018 (RS.18.006 index A): Professional guide on the requirements applicable to repairs and modifications of nuclear pressure equipment subject to Points 1 to 4 in Appendix V of the French Nuclear Pressure Equipment Regulation of December 30, 2015 as amended, and the procurement of the parts required for such repairs and modifications Approved by ASN (decision CODEP-CLG-2019-003687)
	PTAN RSE-M 2018 (RS.18.007 index A): Professional guide for operations on nuclear pressure equipment in main primary and secondary systems
RCC-MRx	PTAN RCC-MRx 2017: Guide for introducing a new material in RCC-MRx – Requirements and recommendations for acquiring and gathering the necessary data for establishing all the characteristics for the materials in Appendix A3 of RCC-MRx
	PTAN RCC-MRX 2018: Supplements to the guide for seismic analysis of components - Recommendations for the seismic design of equipment according to Appendix A1 of RCC-MRx
RCC-CW	PTAN RCC-CW 2015: French experience and practice of seismically isolated nuclear facilities
	PTAN RCC-CW 2018: Study report on Seismic Dissipative Devices
RCC-E	PTAN RCC-E 2012: RCC-E 2012 Gap analysis with the RCC-E 2005
	PTAN RCC-E 2016: RCC-E 2016 Gap analysis with the RCC-E 2012
	PTAN RCC-E 2019: RCC-E 2019 Gap analysis with the RCC-E 2016
	PTAN RCC-E 2019: Guide to preparing project specifications associated with RCC-E 2019
RCC-C	PTAN RCC-C 2019: Qualification of scientific computing tools for first barrier safety demonstrations

2.2 MECHANICAL FIELD FOR PRESSURIZED WATER REACTORS 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 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 FIELD FOR PRESSURIZED WATER REACTORS 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),

. 48 M310 (4), CPR-1000 (28), CPR-600 (6), HPR-1000 (8) 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).

The 2017 edition introduced the Q subsection as Probationary Phase Rules to cover the qualification of active mechanical components (pumps and valves) and the new non-mandatory Appendix Z C to guide users in carrying out non-linear finite element analyses.

2.2.3 Edition available as of early 2020

The 2018 edition is the most recent version of the code. It integrates 176 modification files, mainly relating to the commissioned studies into the ESPN Regulation. This edition is supplemented by the different guides released as PTAN publications and addresses the essential safety requirements of the ESPN Regulation of December 30, 2015, as amended by the Regulation of September 3, 2018. AFCEN has provided an extensive set of documentation to justify how the requirements in the RCC-M code are compliant for N1, N2 and N3 nuclear pressure equipment. Despite being unable to finish examining the safety factors and uncertainties during AFCEN's demonstrations, ASN and GSEN nevertheless endorsed this edition.

More specifically, the changes implemented in the 2018 edition relate to the following provisions:

. Incorporation of the work involved in testing the code for conformity with the essential requirements of French regulations (Annex I of Directive 2014/68/EU and Appendices I to IV of the French Nuclear Pressure Equipment Regulation of December 30, 2015, as amended by the "ESPN" Regulation of September 3, 2018), including an update to Appendices ZY and ZZ relating to the French and European regulations respectively, which contain all the work from the commissioned studies:

. The technical qualification methodology and applicable requirements for materials used in the pressure parts of N1 equipmentThe "unacceptable defects" methodology relating to Section 3.4 (Essential Safety Requirements) in Appendix I of the ESPN Regulation (an application guide is available in ZY 360) References to AFCEN's different technical publications (PTAN), which provide support in the form of solutions for achieving the objectives laid down in the regulationIntroduction of two new Probationary Phase Rules (RPP no. 5 and 6) concerning N1 and N2/N3 assemblies respectivelyIntroduction of a new appendix to Section III describing the procedure for preparing an equivalence report as defined in MC 2900, which describes the methodology for advanced ultrasound inspectionsLowering of the evaluation threshold for ultrasound inspections of Class 1 and 2 welds to -12 dB.

. Introduction of eddy current examinations for steam generator tubes after bending.

. Introduction of reduction factors for effective fatigue resistance for welded joints in N2 or N3 equipmentClarification of the thicknesses to be used for analysis dossiersRevision of the terms for carrying out tensile testingIntroduction of two new STRs:

- M 1161 N1, N2 and N3 bars made from rolled non-alloy steel
- M 2331 Valve forged from steel with a nickel, chrome and molybdenum alloy for primary pumps in pressurized water reactors

. Alignment of Chapters B C D 6000 with EN ISO 4126 and EN 764-7Update to Chapter A 5000 introducing the 2015 edition of the ISO 9001 Quality standard

CONTENTS OF THE 2018 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 "Z": TECHNICAL APPENDICES
SECTION II - MATERIALS
SECTION III - EXAMINATION METHODS
SECTION IV - WELDING
SECTION V - FABRICATION
SECTION VI - PROBATIONARY PHASE RULES

2.2 MECHANICAL FIELD FOR PRESSURIZED WATER REACTORS RCC-M

2.2.4 Next edition

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

In addition to pursuing its activities relating to the ESPN Regulation, AFCEN has produced an editorial program for the RCC-M Subcommittee to cover the 2019-2022 period and define the key improvements that need to be made to the RCC-M code to reflect project requirements and industrial practices.

The next edition of RCC-M is scheduled for 2020 to leverage initial feedback on the use of the 2018 edition. This edition will incorporate the modifications relating to the follow-up work on the ESPN Regulation.

The new 2020 edition of the code will also incorporate the feedback on the code's use in current projects (EPR UK, TSN, FA3, replacement steam generators, etc.) and on the results of the development or assessment work carried out in AFCEN's working groups (France, China Users Groups and UK) by ASN or in international groups (Europe and MDEP).

2.2.5 RCC-M technical publications

Publication of interpretation requests

In 2018, the RCC-M Subcommittee released the interpretation requests relating to the editions of the RCC-M code published since 2007 and its addenda. This publication is presented as a compilation of anonymous interpretation requests arranged by edition and topic.

This document can be downloaded free of charge from the AFCEN website.

An update to this document will be available early 2020 to reflect the interpretation requests addressed by the Subcommittee since the first edition of the PTAN was released.

Guides

All PTAN publications relating to the ESPN Regulation and referenced by the 2018 edition of RCC-M have been made available to users.

RCC-M criteria

The RCC-M code criteria 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.

A PTAN was 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.

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

AFCEN completed the three-year ESPN program, which culminated in a 2018 edition of the RCC-M code to provide a satisfactory response to the essential safety and radiation protection requirements stipulated in France's Nuclear Pressure Equipment Regulation and the European PED Directive for N1, N2 and N3 equipment.

Work targeted the following topics:

. hazard analyses,
. Inspectability,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 for fabrication,
. definition of a component's admissible limits,
. instructions manuals,
. fabrication of assemblies,
. developments in technologies and practices,
. safety devices and pressure accessories,
. technical qualification,
. SRMCR systems.

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). Aside from the commissioned study on Safety Factors and Uncertainties, whose results are being assessed, ASN and GSEN examined the proof of compliance submitted by AFCEN and subsequently endorsed the 2018 edition as fulfilling the essential safety requirements of the ESPN Regulation.

In 2018, commissioned studies were also launched and finalized to address other regulatory requirements that are not considered to be essential safety requirements:

. A material storage guide aimed at specifying the rules for identifying and reserving the materials that will be supplied to the operator in accordance with Section 8.1 in the Regulation of December 30, 2015 as amended.
. A methodological guide for overseeing the fabrication of components that are not subject to specific technical qualification. This guide aims to provide guarantees relating to the conditions for manufacturing certain components that are not subject to specific technical qualification. The main objective is to ensure that suppliers consistently enforce the provisions stipulated by the STR.
. Work focusing on testing in response to Section 8.2 (accreditation of test laboratories for nuclear pressure equipment) of the Regulation of December 30, 2015 as amended.
. A definition of what constitutes "situations" and "loads".

2.2 MECHANICAL FIELD FOR PRESSURIZED WATER REACTORS RCC-M

In a bid to continually improve the solutions proposed and take account of feedback from projects using the code in relation to the ESPN Regulation, a second ESPN work program has been defined for 2019-2022. Thirteen topics will be addressed:

. documentation covering the evaluation of compliance,

. hazard analysis,

. final examination,

. visual examinations during fabrication,

. development of codes covering EPR materials,

. fast fracture resistance,

. generic note for identifying unacceptable defects in basic materials,

. specific evaluations,

. terms for applying Section 8.2 and improving the reliability of Pellini testing,

. guide to integrating nuclear pressure equipment under assessment (section 8.4),

. design of tube support plates,

. safety factors and uncertainties,

. incorporation of feedback of existing ESPN guides.

As with the three-year program, this four-year version is being carried out in liaison with ASN's Nuclear Pressure Equipment Department and the relevant organizations.

2.2.7 2019-2022 editorial program

In addition to the topics related to the ESPN Regulation, the RCC-M Subcommittee has defined its editorial roadmap, which identifies the different technical topics that it wishes to develop over the 2019-2022 period with assistance from its members, with the focus on the next two editions of the code scheduled for 2020 and 2022.

The program has been defined to address a number of issues:

. respond to the requirements expressed by our users and projects,

. incorporate feedback from users and projects,

. integrate developments prompted by technical and scientific progress,

. incorporate changes in industry practices and standards,

. include changes in safety regulations and standards,

. assist with harmonizing practices in the different codes,

. extend the code's scope of application.

As part of this roadmap, a number of working groups were created in 2019 whose activities will dovetail with those of the ESPN program working groups on the following topics:

. update to Volume H on supporting roles,

. update to Appendix Z G with the aim of addressing the fields that are presently not covered and updating the approach to reflect feedback from current projects,

. coverage of progressive deformation in Appendix Z C on non-linear finite element analyses,

. introduction of design by analysis rules for tube support plates,

. update to Volume S8000 on hard coatings,

. finalization of the update to Appendix Z V on the design of flanged connections.

A number of topics identified in this program should be given the green light in 2020, including:

. the use of ultrasonic NDT as an alternative to RT NDT for level 2 ferritic steels in RCC-M,

. incorporation of ISO 15614-1:2017.

2.2.8 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 2019:

. AFCEN held its international congress between March 26 and 28, 2019, which enabled the association to provide members with a review of its RCC-M activities.

. Experts from the RCC-M Subcommittee travelled to the UK in March (three experts) to attend a meeting of the UK Users Group (UKUG). The Subcommittee's recent activities (2016-2018) were presented, as well as the process for issuing interpretation and modification requests. A specific presentation was given to clarify the cleanliness requirements in RCC-M.

. Experts from the RCC-M Subcommittee traveled to China in May (two experts) and November 2019 (two experts) to answer questions from the Chinese Specialized Users Groups (CSUGs). The two-day meetings each attracted over 50 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. Technical presentations on recent or current developments in the RCC-M code and insights into Chinese standards improved understanding on both sides and revealed areas of mutual interest.

In 2019, 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.

. At the European level, Phase 3 of the GEN II/III Prospective Group (PG1) of CEN workshop WS 64 was launched and is scheduled to last three years (refer to the dedicated paragraph in Section 1.2.2).

In 2020, there are plans to maintain international initiatives:

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

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

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

. at the European level as part of the CEN/WS 64 workshop.

2.3 IN-SERVICE INSPECTION RSE-M

THE RSE-M CODE

2.3.1 Purpose and scope

The RSE-M code defines the installation, in-service inspection and maintenance rules for PWR mechanical components. It applies to pressure equipment used in PWR plants, as well as spare parts for such equipment.

It may be 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 in the RSE-M code describe 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 36 commissioned units in China's nuclear infrastructure, corresponding to the M310, CPR-1000, ACPR-1000, CPR-600 and EPR 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 basis 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 an overhaul in 2010.

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

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 (FA3).

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.

The 2017 edition builds on the technological, legislative and international developments that occurred in 2016.

2.3.3 2018 edition

The 2018 edition is the most recent version of the RSE-M code.

It builds on the technological and legislative developments that occurred in 2017. The changes made to this new edition mainly involve:

. 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,

. introduction of an appendix with a safety rating for the modification files in RCC-M, including 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),

. creation of sections covering requirements for installing, integrating and laying out nuclear pressure equipment,

. development of the section covering spare parts,

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 on nuclear pressure equipment (not including Class 1 equipment),

. guide to the documentation associated with repaired / modified N2/3 nuclear pressure equipment,

. guide to the 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,

. guide to the methodology for the periodic requalification of N2 or N3 piping,

. guide on the installation of nuclear pressure equipment subject to Point 5 in Appendix V of the French Nuclear Pressure Equipment Regulation,

. guide for equipment not subject to in-service inspections,

. modifications to the code for the constitution of nuclear facilities.

2.3 IN-SERVICE INSPECTION RSE-M

The groups' findings were published in 2016 as change records for the code and PTAN.

CONTENTS OF THE 2018 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 NC COMPONENTS

VOLUME II - APPENDICES 1 to 8
APPENDICES 1.0 to 1.8: Supporting appendices for the general requirements
APPENDIX 2.1: Appendix associated with § B2000 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
APPENDIX 7.1: Appendix associated with installation, integration and implementation operations for constituting a new basic nuclear facility
APPENDICES 8.1 and 8.3: 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 ANY PARTICULAR RSE-M CLASS

2.3.4 Outlook and next edition

2020 edition

The 2020 edition has the objective to consolidate and build on technological, legislative and international developments. With this aim in mind, special attention will be paid to the following points:

. inclusion of feedback on the ESPN guides,
. examination of the prospect of creating an RSE-M PTAN containing a thesaurus and definitions,
. use of an engineering process to define requirements following the tests on Volume A,
. inclusion of the specific characteristics of the FA3 EPR,
. Appendix 4.3: clarification of influential parameters,
. Section A4700 - Qualification and certification of testing personnel: supplements and alignment with Appendix 4.3 – IX,
. clarify the case of examinations that should not be considered to be NDTs: metrological examinations and cleanliness video examinations,
. clarification of the terms for performing pre-service inspections of components at the factory (case of replacement steam generators),
. Appendix 5.2: clarification of defect priming and propagation methods (aggregated transients).

2.3.5 Other RSE-M technical publications

PTAN RS.16.018 "WPS" criteria (relating to Probationary Phase Rule 2 of RSE-M)

The purpose of the 2016 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.

PTAN RS.17.019 Criteria "Appendix 5.4"

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.

PTAN RS.18.026 Criteria "Appendix 5.5"

These criteria were finalized in 2018 and published in Q1 2019.

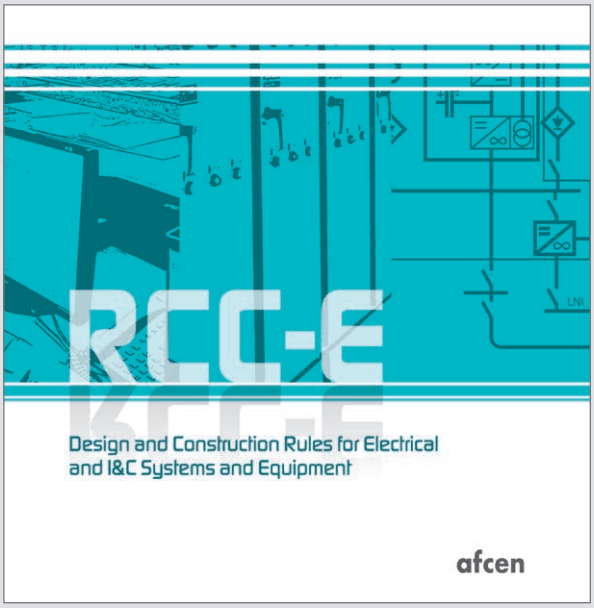
The criteria for analyzing the impact of planar defects are explained.

PTAN RS.19.013 « Methodological guide for the elaboration of NDT qualifications for ultrasonic processes » (2020 horizon),

Other PTANOther AFCEN technical publications (PTAN) are being prepared:

"Appendix 1.4" criteria for helping control the specific provisions for applying RCC-M for modifications / repairs (2021 horizon).

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, as well as for other nuclear projects.

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:

. electrical and I&C architectures and the associated systems,

. materials engineering and the qualification procedure for normal and accidental environmental conditions, including consideration for internal and external hazards,

. 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.

2.4.2 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),

. 48 M310 (4), CPR-1000 (28), CPR-600 (6), HPR-1000 (8) and EPR (2) reactors in service or undergoing construction in China,

. 1 EPR reactor in France and 2 reactors in the UK (Hinkley Point C).

The RCC-E code is used for maintenance operations in French power plants (58 units) and 32 Chinese M310 and CPR-1000 power plants.

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, 2016 and 2019 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. With the 2019 revision, AFCEN has created a PTAN that provides users with guidelines on how to produce project specifications.

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 2020

The RCC-E 2019 edition is the most recent version. It is available in French (December 2019) and English (to be published early 2020).

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 2019 edition:

. is an update to the previous edition,

. 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.

2.4 ELECTRICAL AND I&C SYSTEMS RCC-E

Reasons for updating the code include:

. a clearer insight into safety approaches (defense-in-depth examinations, design standard, events and deterministic approach, failure-oriented principle to encourage protective action, consistency of hazards with the French Regulation on basic nuclear facilities, etc.),

. 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,

. extended scope for power sources, especially to ensure the long-term management of potential serious accidents: internal power sources, control sources and mobile power sources,

. consolidation of the design for the electrical power supply architecture.

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 2019 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

Editions gap analysis

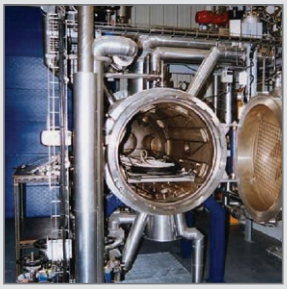
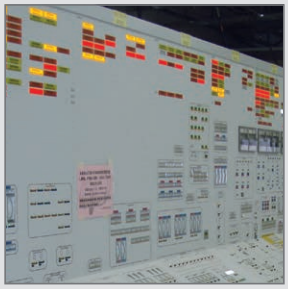
AFCEN is producing a document that compares the most recent edition of the code against the previous edition.

This document is currently being finalized for the 2019 edition.

In terms of the previous editions of the code, AFCEN has published:

. 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 2019,

. measurement, control and regulation systems,

. design extension situations,

. cybersecurity,

. integration of IEC 62566-2 “Development of HDL-programmed integrated circuits for systems performing category B or C functions”,

. qualification of automatic protection systems certified to IEC 61508 Class III.

There are also plans to investigate the feasibility of producing the code in UML format and thereby creating an object-oriented representation linking the requirements to the design while considering the imposed constraints.

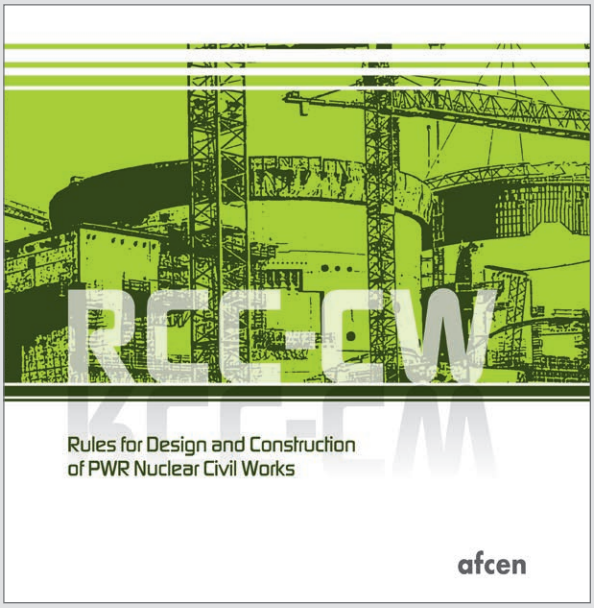
2.4.6 International activities

The RCC-E Subcommittee took part in meetings with the CSUG (Chinese Specialized Users Group). The Chinese working group comprises approximately 30 members. 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 were held in 2019: one in France to coincide with the AFCEN Congress in March and the other in November in Beijing. A similar meeting has been scheduled for 2020.

The Users Group in the United Kingdom to address the specific characteristics of the British projects currently undergoing construction (Hinkley Point, Sizewell and Bradwell) has not yet been formalized. However, the need for such a Users Group has been confirmed, and AFCEN is actively working on its creation.

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,

. joints, paints and coatings,

. containment leak tests.

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

2.5.2 Use and background of RCC-CW

AFCEN published the first civil engineering code 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 EDF document acted as a basis for a civil engineering code that AFCEN produced in 2010 as part of the RCC-CW Subcommittee, which led to:

. initially, the publication of two specific editions for EPR projects: a 2010 edition followed by a 2012 edition,

. subsequently, the publication of a generic civil engineering code that is not specific to any given project: successive annual editions of RCC-CW have been published since 2015.

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

SUCCESSIVE VERSIONS OF RCC-CW

Release	Description	Key applications
1988	AFCEN document including French PWR fleet experience (RCC-G 1988)	French 1300, 1450 Mwe
2006	Draft for further AFCEN releases (EDF document)	Flamanville 3, Taishan 1&2
2010 - 2012	Prepared for UK GDA process in 2010. Revised in 2012	UK EPR Hinkley Point
2015 - 2016 2017 - 2018 2019	Renewed edition: . post-Fukushima level & methods . improvements & updates . extensions of scope	Updated editions to be used as reference for New Build Projects

2.5.3 Edition available as of early 2020

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 EPR2 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 in the United Kingdom,

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

2.5 CIVIL WORKS RCC-CW

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).

The 2018 edition of the RCC-CW code includes the following improvements:

. improved requirements relating to the minimum reinforcement rate,

. introduction of requirements for post-installed anchors and recently updated standards,

. changes to the contents for reinforcements (CREIN) in alignment with EN 13670,

. general revision of the requirements relating to tolerances (CA).

The 2019 edition of the RCC-CW code includes the following improvements:

. change in the scope of application for durability requirements (DCONC § 3000, 4110, 9000),

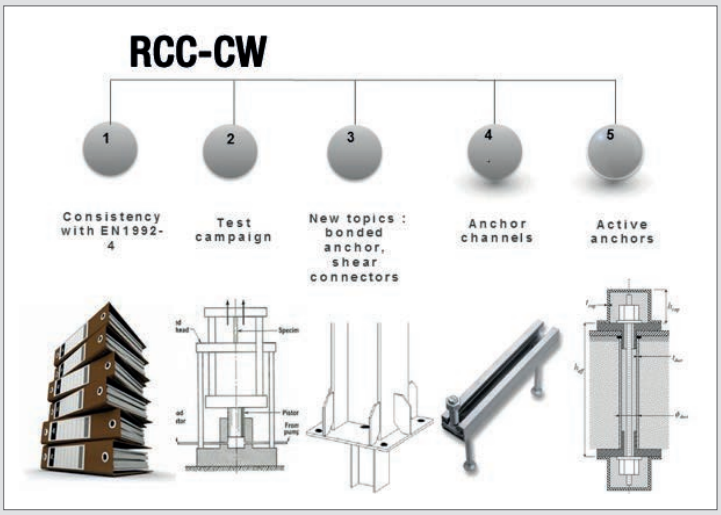
. removal of diameter pressure failure mode for anchor design (DANCH),

. improvement of requirements for bending steel on site (CREIN),

. change in leak detection requirements for pools and tanks (DPLIN & CPLIN),

. introduction of industrial feedback for containment testing and monitoring (MCONT).

THE RCC-CW CODE COVERS ANCHOR-RELATED TOPICS



CONTENTS OF THE 2019 EDITION OF THE RCC-CW CODE

PART G - GENERAL
GUSER - NOTE TO THE USER
GTABL - ORGANIZATION OF RCC-CW
GREFD - STANDARDS AND DOCUMENTS MENTIONED IN RCC-CW
GDEFN - DEFINITIONS, NOTATIONS AND ABBREVIATIONS
GGENP - GENERAL PROVISIONS
GA - APPENDICES

PART D - DESIGN
DGENR - GENERAL DESIGN REQUIREMENTS
DGEOT - GENERAL RULES FOR GEOTECHNICAL ENGINEERING
DCONC - GENERAL RULES FOR CONCRETE STRUCTURES
DCLIN - LEAK-TIGHT METAL PARTS ON CONTAINMENTS
DCLIN - LEAK-TIGHT METAL PARTS ON POOLS AND TANKS
DCONC - GENERAL RULES FOR STRUCTURAL STEELWORK
DANCH - DESIGN REQUIREMENTS FOR ANCHORING SYSTEMS EMBEDDED IN CONCRETE
DA to DN - APPENDICES

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

PART M - MAINTENANCE AND MONITORING
MCONT - CONTAINMENT LEAK TESTS AND INSPECTION
MA to MB - APPENDICES

2.5 CIVIL WORKS RCC-CW

2.5.4 Outlook

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/WS 64 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,

. deep foundations,

. improved reinforcement rates,

. maintenance.

2.5.5 Technical publications on seismic isolation and dissipation

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.).

A new technical publication entitled "PTAN – Study report on Seismic Dissipative Devices" was released early 2019. This PTAN compiles the collective experience of AFCEN's corporate members on seismic dissipative devices.

2.5.6 International activities

CEN/WS 64

The Subcommittee is involved in the activities of CEN Workshop 64 - Phase 3.

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

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

Chinese Users Group (CSUG)

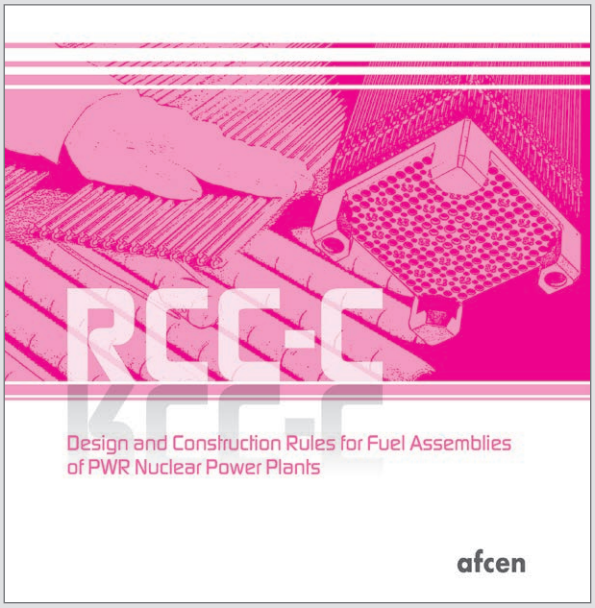
The RCC-CW codes are being shared within the Chinese Users Group, which has held meetings every year since 2015 and is attended by 20 to 30 Chinese experts.

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 Congress. The group held two meetings in 2017 and one meeting in 2018 and 2019.

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 elements (core components),

. the characteristics to be checked for products and parts,

. fabrication methods and 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.

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

Plan of the 1981 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

Plan of the 1986 - 2005 code

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

Plan of the 2015 code

1 - General provisions
2 - Description of the fuel
3 - Design
4 - Manufacturing
5 - Handling and storage

Since the overhaul in 2015, work on modifying the code has mainly focused on reflecting the changes that suppliers have made to the manufacturing aspects, as well as taking account of new products. The code may also be amended as and when requests are issued by ASN following the Permanent Working Groups on fuel, especially product design.

2.6.3 Edition available as of early 2020

The RCC-C 2019 edition is the most recent version.

The main changes between the 2018 and 2019 versions are as follows:

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 (Permanent Working Group).

The RCC-C code will be modified in 2020 to take account of any changes requested by ASN in the follow-up letter from the Permanent Working Group on fuel performance criteria issued by ASN in the summer of 2019.

2.6 NUCLEAR FUEL RCC-C

In terms of manufacturing:

The modifications examined by the working group are as follows:

. additional information on the requirements for the sintering process in the section on pellet qualification,

. heat treatment in case of brazing,

. measures to be taken for cropping in ultrasonic inspections,

. contamination inspection for the primary source fuel rods and source activity for californium capsules,

. criteria for mechanical justification of core component,

. correction of minor typographical errors.

CONTENTS OF THE 2019 EDITION OF THE RCC-C CODE

The professional guide on the qualification of scientific calculation tools used in the safety demonstration (first barrier) is now available in English. It provides the elements of industrial practice required by the French Nuclear Safety Authority (ASN) Guide n°28.

Next edition

The next edition (in French and English) is scheduled for 2020.

2.6.4 Outlook

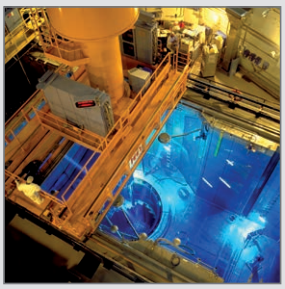
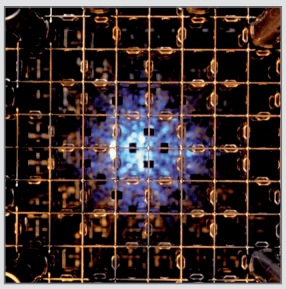
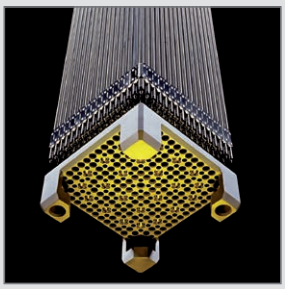
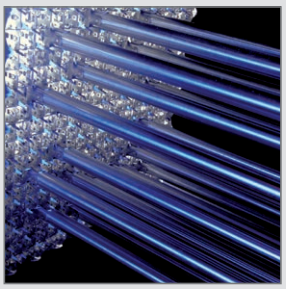
The code will be updated in alignment with the requirements of ISO 9001:2015.

The RCC-C Subcommittee's work on adapting the design requirements will focus on incorporating the conclusions of the French 2017 Permanent Working Group on fuel performance criteria once ASN has issued its follow-up letter.

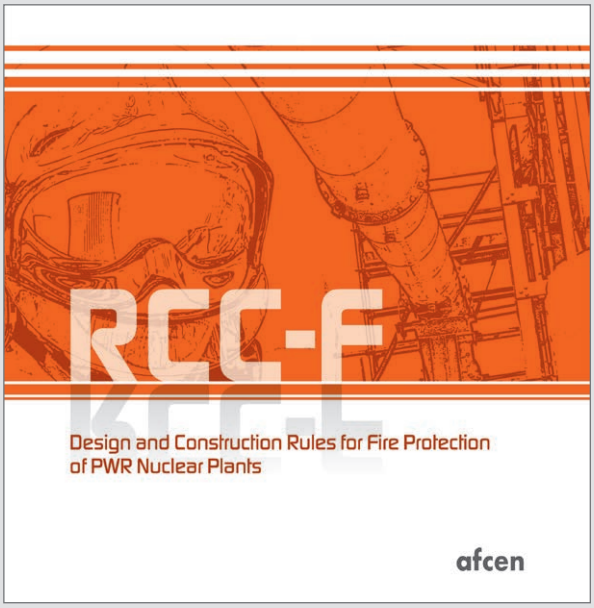
Manufacturing process requirements will be modified according to the proposals and feedback from Subcommittee members. There are also plans to clarify how heat treatment requirements apply to factories.

Chapter 5 (situations outside the nuclear steam supply system) will be revised to clarify the rules and scope of requirements.

The cleanliness requirements in RCC-C will be analyzed and amended if necessary.

2.7 FIRE PROTECTION RCC-F



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 controlling the fundamental nuclear functions. The code also defines the rules for analyzing 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 analyzing 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 analyzing 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 the Flamanville 3 EPR project in France, EDF published a reference document called ETC-F for the design of fire protection systems.

This document 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 2020

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

The English reference version of RCC-F 2017 was published in February 2018, while the French version was released in December 2018.

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, if the principles used for this purpose correspond to updated best practices, they are mentioned for guidance only and their implementation may be suited to other options by a project applying 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 basic nuclear facilities and the ASN decision on the applicable rules for basic nuclear facilities). One of the consequences is that the body of the text in the code now features the new presentation of defense-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

VOLUME A - GENERALITIES
A 1000 - STRUCTURE OF THE RCC-F
A 1100 - GENERALITIES
A 1200 - GENERAL SUMMARY
A 1300 - CODES AND STANDARDS
A 2000 - GENERAL POINTS
A 2100 - OBJECTIVE OF THE RCC-F
A 2200 - APPLICABILITY OF THE RCC-F
A 2300 - DEFINITIONS
A 5000 - QUALITY ASSURANCE

VOLUME B – GUIDELINES FOR NUCLEAR SAFETY DESIGN PRINCIPLES
B 1000 - GUIDELINES FOR NUCLEAR SAFETY DESIGN PRINCIPLES CONCERNING FIRE
B 1100 - MAIN SAFETY OBJECTIVES
B 1200 - DESIGN NUCLEAR SAFETY REQUIREMENTS AND ANALYSIS RULES
B 1300 - APPLICATION OF RANDOM FAILURE PRINCIPLE
B 1400 - FIRE AND EVENTS

VOLUME C – FIRE PROTECTION DESIGN BASES
C 1000 - FIRE PROTECTION DESIGN BASES
C 1100 - PREVENTION OF FIRE START
C 1200 - QUICK DETECTION AND EXTINCTION
C 1300 - LIMITATION OF AGGRAVATION AND PROPAGATION
C 1400 - PREVENTION OF EXPLOSIONS

VOLUME D - CONSTRUCTION PROVISIONS
D 1000 - CONSTRUCTION PROVISIONS
D 1100 - PREVENTION
D 1200 - FIRE CONTAINING
D 1300 - BUILDING ARRANGEMENT FOR EVACUATION AND INTERVENTION
D 1400 – SMOKE PROTECTION, CONTROL AND EXHAUST SYSTEM
D 1500 - EMERGENCY LIGHTING AND FIRE SIGNAGE
D 1600 - PROVISIONS FOR THE DISABLED

VOLUME E – INSTALLATION RULES FOR FIRE PROTECTION
E 1000 - RULES FOR INSTALLING THE FIRE PROTECTION COMPONENTS AND EQUIPMENT
E 1100 - PRODUCTION COMPONENTS AND EQUIPMENT
E 1200 - FIRE PROTECTION EQUIPMENT
E 1300 – EXPLOSION PROTECTION REQUIREMENTS

APPENDIX A (France): Regulations, codes and standards
APPENDIX A (United Kingdom - England and Wales): Regulations, codes and standards
APPENDIX B: Seismic qualification - EPR FA3 example
APPENDIX C: Commissioning and periodic tests
APPENDIX D: Installation provisions for fire-resistant cable wraps
APPENDIX E: Installation provisions for fire-resistant cases
APPENDIX F: EDF documentation applicable to design and operation
APPENDIX G: EPRESSI method
APPENDIX H: Common mode criteria

2.7.4 International activities

The RCC-F Subcommittee held a joint meeting with the CSUG (Chinese Specialized Users Group) in Taishan on November 20-22, 2019 (25 participants). 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.

The CSUG was represented during the AFCEN Congress in Paris from March 26 to 28, 2019.

Several meetings were held in 2019 as part of the AFCEN/NEA agreement on codes and standards (March 28, July 18 and November 22, 2019). The dedicated working group reviewed two research reports in anticipation of updating the Chinese fire code (currently GBT 22158). A Chinese-language version of RCC-F is currently being prepared.

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 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.

In France, further changes may be requested during examination of the RCC-F code as part of the EPR2 project and following China's activities associated with the AFCEN/NEA memorandum of understanding or the GDA for UK Hualong HPR-1000.

The first set of priority topics was launched in 2019:

. methods for analyzing fire risks,

. risks associated with fire protection equipment,

. external fires,

. combined internal and external hazards,

. comparison with international codes (first step: WENRA).

Points 1 and 5 will be addressed in PTAN publications.

Additional sets of topics are also being examined, including post-Fukushima considerations, hydrogen fire risks, requests from the CSUG on cable arrangements.

Lastly, efforts are underway to align each version with the latest changes to regulations, standards, as well as editorial corrections and improvements.

2.8 MECHANICAL FIELD 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).

In particular, it provides the rules for designing and building mechanical components involved in areas subject to significant creep and/or significant irradiation. It incorporates an extensive range of materials (aluminum and zirconium alloys in response to the need for transparency to neutrons, Eurofer, etc.), sizing rules for thin shells and box structures, and several 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-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 standard, drafted by the RCC-MX Approval Committee formed on March 31, 1998 by the Commissariat à l'Energie Atomique, AREVA-TA (now TechnicAtome) and AREVA-NP (now Framatome) for the specific needs of the RJH project (Jules Horowitz reactor). This standard 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. The RCC-Mx standard is being used in the current construction of the RJH experimental reactor (Jules Horowitz reactor).

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. Since then, two new editions of RCC-MRx have been published (in 2015 and 2018).

The RCC-MRx code is serving as a reference for the design of the systems in the RJH project and 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 2020

CONTENTS OF THE 2018 EDITION OF THE RCC-MRx CODE

SECTION I - General provisions
SECTION II - Additional requirements and special provisions
SECTION III - Rules for nuclear installation mechanical components
VOLUME I: Design and construction rules
. Volume A (RA): General provisions and entrance keys
. Volume B (RB): Class 1 components and supports
. Volume C (RC): Class 2 components and supports
. Volume D (RD): Class 3 components and supports
. Volume K (RK): Examination, handling or drive mechanisms
. Volume L (RL): Irradiation devices
. Volume Z (Ai): Technical appendices
VOLUME II: Materials
VOLUME III: Examination methods
VOLUME IV: Welding
VOLUME V: Manufacturing operations
VOLUME VI: Probationary phase rules

The 2018 edition is the most recent version.

This edition reflects feedback on the use of the previous editions of the code, especially in current projects and mainly the Jules Horowitz reactor and the ASTRID project. Examples include the inspection and welding procedures for aluminum, as well as the code’s improvements and new structure relating to components used at high temperatures (design rules, welded assemblies and material properties), with special focus on the rules for preventing progressive deformation.

2.8 MECHANICAL FIELD FOR HIGH-TEMPERATURE, EXPERIMENTAL AND FUSION REACTORS: RCC-MRx

The 2018 edition also proved to be the ideal opportunity to clarify how to use the code, which involved modifying the code's structure and incorporating flowcharts to explain how the rules are organized. This initiative was implemented for the design process, the rules for analyzing fast fracture resistance, and the rules for designing bolted assemblies.

Integration of the Eurofer material used by the fusion community was finalized in the 2018 edition by including the data for use in cases of significant irradiation.

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 (such as incorporation of ISO 3834) and regulations (e.g. updated versions of France's nuclear regulations).

Lastly, the 2018 edition began factoring in feedback from CEN/WS 64 by integrating the workshop's initial modification that identifies the applicable procedure for using the code in case of an innovative coolant,

2.8.4 Outlook

Between 2019 and 2021, efforts will be dedicated at preparing the next edition of the code, which is due to be published in 2022. The aims for the new edition of RCC-MRx are to improve the code's modularity and clarity, so that it can be adapted to the many projects that are likely to use it as a reference. Specific volumes, such as Volume K (examination, handling or drive mechanisms) and Volume L (irradiation devices) will be updated, while a general discussion will be launched on the topic of small equipment.

Another key objective is pursuing and contributing to the success of Phase 3 of CEN/WS 64.

2.8.5 Technological commissioned 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:

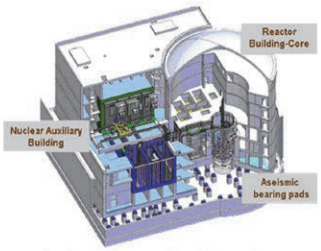
. Fast fracture analysis: this commissioned study also involves the RCC-M code. The aim is to standardize practices between the RCC-M and RCC-MRx codes and clarify the approach for identifying areas where fast fracture analyses must be performed. This commissioned study was completed in 2019 and identifies opportunities for improving the code accordingly.

. 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. This commissioned study will be continued in 2020.

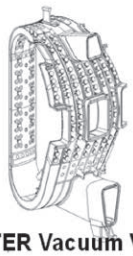
. Preparation of a document describing the sources and key reasons underlying Appendix A1 (guide for the seismic analysis of equipment): the aim of this commissioned study is to publish the criteria for Appendix A1 in a PTAN. This commissioned study was finalized in 2018, following which these criteria were published.

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

RCC-Mx 2008



Jules Horowitz Reactor



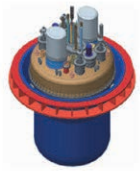
ITER Vacuum Vessel

RCC-MR 2007

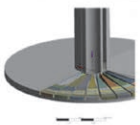
Indian PFBR

RCC-MR 2002

RCC-MRx 2012

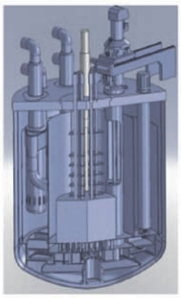


MYRRHA primary system



RCC-MRx 2012

European Spallation Source target



ASTRID

RCC-MRx 2012

afcen

Shaping the rules for a sustainable nuclear technology

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 list of standards used by a code is grouped in one of the code's chapters.

The Subcommittees occasionally analyze 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 bureaus that produce standards with a potentially significant impact on its codes and subsequently increasing their presence if necessary (ISO, IEC and CEN/CENELEC at the European level). Such participation is also conducive to harmonizing practices at the international level.

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 pursued by the international group of standards developing organizations via the SDO Convergence Board, and interacts with the code-specific groups in OECD/NEA/CNRA (safety authorities) and WNA/CORDEL (industrial organizations).

AFCEN promotes interaction between leading players in Europe's nuclear industry through CEN WS 64, which aims to share the different countries' code-related practices and issue recommendations and requests to help make AFCEN easier to understand and use.

3.2.1 SDO Convergence Board

AFCEN is an active contributor to the international group of standards developing organizations (SDO Convergence Board), which was founded in 2010 to simplify introduction of compatible rules in each of the different mechanical codes. The SDO Board holds four meetings a year in addition to the ASME (Code Week).

AFCEN is a member of the Convergence Board, just like ASME, JSME, KEPIC, CSA and NIKIET. AFCEN voices its development objectives and contributes to convergence opportunities on the topics examined by the group. In 2019, AFCEN presented its development program for the RCC-M code. This outward-looking approach garnered the interest of other SDOs, particularly ASME, to collaborate on specific topics (e.g. equipment seismic analyses).

The SDO Convergence Board liaises with WNA/CORDEL and OECD/NEA/CNRA (industrial organizations and safety authorities respectively), which strive to improve code harmonization, especially in the mechanical engineering field.

AFCEN is an observer in the MCSTF Task Force (Mechanical Codes & Standards) of the CORDEL working group (Cooperation in Reactor Design Evaluation and Licensing). The World Nuclear Association (WNA) created CORDEL in 2007 to stimulate dialog between international nuclear industry professionals. CORDEL/MCSTF compares the different mechanical codes on various subjects, such as non-linear analyses and fatigue, and organizes case studies (benchmarks). These works take account of the rules in AFCEN's codes (RCC-M and RCC-MRx). They are implemented in the benchmarks via AFCEN's members. The conclusions of CORDEL/MCSTF's works are submitted to the standards developing organizations for their opinion. In 2019, AFCEN issued an advisory on the benchmark report on fatigue analysis rules.

Safety authorities have taken an interest in the convergence efforts spearheaded by the standards developing organizations (SDO Convergence Board) and WNA/CORDEL association. Following a request from the French Nuclear Safety Authority, AFCEN presented its technical qualification strategy for fabricated components, including fulfilment of the requirements of the ESPN Regulation, the OECD/NEA/CNRA Working Group on Codes & Standards in 2019.

3.2 HARMONIZATION AND COOPERATION INITIATIVES

3.2.2 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 RCC-MRx code draft. 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 files 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 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 enabled participants to fully implement the process for ensuring continuous coordination with AFCEN, such as stipulated in the business plan.

Phase 2 of 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. The kick-off meeting for Phase 3 was held in January 2019 and allowed participants to finalize the business plan with the following four key objectives:

. Strengthen synergistic ties between European experts on nuclear codes to minimize fragmented best practices across the nuclear industry and give international rules greater emphasis while promoting European requirements and practices.

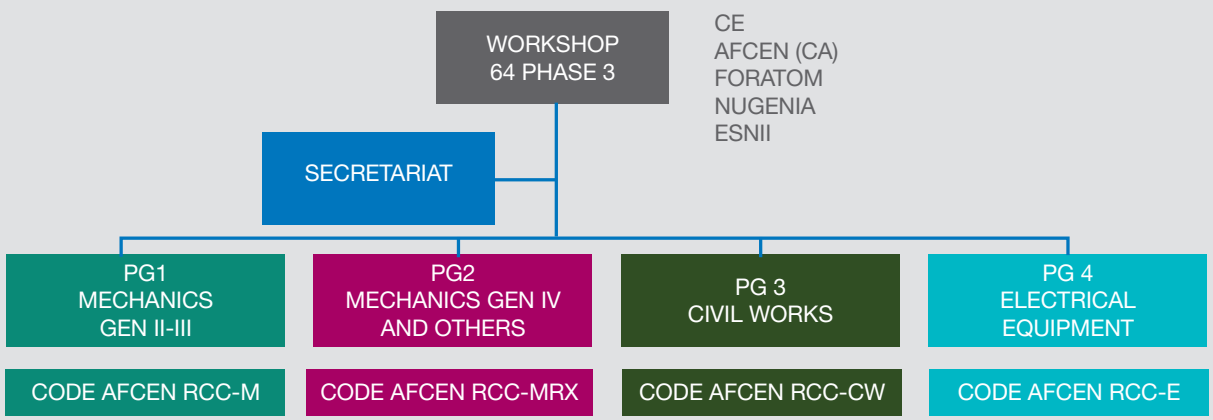
. Allow future nuclear project leaders to raise awareness of their project's constraints and suggest changes to the codes.

. Engage operators and manufacturers with a collaborative process for preparing and defining a standard for managing aging facilities, sourcing spare parts and extending the service life of nuclear power plants.

. Raise awareness of AFCEN's codes among entities potentially involved in evaluating nuclear reactors during an invitation to tender for the purpose of developing new nuclear production assets as part of the long-term plan to renew Europe's existing nuclear infrastructure.

This phase covers the three codes previously involved in Phase 2 (RCC-M, RCC-MRx and RCC-CW) and also encompasses the RCC-E electrical code.

ILLUSTRATION OF AFCEN'S PARTICIPATION IN CEN



afcen

Shaping the rules for a sustainable nuclear technology

SUPPORT THROUGH 4 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

IN 2019, AFCEN RENEWED ITS TRUST IN TWO PARTNERS: PONT FORMATION CONSEIL AND VINCOTTE ACADEMY, AND INITIATED A PARTNERSHIP WITH UFPI. IN ALL, THE 12 ORGANIZATIONS THAT HAVE SIGNED A PARTNERSHIP AGREEMENT WITH AFCEN TO DELIVER TECHNICAL TRAINING ARE AS FOLLOWS: VINCOTTE ACADEMY, APAVE, FRAMATOME, BUREAU VERITAS, PONT FORMATION CONSEIL, EFECTIS, INSTITUT DE SOUDURE GROUP, INSTN, SICA NUCLEAIRE, SNPI (CGN GROUP), CEF INGÉNIERIE AND UFPI.

PARTNERSHIP AGREEMENTS SIGNED BY AFCEN AND TRAINING ORGANIZATIONS BY THE END OF 2019

4.1 CERTIFIED TRAINING

Following proposals from the training officers, the Committee has certified the content of 36 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.


afcen

ATTESTATION

de suivi de la session de formation

« TITRE DE LA FORMATION »

Titre du Code

Logo Organisme

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
Prénom, Nom

Pour l'organisme
Le Responsable de la Formation
Prénom, Nom

www.afcen.com

www.site organisme

AFCEN CERTIFICATE OF ATTENDANCE

AFCEN TRAINING CATALOG AS OF LATE 2019 (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 partners
	Structure and application of the code	3 days	FR	One partner
	Procurement of 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	2 days	FR	One partner
	Introduction to the RSE-M and RCC-M codes	5 days	FR	One partner
RCC-E	Introduction to the code	1 day	FR/EN	Two partners
	Comprehensive code training	4 days	FR/EN	One partner
	Qualification and long-term fabrication of mechanical components qualified under accidental conditions (2012 & 2016 editions)	2 to 3 days	FR/EN	One partner
	Gap 2012 – 2016	1 day	FR/EN	One partner
RCC-CW	Introduction générale	1 jour	FR/EN	1 partenaire
	Construction	2 jours	FR/EN	1 partenaire
	Design	3 jours	FR/EN	1 partenaire
RCC-C	Introduction and use of the RCC-C code	2 days	FR	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 agreement with AFCEN.

4.2 TRAINING COURSES DELIVERED IN 2019

In 2019, 44 training sessions were held and covered all codes, representing 572 trainees and 1,413 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 2019, the certified training catalog was enhanced. 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 will be available in 2020.

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 2019, courses were delivered in Germany, China, South Korea, India and the United Kingdom.

A partnership agreement was renewed for China with SNPI (CGN Group) in 2018. The RCC-M training course provided by this organization was certified in 2016. In 2018, 372 trainees completed the RCC-M course.

In India, a partnership was set up by AFCEN, EDF, BUREAU VERITAS and LARSEN & TOUBRO to facilitate the provision of certified training in the country and thereby accompany the projects currently being spearheaded by the French nuclear industry. In 2019, close to 30 trainees completed the RCC-M course.

4.4 UNIVERSITY TRAINING

As discussed when preparing its strategic plan, efforts are currently being made to present AFCEN's codes in certain undergraduate courses in nuclear engineering. It is effective for students on the following programs:

. Masters in Nuclear Energy - part of the common core syllabus and also available as specialized modules: Fuel Cycle (RCC-C), Operation (RSE-M) and Nuclear Plant Design (RCC-M, RCC-E and RCC-CW),

. Engineering degree with honors in nuclear engineering offered by CNAM (RCC-M, RCC-F and RCC-CW)

. Degree in atomic engineering from INSTN (RCC-MRx)

The related course content is coordinated by the Training Committee and reviewed by the training managers to ensure that it is relevant and regularly updated with the latest editions of the codes.

afcen

Shaping the rules for a sustainable nuclear technology

APPENDIX A

ORGANIZATION AND OPERATION OF AFCEN

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

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, who approve its general strategic directions and budget.

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

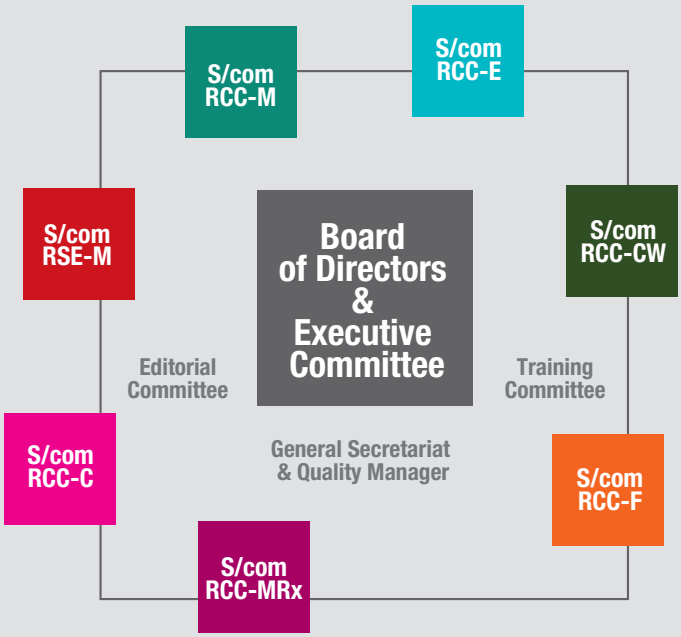
The Board designates an Executive Committee, which is tasked with achieving its work program. The Executive Committee is assisted by a General Secretariat, which is responsible for the general coordination of the association's activities, a Training Committee, an Editorial Committee and seven Subcommittees (one for each code).

AFCEN does not have any regular employees. Its work is performed by experts who have been designated by the Board of Directors and Committees, and who are made available by its members.

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, while capitalizing on user feedback.

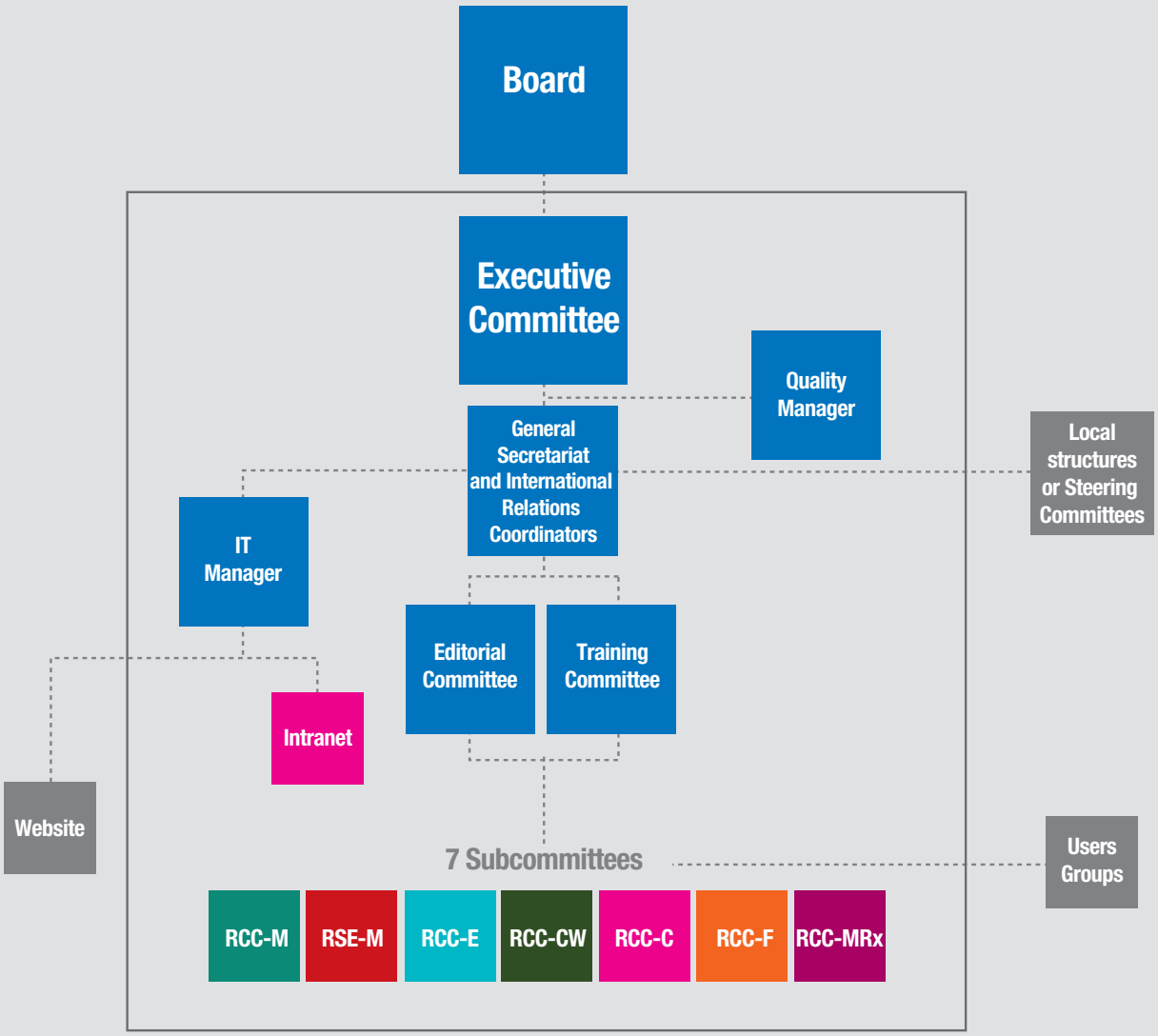
These local structures usually comprise Users Groups, which are not necessarily AFCEN members. In principle, each Users Group is associated with a code.

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 to members on its activities during the General Meeting.

PHILIPPE BORDARIER
PRESIDENT, EDF ADMINISTRATOR

FRANÇOISE DE BOIS
VICE-PRESIDENT TREASURER,
Framatome ADMINISTRATOR

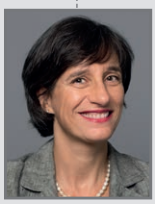
PARTICIPATE IN BOARD MEETINGS

LUCIEN ALLAIS
CEA ADMINISTRATOR

ÉRIC PROUST
CEA ALTERNATE ADMINISTRATOR

MANUEL CARRASCO
EDF ALTERNATE ADMINISTRATOR

NICOLAS GILLET
FRAMATOME ADMINISTRATOR



CHRISTINE MURISON
GENERAL SECRETARY

BRUNO MARQUIS
DEPUTY GENERAL SECRETARY

AFCEN'S BOARD OF DIRECTORS

A.2 ORGANIZATION AND OPERATION

The activity of the Board of Directors and the General Meeting in 2019 is summarized in the box below.

ACTIVITY OF THE BOARD OF DIRECTORS AND THE GENERAL MEETING IN 2019

The Board of Directors held two meetings in 2019, while the Executive Committee held five meetings.

Members held their General Meeting on March 28, 2019, and approved AFCEN's strategic directions for 2019:

implement AFCEN's strategic roadmap,

in France, keep our commitments for conformity of mechanical construction code with French ESPN regulations,

support preparation of international nuclear offers,

reinforce AFCEN international position to be reference in Europe,

pursue the development of our open policy towards new members and reinforce their technical participation,

strengthen our provision of adapted AFCEN training courses to reply to industrial demand,

maintain AFCEN financial performance and organization efficiency,

protect AFCEN expertise and ensure respect of publications right of use.

In 2019, Framatome appointed a new administrator on AFCEN's Board of Directors: Nicolas Gillet substituting Françoise de Bois.

In November 2019, the Board of Directors appointed Philippe Geyer from EDF UTO as Chair of the RSE-M Subcommittee.

In 2019, the Board of Directors approved the membership of Ponticelli, Wood Nuclear France, Alphatest, Cita Production and Edvance (membership for 2020).

AFCEN's strategic directions in English

Implement AFCEN strategic roadmap

In France, keep our commitments for conformity of mechanical construction code with French ESPN regulations

Support preparation of international nuclear offers

Reinforce AFCEN international position to be reference in Europe

Pursue the development of our open policy towards new members and reinforce their technical participation

Strengthen our provision of adapted AFCEN training courses to reply to industrial demand

Maintain AFCEN financial performance and organization efficiency

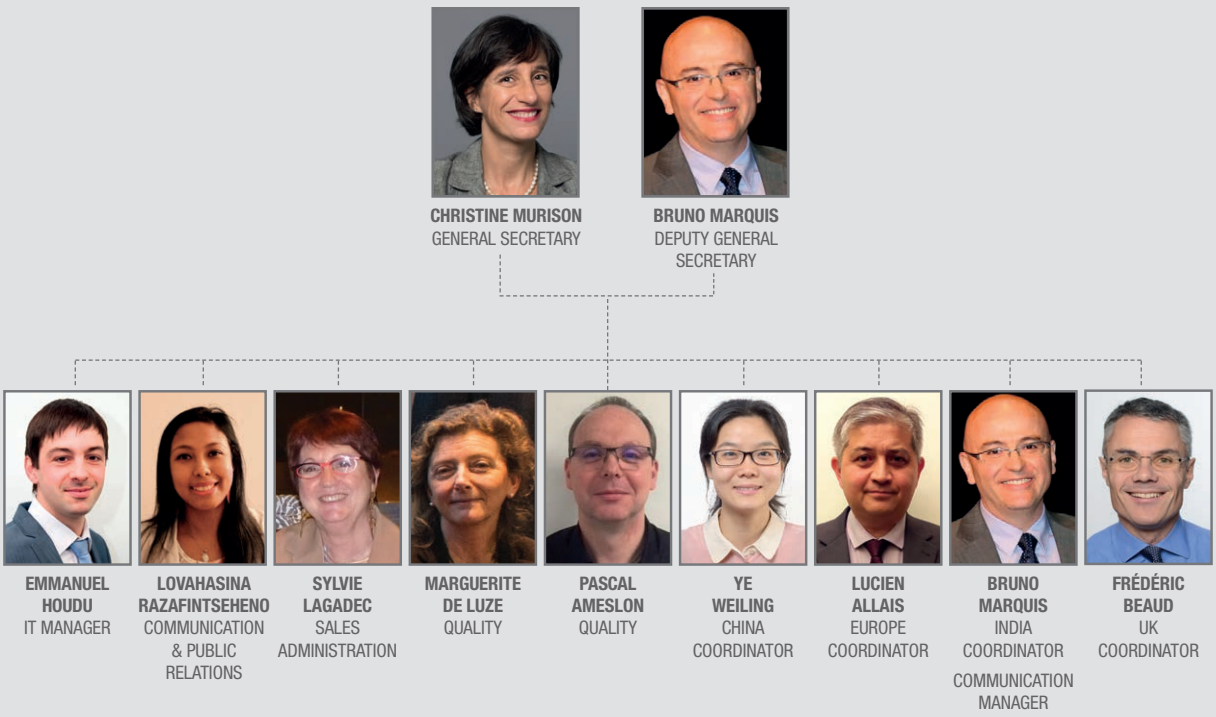
Protect AFCEN expertise and ensure respect of publications right of use

A.2.3 General Secretariat

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

The General Secretariat organizes and leads meetings of the Executive Committee, the body responsible for taking the association's operational decisions. It organizes the process of producing and distributing codes, and supports all AFCEN activities deployed by the Editorial and Training Committees. The General Secretariat interfaces with the association's members, clients and interested parties.

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 Committees, Subcommittees and their expert 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 the 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 and the Deputy Chairs are appointed by the Board of Directors. In addition to the Chair and two Deputy Chairs, the Editorial Committee is attended by the Chairs from each Subcommittee. The Secretary-General and the Deputy Secretary-General, as well as the International Coordinators, Quality Manager and Information System Manager, are invited to attend Editorial Committee meetings. Depending on the order of business, working group leaders are also invited to report on the progress of specific work programs covering multiple subject areas.

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.

FRÉDÉRIC BEAUD
CHAIRMAN OF THE EDITORIAL COMMITTEE

CLAUDE DUVAL
DEPUTY

GAUTIER COSSART
DEPUTY

STÉPHANE MARIE
CHAIRMAN
OF THE RCC-M
SUBCOMMITTEE

PHILIPPE GEYER
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

BERNARD GAUTIER
CHAIRMAN
OF THE RCC-F
SUBCOMMITTEE

CÉCILE PETESCH
CHAIRMAN
OF THE RCC-MRx
SUBCOMMITTEE

AFCEN'S EDITORIAL COMMITTEE

A.2 ORGANIZATION AND OPERATION

General activity of the Editorial Committee in 2019:

The Editorial Committee held four meetings. The main items addressed during the meetings were as follows:

a. AFCEN's general information (events, meetings, organization, information system, etc.)
b. International news and projects
c. Operation of the Editorial Committee (organization, quality, etc.)
d. Oversight of the editorial program (codes, overarching studies, ESPN program, etc.) with subject presentations
d. Subcommittee reporting

The Editorial Committee approved the publication of three new editions in 2019: RCC-E, RCC-CW and RCC-C.

The three-year ESPN program (2016-2018) produced a professional technical standard to address the essential safety requirements of the ESPN Regulation of December 30, 2015, as amended, which governs the construction, manufacture and installation of nuclear pressure components in France. This standard is modeled on the 2018 editions of the RCC-M and RSE-M codes and a set of guides (AFCEN technical publications) targeting the topics covered by the ESPN Regulation. For N1 equipment, ASN wrote in 2019 that "applying the 2018 edition of the RCC-M code provides a solid foundation for implementing the ESPN Regulation". GSEN had already gone on record in 2018 as stating that the solutions provided fulfilled the essential safety requirements for N2 / N3 nuclear equipment and assemblies.

A four-year follow-up program was defined and launched in 2019 to build on feedback and continue exploring specific topics in greater detail.

ASN and GSEN are frequently in contact.

Finally, the terms for complying with the requirements of the ESPN Regulation, such as described in AFCEN's standard, are gradually being developed into a digital tool (ESPN Digital) with the aim of simplifying their implementation by the different stakeholders (manufacturers, organizations, operators, safety authorities, etc.). AFCEN is ensuring that its codes are effectively represented in the tool.

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.

Various work programs were completed in 2019, such as efforts focusing on improved fast fracture (RCC-M/RCC-MRx). Other work programs were launched or continued on such topics as the design of mechanical and electrical equipment to withstand extreme natural hazards, quality management requirements (all codes), cybersecurity (RCC-E) and ageing concrete structures (RCC-CW).

A.2.5 Training Committee

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

Training programs certified by AFCEN 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 catalog 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.

BRUNO MARQUIS
CHAIRMAN OF TRAINING COMMITTEE

CHRISTINE MURISON
DEPUTY

ANDREW WAZYLYK
MANAGER FOR TRAININGS ON RCC-M

PASCAL BLIN
MANAGER FOR TRAININGS ON RSE-M

THOMAS RIOU
MANAGER FOR TRAININGS ON RCC-E

ALEXANDRE BOULE
MANAGER FOR TRAININGS ON RCC-CW

LUDOVIC QUEMARD
MANAGER FOR TRAININGS ON RCC-C

MICKAËL CESBRON
MANAGER FOR TRAININGS ON RCC-F

THIERRY LEBARBE
MANAGER FOR TRAININGS ON RCC-MRx

AFCEN'S TRAINING COMMITTEE

A.2 ORGANIZATION AND OPERATION

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 2019

General activity of the Training Committee in 2019:

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 reporting (certified training strategy, in-class evaluations, feedback from trainees, etc.)

The Training Committee consolidated 36 training courses and issued 572 certificates of attendance for courses on AFCEN codes. A new course entitled "Introduction and use of the UFPI RSE-M code" was certified in 2019, and the first session was held in November.

The Training Committee pursued its strategy of developing international courses, particularly in China with a certified Chinese-language course on RCC-M and also in India (one course on RCC-M).

Specialized courses are available for the RCC-M code. The committee has also pursued work on creating a training program on the documentation associated with the ESPN Regulation, which are now available to accompany the publication of the 2018 editions of the RCC-M and RSE-M codes.

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 2019

In 2019, seven Subcommittees were active:

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

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.

Each Subcommittee comprises:

. a Subcommittee General Assembly,

. a Subcommittee Board,

. permanent working groups,

. dedicated 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.

The dedicated working groups spend a finite amount of time investigating specific technical subjects commissioned by the Subcommittee. They produce studies that may culminate in publications following approval from the Subcommittee or issue modification requests that are examined by the permanent working groups.

Permanent 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-field concerned,

. examining and responding to modification and interpretation requests.

Permanent working groups investigate modification requests 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.

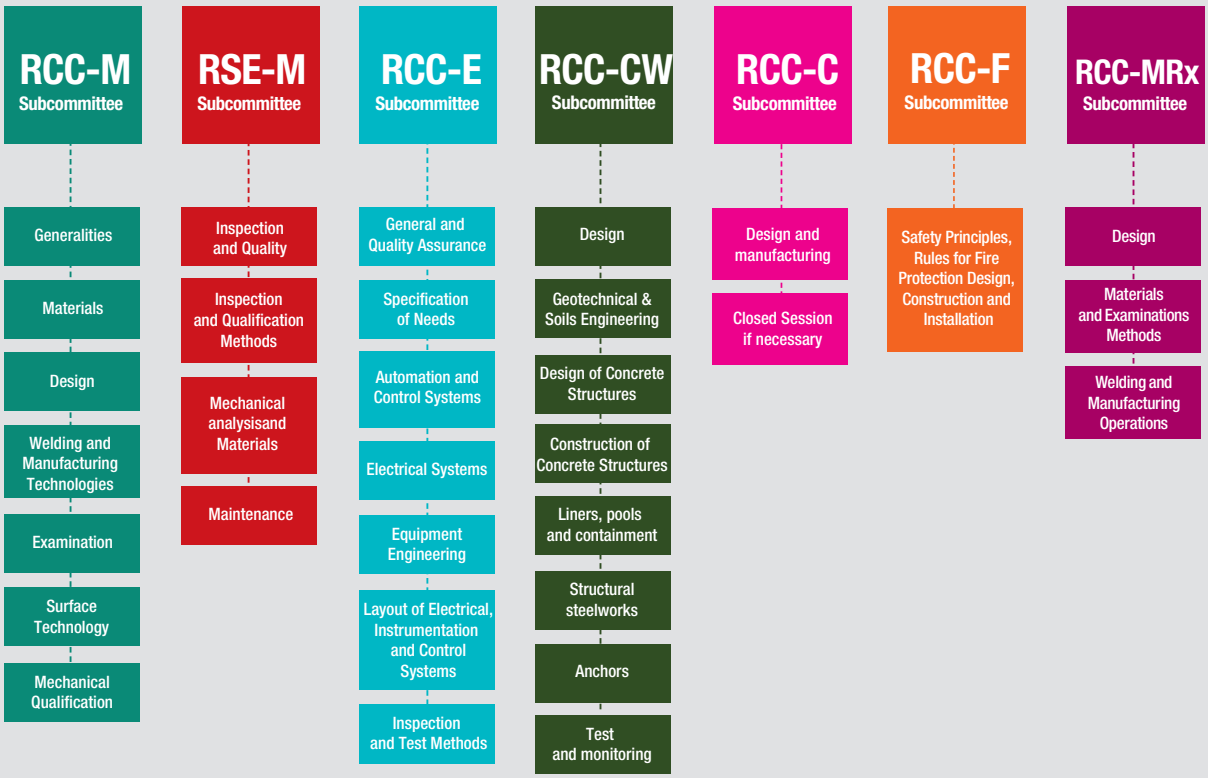
Texts approved by the Subcommittee Board are submitted to the Editorial Committee and Secretary-General by the Subcommittee Chair to obtain approval for publication.

In 2019, 32 permanent working groups were active.

The Subcommittees held between three and nine plenary sessions
(RCC-M: 4; RSE-M: 6; RCC-F: 4; RCC-C: 9, RCC-MRx: 5; RCC-CW: 4; RCC-E: 3)

GENERAL ACTIVITY OF THE SUBCOMMITTEES IN 2019

A.2 ORGANIZATION AND OPERATION



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 activities within the scope of the relevant Subcommittee. Their missions involve:

. pre-investigating modification and interpretation requests 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 national Steering Committee coordinates activities of all the Users Groups in a given country. This Steering Committee is governed by an agreement with AFCEN and at the very least comprises a representative from AFCEN's General Secretariat (a designated international coordinator for the country), members from the relevant Subcommittees (international stakeholders) and the Chair of each Users Group in the country.

In 2019 in the UK:

The RCC-M Users Group, which is coordinated by TWI (The Welding Institute), was relaunched in a different format and held a meeting in March after the spate of meetings between 2014 and 2016, which were attended by approximately 15 representatives from the UK's nuclear industry.

The Users Group for civil engineering codes was launched late 2016 under WOOD's supervision. The group held one meeting in 2019 (October). The group proved to be an attractive and profitable venture for taking advantage of the lessons learned from the HPC project and fostering a close-knit community of experts and manufacturers in the UK.

The principle of creating an RCC-E Users Group was approved in 2018. In 2019, the group had yet to be formed.

The Steering Committee for the UK Users Groups, which is chaired by NNB, will hold a meeting early 2020.

In 2019 in China:

Most of the Chinese Specialized Users Groups (CSUGs) for each code held two meetings in 2019. The CUG Steering Committee held a meeting in November 2019. The CSUGs also host the working groups between AFCEN and NEA (National Energy Administration) based on collaborative projects with Chinese standards.

GENERAL ACTIVITY OF THE AFCEN CODE USERS GROUPS IN 2019

A.3 AFCEN QUALITY MANAGEMENT

AFCEN has set up a process-based management system to perform its missions, namely produce and disseminate reference publications and codes for building, operating and using nuclear facilities.

This process-based organization enables AFCEN to:

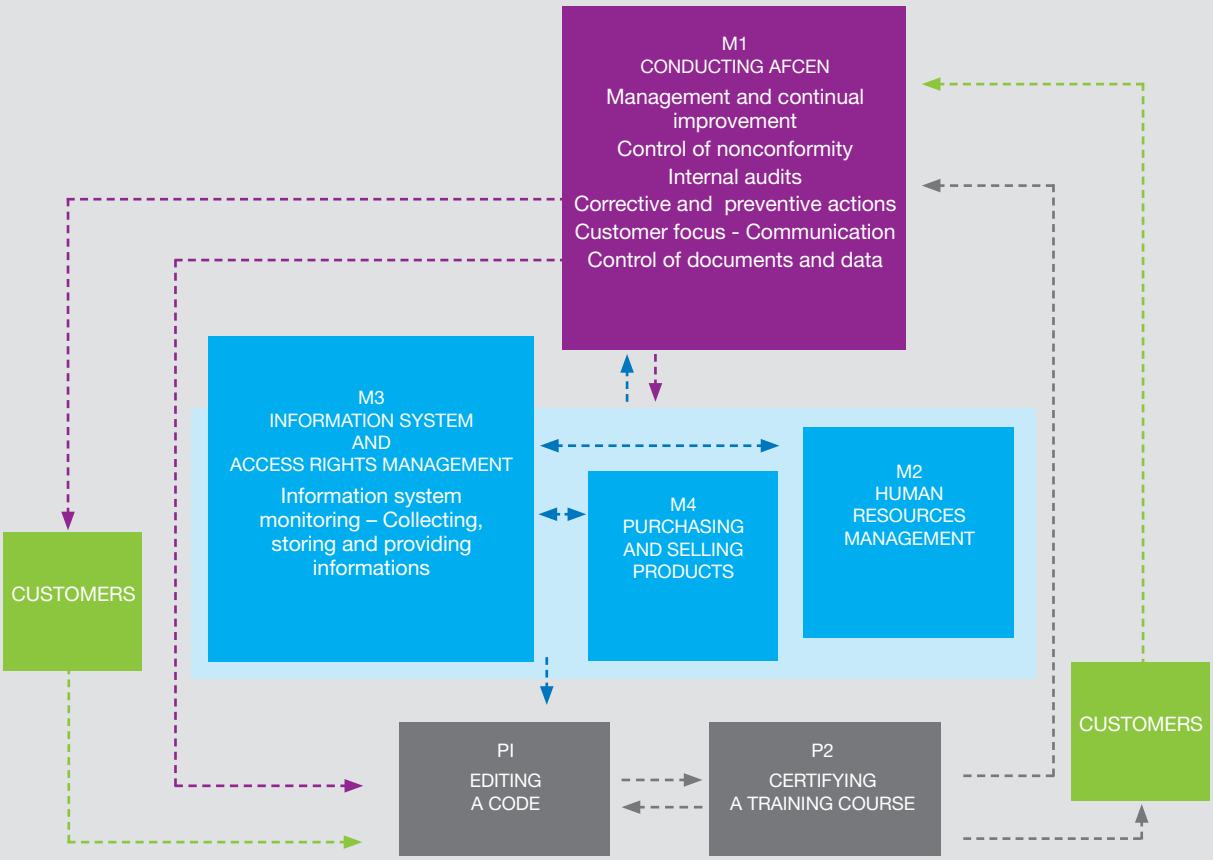
. supervise AFCEN's operation from a cross-functional perspective,

. 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) required to distribute the codes.

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 has been ISO 9001-certified since January 2014. In 2017, AFCEN migrated its quality management system to the 2015 version of ISO 9001. In 2019, the renewal audit concluded that AFCEN's quality management system was sufficiently robust and effective.

AFCEN's general quality management activities in 2019 are summarized in the box below.

Two internal audits were conducted in 2019 into the code production process and AFCEN's management practices.

Two process reviews were performed for skills management and information system management.
The AFCEN management review was held on February 13, 2019. 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,
. consider the interested parties and assess their expectations,
. examine the risk assessments for the processes that changed during 2019 and decide which actions need to be implemented to mitigate such risks, while considering the opportunities for improving process performance,
. analyze feedback from the AFCEN Day event in June 2018,
. incorporate feedback from the European workshop on AFCEN codes,
. 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, and by assisting with the development of training courses for partner organizations specifically on how to apply the guides and appendices,
. disseminate the safety culture at the international level via the Users Group meetings in China and the United Kingdom, and enhance the culture through targeted training,
. support training on the RCC-M code in China and India,
. 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, and so on,
. engage and coordinate Phase 3 of the European workshop,
. expand its code dissemination platform in partnership with AFNOR.
. formalize standards and legislative intelligence activities in the subcommittees.

Certification renewal audit:

On October 25, 2019, AFCEN passed the certification renewal audit on its quality management system (ISO 9001: 2015). The auditor highlighted a number of strengths, including the consistency between AFCEN's activities with its clearly stated strategic challenges, bearing in mind that its resources work at a great distance from each other on a range of extremely technically advanced topics. The auditor also commented that the quality strategy is a key part of AFCEN's and its members' DNA. He concluded that AFCEN's quality management system is fit for purpose and regularly revised with a dynamic and strongly involved management team.

AFCEN'S GENERAL QUALITY MANAGEMENT ACTIVITIES

A.4 RESOURCES (MEMBERS, RESOURCES PER SUBCOMMITTEE)

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

A.4.1 AFCEN members in 2019

By the end of 2019, AFCEN had 72 members:

1	ALPHATEST	FR	26	FUSION FOR ENERGY	ESP	51	SCHNEIDER ELECTRIC	FR
2	APAVE	FR	27	GENERAL ELECTRIC	FR	52	SCK CEN	BELG
3	ASAP	FR	28	GEODYNAMIQUE ET STRUCTURE	FR	53	SICA NUCLEAIRE	FR
4	BERNARD CONTROLS	FR	29	GIS MIC NUCLEAIRE	FR	54	SIGEDI	FR
5	BOUYGUES TP	FR	30	HALFEN GMBH	ALL	55	SITES	FR
6	BUREAU VERITAS	FR	31	HILTI France	FR	56	SNCT	FR
7	CEA	FR	32	INSTITUT LAUE LANGEVIN	FR	57	SPXFLOW	FR
8	CETIM	FR	33	INTERCONTROLE	FR	58	TECHNICATOME	FR
9	CGNPC	CHINE	34	ITER	EN	59	TRACTEBEL Engineering (ENGIE)	FR
10	CITA PRODUCTION	FR	35	JIULI (ZHEJIANG JIULI HI-TECH METALS CO LTD)	CHINE	60	TUV UK Ltd	UK
11	CNNC					61	TWI LTD	UK
12	CSTB	CHINE	36	JORDAHL	ALL	62	UGITECH	FR
13	DAHER VALVES	FR	37	LISEGA SAS	FR	63	VALINOX NUCLEAIRE	FR
14	DEXTRA MANUFACTURING	FR	38	MANGIAROTTI SPA	ITA	64	VELAN SAS	FR
15	EDF	THAI	39	NAVAL GROUP SA	FR	65	VINCI CONSTRUCTION	FR
16	EFECTIS France	FR	40	NFM SYSTEMS	FR	66	VINCOTTE SA	BELG
17	EGIS INDUSTRIES	FR	41	NNB	UK	67	WEIR POWER & INDUSTRIAL France	FR
18	EIFFAGE GC	FR	42	NUVIA PROTECTION	FR			
19	EMERSON PROCESS MANAGEMENT	FR	43	ONET TECHNOLOGIES	FR	68	WESTINGHOUSE FR	FR
20	ENDEL	FR	44	ORANO	FR	69	WOOD	UK
21	ENSA (EQUIPOS NUCLEARES S.A, SME)	FR	45	ORTEC	FR	70	WOOD Nuclear France	FR
		ESP	46	OXAND	FR	71	WUERTH	ALL
22	EPM INC	USA	47	PETERCEM	FR	72	EDVANCE	FR
23	ESI GROUP	FR	48	PONTICELLI	FR			
24	FLOWSERVE	FR	49	ROLLS ROYCE CN SAS	FR			
25	FRAMATOME	FR	50	SAMT	FR			

AFCEN MEMBERS IN 2019

A.4.2 Member involvement in the Subcommittees

In 2019, AFCEN members were involved in the Subcommittees as described in the box below.

RCC-M (40 members)
ALPHATEST, APAVE, ASAP, BUREAU VERITAS, CEA, CETIM, CNNC, CGNPC, CITA, DAHER VALVES, EDF, EDVANCE, EMERSON PROCESS MANAGEMENT, ENDEL, ENSA, ESI GROUP, FLOWSERVE SAS, Framatome, GIS MIC NUCLEAIRE, JIULI, LISEGA SAS, MANGIAROTTI, NAVAL GROUP, NNB, ONET TECHNOLOGIES, ORANO, ORTEC, PETERCEM, SIGEDI, SNCT, SNPI (CGN Group), SPXFLOW, TECHNICATOME, TUV UK Ltd, TWI LTD, UGITECH, VALINOX NUCLEAIRE, VELAN SAS, VINCOTTE SA, WESTINGHOUSE FR, WEIR;

RSE-M (19 members)
APAVE, ASAP, BUREAU VERITAS EXPLOITATION, CEA, CNNC, EDF, ENDEL, ESI GROUP, Framatome, INTERCONTROLE, NNB, ONET Technologies, ORANO, ORTEC, PONTCELLI, SNPI (CGN Group), TECHNICATOME, TWI LTD, WESTINGHOUSE FR.

RCC-E (17 members)
APAVE, Bernard Controls, CEA, CNNC, EDF, EMERSON PROCESS MANAGEMENT, Framatome, GENERAL ELECTRIC, NNB, PETERCEM, ROLLS ROYCE CN SAS, SCHNEIDER ELECTRIC, SICA NUCLEAIRE, TECHNICATOME, SNPI (CGN Group), WESTINGHOUSE FR, WOOD.

RCC-CW (30 members)
ADOLF-WUERTH GmbH & Co.KG, APAVE, ARCADIS, BOUYGUES TP, CEA, CNNC, CSTB, DEXTRA MANUFACTURING, EDF, EDVANCE, EGIS INDUSTRIES, EIFFAGE GC, Framatome, FUSION FOR ENERGY, GEODYNAMIQUE ET SRUCTURE, HALFEN GMBH, HILTI France, JORDAHL, NFM TECHNOLOGIES, NNB, ORANO, OXAND, SAMT, SITES, SNPI (CGN Group), TECHNICATOME, TRACTEBEL Engineering, UGITECH, VINCI CONSTRUCTION, WOOD.

RCC-C (6 members)
CEA, CNNC (NPIC), EDF, Framatome, SNPI (CGN Group), WESTINGHOUSE FR.

RCC-F (8 members)
CEA, SNPI (CGN Group), EDF, EDVANCE, EFECTIS France, EPM Inc, Framatome, NUVIA PROTECTION (formerly MECATISS).

RCC-MRx (18 members)
APAVE, BUREAU VERITAS EXPLOITATION, CEA, CNNC, EDF, ENSA, Framatome, FUSION FOR ENERGY, ILL, ITER, MANGIAROTTI, ONET Technologies, ORANO, SCK CEN, SPXFLOW, TECHNICATOME, VALINOX NUCLEAIRE, VINCOTTE SA.

AFCEN MEMBER INVOLVEMENT IN THE SUBCOMMITTEES IN 2019

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.

In 2019, over 860 experts contributed to AFCEN's work as follows:

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

Commissioned studies relating to the four-year ESPN program: 84

Foreign experts in the Users Groups: 199 (China), 53 (UK)

A.4 RESOURCES (MEMBERS, RESOURCES PER SUBCOMMITTEE)

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.

In 2019, AFCEN continued offering training sessions for its main users in the collaborative space available to its expert members. Over 1,000 users have registered. In 2019, efforts were directed at upgrading the system with improved search functionality and superior usability. Sharing the tables ensures faster access to information. The shared calendar featuring the main events is now operational.

A.5.2 The AFCEN.com website

AFCEN.com presents AFCEN's organization, activities and latest news. The website acts as an interface with the public, interested parties and users.

The website also supports the AFCEN sales model. The e-shop sells AFCEN's publications with access via the online library. Since 2019, users can also sign up for AFCEN's events on the website.

In 2019, AFCEN finalized the provisions required by the General Data Protection Regulation (GDPR), which became effective on May 25, 2018, for information exchanges. At the same time, AFCEN defined its data privacy policy and updated its terms and conditions of sale on the **www.afcen.com** website to ensure complete transparency.

A.5.3 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,

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 clients sign up for the three-year subscription plan, they receive a 60% discount for the first year of their subscription. The price per code is summarized in Appendix B of the price list.

A.5.4 Distribution agreement with AFNOR

In October 2017 and subsequently in August 2018, AFCEN and AFNOR signed two non-exclusive agreements to distribute AFCEN's codes using AFNOR's "WEBPORT" and "SAGAWEB" web solutions.

These solutions are aimed at both large industrial organizations and small businesses / industries, and are designed to provide users at one or more sites with access to all the codes. These platforms are intended to centralize purchases instead of the AFCEN e-shop, which is more suited to low-volume purchases.

Visit **www.afcen.com** to find out more!

afcen

Shaping the rules for a sustainable nuclear technology

APPENDIX B

CATALOG

OF AFCEN CODES AND DOCUMENTS AVAILABLE FOR SALE

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 2018 / 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 / CRITERIA RCC-M 2014 / ERRATA APPENDIX ZG - Ed 2000 addenda 2007 and following editions / PTAN 2015 Radioprotection / PTAN 2018 Radioprotection / PTAN 2016 ADR N1 / PTAN 2018 ADR N1 / PTAN 2018 ADR N2 / PTAN 2016 Référentiel Dimensionnel N1 / PTAN 2016 KV Faibles Epaisseurs / PTAN 2016 Notice d'instructions / PTAN 2018 Notice d'instructions / PTAN 2017 Inspectabilité N1 / PTAN 2018 Inspectabilité N1 / PTAN 2018 Inspectabilité N2 N3 / PTAN 2018 Classement des pièces des accessoires type ASP ou ADS / PTAN 2018 Conservation de la matière / PTAN 2018 Corrosion des aciers inoxydables austenitiques N1 N2 et N3 / PTAN 2018 Modalités de l'examen visuel final / PTAN 2018 Réalisation des contrôles visuels de fabrication / PTAN 2018 Rédaction des EPMN N2 N3 / PTAN 2018 RDE N2 N3 / PTAN 2018 SRMCR N2 N3 / PTAN 2018 Surveillance de la fabrication des composants non soumis à QT spécifique / PTAN 2018 Vieillissement des aciers inoxydables austenitiques N2 N3 / PTAN 2018 Identification Limites admissibles N1 / PTAN 2018 identification Limites admissibles N2 N3 / PTAN Réponses aux Demandes d'Interprétation	•	/	/	2600
RCC-M 2018	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	2 950	/	Cf. Subscription
RCC-M 2017	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	2 950	/	
RCC-M 2016	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	2 950	/	
"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	2 820	/	
"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	/	1 620	
"RCC-M 2000 + add 1 add 1= addendum 2002"	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR	/	1 620	
CRITERIA RCC-M 2014	Prevention of damages in mechanical components. Introduction to the design, analysis and construction rules of the RCC-M	FR, EN	1 590	1 540	
PTAN 2015 Radioprotection	Radiation protection guide for the design of Nuclear Pressure Equipment for PWR plants in France	FR, EN	/	30	
PTAN 2016 ADR N1	Guide Analyse de risques pour ESPN N1	FR	/	210	
PTAN 2018 ADR N1	Guide Analyse de risques pour ESPN N1	FR	/	255	
PTAN 2018 ADR N2	Analyses de risques pour les équipements ESPN de niveau N2 fabriqués selon RCC-M	FR	/	325	
PTAN 2016 Dimensional Reference N1	Dimensional reference standard of N1 nuclear pressure equipments	FR, EN	/	85	
PTAN 2016 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 2017 Inspectabilité N1	Guide de l'inspectabilité pour la conception des équipements sous pression nucléaires de niveau N1 des centrales REP installées en France	FR	/	30	
PTAN 2018 Inspectabilité N1	Guide de l'inspectabilité pour la conception des équipements sous pression nucléaires de niveau N1 des centrales REP installées en France	FR	/	40	
PTAN 2018 Inspectabilité N2 N3	Guide de l'inspectabilité pour la conception des équipements sous pression nucléaires de niveau N2 ou N3 des centrales REP installées en France	FR	/	30	
PTAN 2018 Classement des pièces des accessoires type ASP ou ADS	Guide « Accessoires sous pression - Accessoires de sécurité» Analyse des textes réglementaires pour le classement des pièces d'un accessoire sous pression de type robinet et d'un accessoire de sécurité de type soupape	FR	/	60	
PTAN 2018 Conservation de la matière	Conservation de la matière issue de la fabrication des composants non soumis à qualification technique spécifique	FR	/	70	
PTAN 2018 Corrosion des aciers inoxydables austenitiques N1*, N2 et N3	"Note support à la rédaction des EPMN pour équipements ESPN N1*, N2 et N3 Corrosion des aciers inoxydables austénitiques et austéno-ferritiques"	FR	/	145	
PTAN 2018 Modalités de l'examen visuel final	Guide sur les modalités de réalisation de la Vérification Visuelle dans le cadre de l'Examen Final	FR	/	25	
PTAN 2016 Notice Instructions	Guide for the contents of the operating instructions for nuclear pressure equipment	FR, EN	/	85	
PTAN 2018 Notice Instructions	Guide pour le contenu de la notice d'instructions d'un équipement sous pression nucléaire	FR	/	65	
PTAN 2018 Radioprotection	Guide de radioprotection pour la conception des équipements sous pression nucléaires des centrales REP installées en France.	FR	/	30	

Codes and publications	Description	Available lang.	Paper book format (€ excl tax)	PDF single format (€ excl tax)	Subscription format* (€ HT)
PTAN 2018 Réalisation des contrôles visuels de fabrication	Guide portant sur la réalisation des contrôles visuels de fabrication issus de l'analyse de risques	FR	/	25	Cf. Subscription
PTAN 2018 Rédaction EMPN N2 N3	Guide méthodologique pour la rédaction des EPMN pour les équipements de niveau ESPN N2/N3	FR	/	80	
PTAN 2018 RDE N2 N3	Référentiel dimensionnel des équipements sous pression nucléaires N1, N2 ou N3	FR	/	80	
PTAN 2018 SRMCR N2 N3	Guide de conception des SRMCR installés sur les REP pour protéger les ESPN de niveau N2 ou N3	FR	/	95	
PTAN 2018 Surveillance de la fabrication des composants non soumis à QT spécifique	Guide méthodologique pour la surveillance de la fabrication des composants non soumis à qualification technique spécifique	FR	/	70	
PTAN 2018 Vieillissement des aciers inoxydables austenitiques N2 N3	Note support à la rédaction des EPMN pour équipements ESPN N2 et N3 Vieillissement thermique des aciers inoxydables austénitiques et austéno-ferritiques	FR	/	135	
PTAN 2018 Identification Limites admissibles N1	Identification des limites admissibles du CPP/CSP	FR	/	50	
PTAN 2018 Identification Limites admissibles N2 N3	Identification des limites admissibles des équipements sous pression nucléaires hors CPP/CSP	FR	/	45	
PTAN Réponses aux DI	RCC-M, Editions 2007 et 2012 et leurs modificatifs - Réponses aux Demandes d'Interprétation (DI)	FR	/	Free	
Subscription RSE-M	Publications included in the subscription: RSE-M 2018 / RSE-M 2017 / RSE-M 2016 / RSE-M 2010 + add 1, 2, 3, 4 / PTAN WPS 2016 / PTAN Annexe 5.4 du RSE-M / PTAN RS 16 010 rev E / PTAN RS 18 007 rev A / PTAN RSE-M Criteria Annexe 5.5 / PTAN RS 16 007 ind E / PTAN RS 16 009 ind B / PTAN RS 17 022 ind B / PTAN RS 18 003 ind A / PTAN RS 18 004 ind C / PTAN RS 18 006 ind A	•	/	/	1600
RSE-M 2018	In-Service Inspection, Installation and Maintenance Rules for Mechanical Components of PWR	FR, EN	1 760	/	Cf. Subscription
RSE-M 2017	In-Service Inspection Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	1 760	/	
RSE-M 2016	In-Service Inspection Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	1 760	/	
"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	1 760	/	
PTAN WPS	Principle and substantiation for taking Warm Pre-Stressing (WPS) into account in PWR vessel fast fracture resistance criterion	FR, EN	/	85	
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 rev E	"Guide professionnel pour le dossier de réparation/modification classée notable d'un ESPN soumis aux points 1 à 4 de l'annexe V de l'arrêté du 30/12/2015 modifié PTAN RS."	FR	/	110	
PTAN RS 18 007 rev A	Guide professionnel pour les interventionssur des ESPN du CPP-CSP	FR	/	40	
PTAN RSE-M Criteria Annexe 5.5	Principles of and background to the formulation of the criteria in Appendix 5.5 of the RSE-M code relating to the fast fracture strength of pressure equipment displaying a planar defect during operation	FR, EN	/	110	
PTAN RS 16 007 ind E	Guide pour la Requalification Périodique des Tuyauteries ESPN de niveau N2 ou de niveau N3	FR	/	45	
PTAN RS 16 009 ind B	Guide professionnel pour les réparations et modifications des ESPN soumis aux points 1 à 4 de l'annexe V de l'arrêté du 30/12/2015 modifié	FR	/	Free	
PTAN RS 17 022 ind B	Guide professionnel pour la conception et la fabrication des PPP destinées à des ESPN du CPP ou CSP	FR	/	Free	
PTAN RS 18 003 ind A	"Guide professionnel pour les exigences et procédures d'évaluation de la conformité pour un assemblage permanent d'installation d'un ESPN soumis au 4.1.a de l'annexe V de l'arrêté du 30/12/2015 modifié"	FR	/	Free	
PTAN RS 18 004 ind C	Guide méthodologique de la protection pour l'installation d'un ESPN	FR	/	Free	
PTAN RS 18 006 ind A	Guide professionnel pour les exigences applicables aux réparations et modifications des ESPN soumis aux points 1 à 4 de l'annexe V de l'arrêté du 30/12/2015 modifié et à l'approvisionnement des parties qui leur sont destinées	FR	/	Free	
Subscription RCC-E	Publications included in the subscription: RCC-E 2019 (FR) / RCC-E 2016 / RCC-E 2012 / Gap analysis RCC-E 2005 - 2012 / Gap analysis RCC-E 2012 - 2016 / PTAN CDP 2019 Cahier de Données de Projet (FR)	•	/	/	950
RCC-E 2019	Design and construction rules for electrical and I&C systems and equipment + PTAN CDP 2019 Cahier de Données de Projet (FR)	FR	1 000	/	Cf. Subscription
RCC-E 2016	Design and construction rules for electrical and I&C systems and equipment	FR, EN	1 000	/	
RCC-E 2012	Design and construction rules for electrical equipment of nuclear islands	FR, EN	625	/	

B PUBLICATIONS PRICES

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 2019 / RCC-CW 2018 / RCC-CW 2017 / RCC-CW 2016 / RCC-CW 2015 / ETC-C 2012 / ETC-C 2010 / PTAN RCC-CW 2015 / PTAN Seismic Dissipative Devices	•	/	/	1430
RCC-CW 2019	Rules for design and construction of PWR nuclear civil works	FR, EN	1 500	/	Cf. Subscription
RCC-CW 2018	Rules for design and construction of PWR nuclear civil works	FR, EN	1 500	/	
RCC-CW 2017	Rules for design and construction of PWR nuclear civil works	FR, EN	1 500	/	
RCC-CW 2016	Rules for design and construction of PWR nuclear civil works	FR, EN	1 500	/	
RCC-CW 2015	Rules for design and construction of PWR nuclear civil works	FR, EN	1 500	/	
ETC-C 2012	EPR Technical Code for Civil Works	FR, EN	Only in english 1 060	1 010	
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	
PTAN Seismic Dissipative Devices	Study report on Seismic Dissipative Devices	EN	/	390	
Subscription RCC-C	Publications included in the subscription: RCC-C 2019 / RCC-C 2018 / RCC-C 2017 / RCC-C 2015 / RCC-C 2005 + add 1 / PTAN RCC-C Qualification OCS rev A	•	/	/	820
RCC-C 2019	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	Cf. Subscription
RCC-C 2018	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	
RCC-C 2017	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	
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	/	
PTAN RCC-C Qualification OCS rev A	Qualification des outils de calcul scientifique utilisés dans la démonstration de sûreté nucléaire - 1ère barrière	FR	/	50	
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	FR, 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 2018 / RCC-MRx 2015 / RCC-MRx 2012 + add 1 / RCC-MR 2007 / PTAN RCC-MRx 2017 / PTAN Seismic Analysis Components	•	/	/	2670
RCC-MRx 2018	Design and Construction Rules for Mechanical Components of nuclear installations : high-temperature, research and fusion reactors	FR, EN	2 940	/	Cf. Subscription
RCC-MRx 2015	Design and Construction Rules for Mechanical Components of nuclear installations : high-temperature, research and fusion reactors	FR, EN	2 940	/	
"RCC-MRx 2012 + add 1 add 1 = addendum 2013"	Design and construction rules for mechanical components of nuclear installations	FR, EN	2 880	/	
RCC-MR 2007	Design and construction rules for mechanical components of nuclear installations	FR, EN	/	2 140	
PTAN New Material	PTAN Guide for introducing a new material in the RCC-MRx	FR, EN	/	100	
PTAN Seismic Analysis Components	PTAN Guide for seismic analysis of components	FR, EN	/	65	

• Access to the publications in all available languages
* The subscription period is one year
** Not available yet

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 12/23/2019

afcen

Shaping the rules for a sustainable nuclear technology

APPENDIX C

TRAINING CATALOG

CATALOG OF TRAININGS CERTIFIED

Field	Reference	Code	Title of training	Duration	Language	Organisme
Mechanics	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	1 d	French	APAVE
	M-005		RCC-M code 2012	2 d	French	NUCLEXPERT
	M-006		Understanding of the code RCC-M	2 d	French	APAVE
	M-007		Code RCC-M	2 d	French/English	BUREAU VERITAS
	M-008		Design of class 2 & 3 equipments	3 d	French	APAVE
	M-009		Fabrication - Welding - Monitoring according to the code RCC-M	2 d	French	APAVE
	M-010		RCC-M code design	2 d	English	BUREAU VERITAS
	M-011		Discovery of the code RCC-M	3 d	French	IS GROUPE
	M-012		RCCM - Construction code for nuclear pressure equipment	3 d	French	BUREAU VERITAS
	M-013		Introduction to RCC-M code	3 d	English (India)	BUREAU VERITAS
	M-014		Architecture and application of the code RCC-M	3 d	French	APAVE
	M-015		Nuclear pressure equipments - Discovery of the code RCC-M	3 d	French	VINCOTTE
	M-016		Discovering RCC-M code	4 d	French / English	FRAMATOME
	M-017		RCC-M code	5 d	Chinese	SNPI (GROUPE CGN
	EM-001	RSE-M	Introduction to the use of the code RSE-M	3 d	French	BUREAU VERITAS
	EM-002		Introduction to the use of the code RSE-M and RCCM	5	French	UFPI
	MRx-001	RCC-MRx	Discovering the code RCC-MRx	3 d	French / English	FRAMATOME
	MRx-002		RCC-MRx Construction code for mechanical materials of nuclear plants	3 d	French / English	BUREAU VERITAS
	MRx-003		Discovery of the code RCC-MRx	3 d	French	INSTN
Civil Engineering	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
Electricity	E-001	RCC-E	Introduction to the code RCC-E (Design and construction rules regarding electric material)	1 d	French / English	FRAMATOME
	E-002		RCC-E 2012 - Qualification and manufacturing of an electrical equipment (Réf. SICA F1501 and E1602)	3 d	French / English	SICA
	E-003		Use of the RCC-E	4 d	French	APAVE
	E-004		RCC-E 2016 - Qualification and manufacturing of an electrical equipment (Réf. SICA F1701 and E1801)	3 d	French / English	SICA
	E-005		RCC-E 2012 - Specialisation “Inspection” (Réf. SICA F1502)	1 d	French	SICA
	E-006		RCC-E 2016 - Qualification and manufacturing of an electrical equipment (Réf. SICA F1703)	2 d	French	SICA
	E-007		RCC-E 2016 - Qualification and manufacturing of an electrical equipment (Réf. SICA F1704 and E1808)	2 d	French / English	SICA
	E-008		Discovry of the code RCC-E 2016 – (Réf. SICA F1802 and E1809)	1 d	French / English	SICA
	E-009		Upgrade RCC-E 2012 ->2016 (Réf. SICA F1702 and E1802)	1 d	French / English	SICA
Fuel	C-001	RCC-C	Connaître et savoir utiliser le Code RCC-C	2 d	French	CF INGENIERIE
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

afcen

Shaping the rules for a sustainable nuclear technology

AFCEN
1 Place Jean Millier
F-92400 Courbevoie
www.afcen.com