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Shaping the rules for a sustainable nuclear technology

2020 ANNUAL REPORT 2020

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CONTENTS

FOREWORD
BY AFCEN'S PRESIDENT

Laurent THIEFFRY,
President

"In December 2020, I was appointed President of the Association by AFCEN's Board of Directors. I would like to thank AFCEN's corporate members for the trust and confidence that they have shown in my abilities by confirming my new role at the helm of the Association.

AFCEN's seven codes represent an exceptional and unique asset that leverages the technical expertise and feedback that have been acquired over more than 40 years from designing, manufacturing and operating systems, structures and components in over 100 nuclear reactors around the world.

New editions were released this year for five of the codes, which again bears testament to our determination to incorporate and build on the latest knowledge. Throughout 2020, AFCEN managed to keep its activities up and running despite the difficulties and highly restrictive conditions unleashed by the pandemic. This achievement reflects the Association's sheer driving force and resilience. In what proved to be an unplanned development for its label, AFCEN allowed its training partners to deliver certified training to participants in online mode. This decision is a further sign of its commitment to offer support to its members.

In 2020, AFCEN continued to hold discussions with France's Nuclear Safety Authority, particularly on the work surrounding the ESPN nuclear pressure equipment regulation. Based on the progress made, AFCEN has every confidence that ASN will continue to endorse the solutions proposed by the codes as being capable of satisfying the Nuclear Pressure Equipment regulation's requirements.

During 2020, AFCEN teamed up with GIFEN organisation in an effort to improve quality control practices across the nuclear industry. In the years ahead, AFCEN will make great strides towards achieving this aim by reinforcing the section on welding in the RCC-M code, releasing a guide for self-assessment of users competencies on RCC-M, and spearheading many other initiatives.

This report paints a clear picture of how the association is thriving. Feel free to join one of our working groups and bring your expertise to this "collaborative development" strategy that benefits the nuclear industry by working together in raising the bar on the quality, safety and competitive advantage of nuclear projects and facilities around the world.

On behalf of all our members, it gives me great pleasure to present the 2020 AFCEN Annual Report. This report clearly illustrates the many achievements and events that our Association has organized and supported over the previous year, despite the difficulties and challenges in 2020.

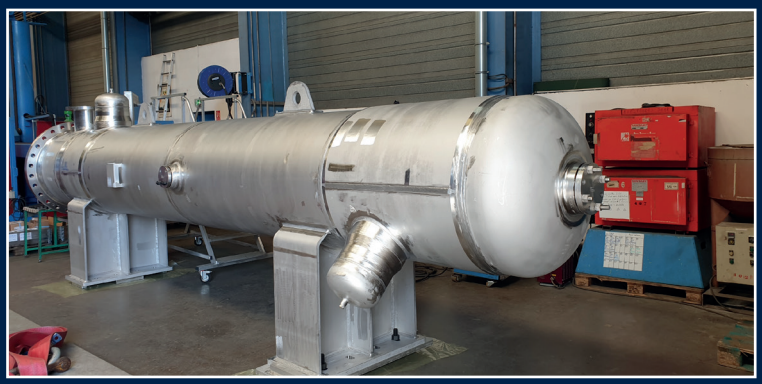
I look forward to seeing you - virtually at least - at the next AFCEN Congress in March 2021"

Laurent THIEFFRY, President

SIGNIFICANT EVENTS
2020

In 2020, AFCEN rolled out its four-year ESPN roadmap with its partners from the French Nuclear Safety Authority and the Inspection Bodies

Building on the work aimed at incorporating the requirements of the ESPN nuclear pressure equipment regulation into the 2018 editions of the RCC-M and RSE-M codes, AFCEN launched a “four-year roadmap” (2019 – 2022) in 2019 to sustain the momentum and allow manufacturers and operators to integrate the regulation into their industrial processes with greater reliability. In 2020, AFCEN continued holding regular meetings with ASN-DEP and GSEN (association of inspection bodies for Nuclear Equipment Safety) as part of a collaborative effort to produce the deliverables specified in the roadmap. In addition, AFCEN lent its support to the development of the “ESPN Digital” tool led by the nuclear industry to ensure alignment with its reference documents.



EASU EXCHANGER,
N2 NUCLEAR PRESSURE EQUIPMENT,
DESIGNED ACCORDING TO THE RCC-M CODE
© ONET TECHNOLOGIES

In 2020, AFCEN published enhanced editions for five of its codes: RCC-M, RSE-M, RCC-F, RCC-CW and RCC-C

AFCEN codes were revised to reflect users’ needs, the latest developments in technology, feedback and changes in regulations and standards. In accordance with AFCEN’s editorial program, five codes were published in 2020: mechanical codes RCC-M and RSE-M, fire protection code RCC-F, civil engineering code RCC-CW, and fuel code RCC-C. AFCEN is committed to helping users adopt its newly updated codes.

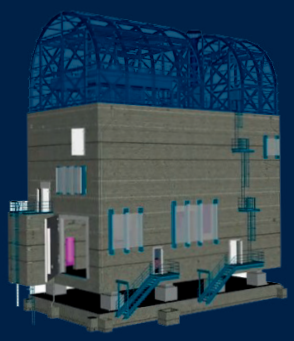
EDITIONS PUBLISHED IN 2020

SIGNIFICANT EVENTS
2020

In 2020, AFCEN brings an extra layer of safety to the French fleet of nuclear power plants

In the wake of the Fukushima accident and the subsequent effort to ratchet up safety at all nuclear power plants, emergency diesel generators (EDGs) have been brought in as an additional power source in case a failure would make the existing external and internal power supplies unavailable. Each reactor will get an emergency diesel generator. In 2020, EDF commissioned 19 EDGs.

EDG design and construction have been modeled on AFCEN's ETC-C 2012 and RCC-E 2012 codes.



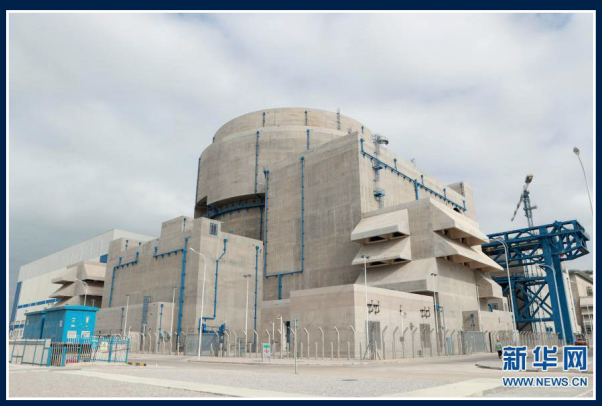
EDGS FOR UNITS 3 AND 4 AT THE TRICASTIN POWER PLANT AND FUNCTIONAL DIAGRAM OF AN EMERGENCY DIESEL GENERATOR
© EDF

In 2020, AFCEN continued lending its support to nuclear reactor construction projects in the UK and China

The Hinkley Point C project has achieved tremendous progress in the construction of two EPR units based entirely on AFCEN's codes. Several milestones were reached in 2020, including completion of one of the cooling water intake tunnels for the reactors (3.5 km long), pouring of the concrete raft for the unit 2 nuclear island, and the impressive lift and installation of a complete liner ring for the unit 1 reactor building (575 tons with the Big Carl crane).

In 2020, the Fuqing 5 unit was commissioned in China, representing a milestone for CNNC's Hualong 1, whose design is based on the RCC-M code.

HPC PROJECT PROGRESS
INSTALLATION OF THE CONTAINMENT LINER
© EDF HINKLEY POINT C MEDIA TEAM



FUQING 5

SIGNIFICANT EVENTS
2020

In 2020, AFCEN actively pursued its collaborative efforts in China.

Despite the health crisis, cooperation with China materialised in seven virtual work sessions of the Users Groups (CSUG) in 2020 between France and China, thereby allowing French experts to ramp up their participation.

According to the terms of the NEA-AFCEN collaborative agreement on codes and standards, discussions continued within the Project Groups. Chinese experts have practically finished translating the RCC codes into Chinese, which are due to be officially published in 2021.

In addition, AFCEN pursued its training initiatives in China, especially for the RCC-M code.

RSE-M CSUG VIDEOCONFERENCE

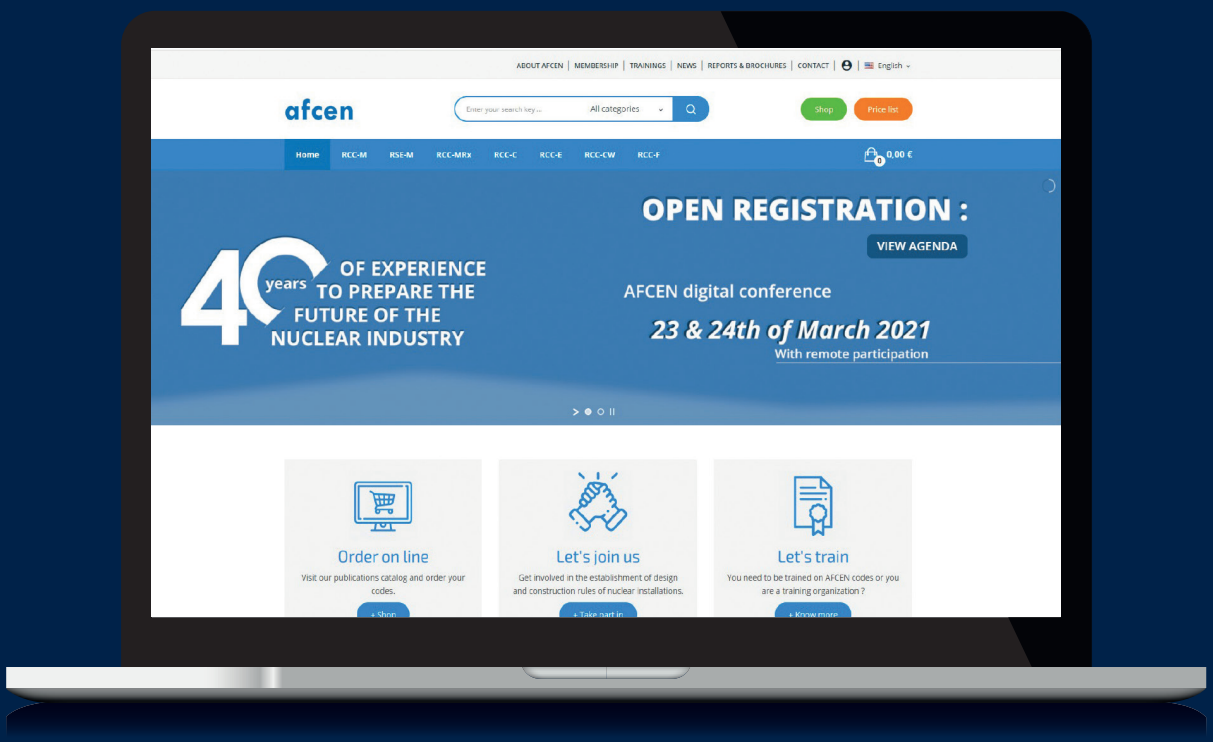
RCC-M TRAINING IN CHINA

SIGNIFICANT EVENTS
2020

In 2020, AFCEN shifted its annual day event to a virtual conference and updated its website.

AFCEN went digital in 2020 and organized its first virtual annual day, attended by over 150 experts, to discuss the work areas and priorities going forward.

In September 2020, AFCEN gave its www.afcen.com website a makeover to improve clarity and accessibility for experts, users and customers.



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SIGNIFICANT EVENTS
2020

In 2020, the CEN/WS 64 workshop made headway in its efforts to open AFCEN codes to European needs

On September 22, 2020, the CEN workshop on "design and construction codes for mechanical equipment of innovative nuclear installations" (CEN/WS 64) held its annual plenary meeting. CEN/WS 64 - Phase 3 was launched in January 2019 and concerns four AFCEN codes (RCC-M, RCC-MRx, RCC-CW and RCC-E). Roger Garbil, Director of the Fission Sector at the European Commission's Directorate-General for Research & Innovation, presented Eurotom's R&D needs and opportunities during the meeting.

Some 18 months after its launch, participants confirmed the workshop's sustained level of activities with hardly any knock-on effects from the health crisis, leading to several proposed changes to the codes. Several topics common to all the codes were also identified, such as ageing management and long-term operation.

European Commission

Presentation of AFCEN to Alain Tranzer, EXCELL Program Director

EDF launched its Excell plan to drive the nuclear industry to achieve the highest standards of craftsmanship and excellence. Phase 2 is divided into five focus areas. AFCEN's codes represent a powerful industrial tool that EDF can leverage to move its Excell program forward.

THE FIVE FOCUS AREAS OF THE EXCELL PLAN

MANUFACTURING AND CONSTRUCTION
Right the first time,
fulfilling the AFCEN codes requirements

COMPETENCIES
Proficiency in AFCEN codes is key
for the supply chain,
from the project organisation
to the lower tier suppliers

WELDING PROGRAMME
Welding right the first time amounts
to fulfilling RCC-M Section IV
welding requirements

STANDARDISATION
AFCEN codes have integrated
the industrial practices
of the French supply chain for 40 years:
it is the role of AFCEN
as an industry association,
as well as the request from ASN as a regulator

AFCEN codes are a powerful industrial tool to support the Excell program

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Shaping the rules for a sustainable nuclear technology

1

NATIONAL AND INTERNATIONAL CHALLENGES

1.1 USE OF AFCEN CODES AROUND THE WORLD

AFCEN codes are used as a reference for nuclear components and structures in over 100 power plants currently in operation (98), under construction (17) 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	E		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			56	56	16	56	x	x	x	x	x		
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		3	25	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	x	
	India	6			6	6	6	x	x	x	x	x	x	
HPR1000	China	4	7	1	12	12	12	x	x	x		x	x	
	UK	2			2	2		x	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
		15	17	98	130	88	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-cooled 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, including the test blanket modules (TBM) in Eurofer.

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 organization 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 normalization. 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 is bolstering its presence in the RCC-M Subcommittee and giving 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, in-service inspection of Chinese Generation II+ nuclear power plants (based on developments of the M310 technology introduced from France, called CPR-1000 and ACPR-1000) and Generation III reactors (especially EPR units and Hualong HPR-1000 units).

FUQING UNIT 5

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 2020, 49 of the 65 units in operation or under construction in China were using AFCEN codes, with 38 in operation and 11 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 2020:

. Fuqing 5, the world's first HPR-1000 unit, was commissioned. Fuqing 5 was designed with the RCC-M code.

. A new reactor, one of which was designed according to AFCEN codes (Tianwan 5, ACPR-1000), entered into commercial operation.

Type of reactor	Units in operation (no.)	Units under construction (no.)	Total number
300 MWe	Qinshan I (1)		1
M310	**Daya Bay (2) Ling'Ao (2)**		**4**
CPR1000 & ACPR1000	**Ling'Ao (2) Hongyanhe (4) Ningde (4) Yangjiang (6) Fangchenggang (2) Fuqing (4) Fangjiashan (2) Tianwan phase III (1)**	**Hongyanhe (2) Tianwan phase III (1)**	**28**
HPR 1000	**Fuqing (1)**	**Fuqing (1) Fangchenggang (2) Zhangzhou (2) Taipingling (2) SanAo (1)**	**9**
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 (2)	2
CAP1400		Shidaowan (2)	2
Total number	**49**	**16**	**65**

LIST OF REACTORS CURRENTLY UNDER CONSTRUCTION OR IN OPERATION IN CHINA AS OF LATE 2020
(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:

. two reactors under construction at the Hinkley Point C site (HPC),

. 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:

. 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). An addendum has been created 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 RSE-M code for monitoring and maintaining in-service mechanical components. The adaptation of the RSE-M in-service inspection rules to meet the context and operational requirements specific to the United Kingdom was submitted in 2020.

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 primarily 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.

AFCEN Day (June 22, 2020)

In response to concerns about the health pandemic, the AFCEN Day event on 22 June was held online. Following a presentation of AFCEN's annual activity report, the seminar was followed by three key sequences:

. The General Secretariat highlighted the significant events of 2019 and the partnerships established in 2020 to lay stable foundations in readiness for the future.

. The Editorial Committee unveiled its editorial program and its strategic directions. Subsequently, each Subcommittee reported on the progress of its developments and priorities for 2020.

. The Training Committee explained the initiatives that have been launched to broaden its array of training solutions and forge pathways with more schools and universities.

The seminar was attended by over 150 participants, who enjoyed the opportunity of discussing AFCEN's priorities.

To round off the event, AFCEN's President Philippe Bordarier paid tribute to the unwavering commitment of all the experts and AFCEN's teams for organizing the virtual seminar. Despite the difficulties caused by the pandemic, AFCEN kept up the pace and pushed ahead with its editorial schedule, while rolling out a new set of work practices. The main stakeholders and contributors appreciated receiving detailed insights into AFCEN's editorial programs for its codes, which helped strengthen dialog about the Association's strategic directions.

The President paid tribute to the headway that has been achieved with the strategic plan, which continues to be adapted accordingly. The President also highlighted the many success stories, such as the progress made with translating AFCEN's codes into Chinese, the Naval Group agreement, the CNAM agreement, and the determination to foster more ties with universities (ENSI Caen).

Going forward, AFCEN is taking part in GIFEN's work on the Excell plan. This represents the ideal opportunity to improve awareness, recognition and understanding of AFCEN's codes throughout the nuclear industry.

1.2 AFCEN'S ACTIVITIES AROUND THE WORLD

1.2.2 European Union

In January 2019, AFCEN kicked off Phase 3 of the CEN workshop on "design and construction codes for mechanical equipment of innovative nuclear installations" (CEN/WS 64).

Rationale for launching Phase 3:

The Nuclear Illustrative Programme (PINC) established by the European Commission's Directorate-General for Energy draws attention to the need to build new nuclear capacities by 2050 with a peak level of investments by 2030. The resulting recommendations invite Europe's nuclear industry to drive down construction costs and shorten lead-times. Since the design for a number of reactors will be based on its codes, AFCEN intends to take part in this preparatory phase by offering to bring stakeholders up to speed on the standardization process through AFCEN's codes while learning how to adapt their local regulatory framework to simplify the use of reactors modeled on AFCEN's codes, or how to gear the codes towards their specific needs and requirements.

The key to increasing the competitive advantage of Europe's nuclear industry involves standardizing the approval processes used by national regulators. The participation of certain safety authorities and technical safety organizations (TSOs) in the workshop is conducive to improving mutual understanding of the technical foundations that underlie the design and construction rules for nuclear power plants and adapting them to suit the different national regulations.

Continuation of the CEN/WS 64 workshop provides the ideal opportunity to maintain solid ties between the different communities of technical experts on nuclear codes that were created during the previous phases.

Objectives of CEN/WS 64 - Phase 3:

The objectives of CEN/WS 64 - Phase 3 are as follows:

. Strengthen synergistic ties between European experts on nuclear codes, working in different countries on different projects, with the aim of minimizing fragmented best practices across the nuclear industry, while offering a platform for technical discussions and creating possibilities for coding practices across Europe.

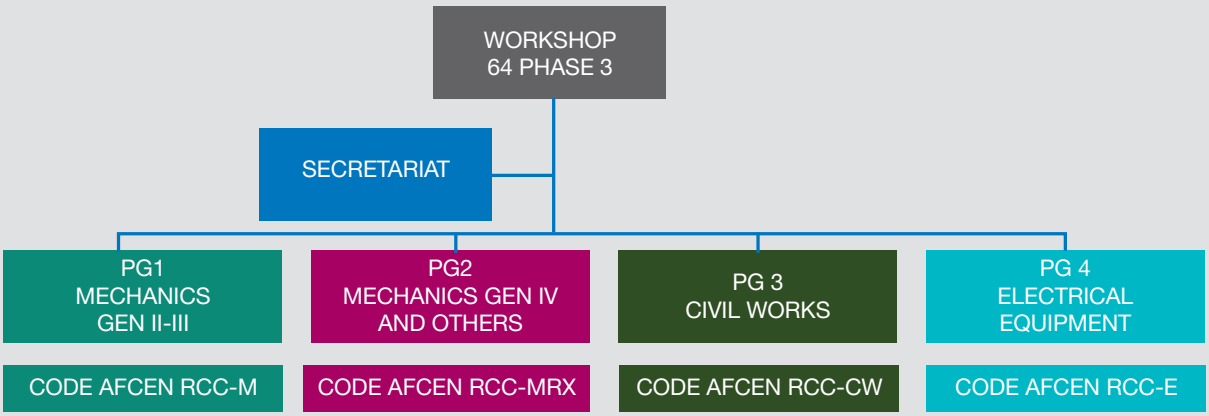
. Allow future nuclear project leaders to raise awareness of their projects' constraints and suggest changes to the codes. The workshop also allows all participants to express the changes that they would like to make to the codes, and lets them incorporate their industrial expertise or the lessons learned from their own practices.

. Engage nuclear power plant operators who are open to the prospect of suggesting and discussing code proposals to address the issues of aging facilities and the difficulties in sourcing spare parts. These proposals are aimed at delivering appropriate solutions to the challenge of downsizing the nuclear supply chain in Europe.

. Raise awareness of AFCEN's codes among all entities involved in evaluating large commercial nuclear reactors during invitations to tender for the purpose of enabling them to correctly assess reactors based on AFCEN's codes. For example, the EPR is a pressurized water reactor based on a European design that is strongly supported by AFCEN's codes. The workshop allows partners who are not yet using AFCEN's codes to improve their knowledge of the codes and prepare to use them during a future implementation if applicable.

Structure of CEN/WS 64 - Phase 3:

As shown in the figure below, the Secretariat for Phase 3 of the workshop is AFNOR. A Prospective Group (PG) has been set up to address the four technical subject areas, each of which is covered by an AFCEN code. PGs are responsible for suggesting changes to the codes and issuing pre-normative R&D proposals.



PGs hold three to four meetings a year, which are chaired by an AFCEN manager and representative. PGs also hold an annual plenary meeting to review the recommendations and proposals for the R&D program.

The workshop currently features 19 members from 11 countries, representing operators, manufacturers, engineering consultancies, research centers, safety authorities and TSOs.

Note that the health crisis had a minor effect on the workshop's activities in 2020. Whereas face-to-face meetings were held in January and early February, the other meetings and the plenary session on September 22 were conducted by videoconference.

Activity review during the plenary meeting on September 22:

The main subject areas reviewed by PG1 included non-linear analyses for assessing damage, preventing fractures and leak-before-break, R&D on assessing RPV integrity, in-service inspection methods, fatigue examinations and hot prestressing. AFCEN's representative notified PG1 participants that they would receive a copy of the RSE-M code to address a number of topics, such as managing aging facilities, sourcing spare parts and assessing RPV integrity.

PG2 focused its efforts on welded joints, the creep-fatigue of steel subject to cyclic softening, small-punch tests, additive manufacturing and the compliance of quality management systems. Following discussions, the criteria for severe accidents and the need to develop a code for GFRs (gas-cooled fast reactors) were excluded. In addition, three proposed changes have already been submitted to AFCEN. They include incorporating an alternative method for calculating creep-fatigue damage in steel subject to cyclic softening, additions and modifications to Appendix A20 for introducing small-punch tests, and the integration of ASME NQA-1 into the code.

PG3 discussed walls subject to shear stresses, dynamic loads resulting from the impact of an aircraft or an extreme earthquake, and aging facilities.

Since electrical equipment is a new subject area for the workshop, PG4 identified a number of topics that require greater investigation before changes can be suggested for RCC-E. The topics involve qualifying equipment using black box software, identifying differences between conventional and nuclear equipment, and managing quality.

1.2 AFCEN'S ACTIVITIES AROUND THE WORLD

The plenary meeting also highlighted a number of topics concerning several PGs. For example, PG1 and PG2 are both responsible for addressing small-punch tests and creep-fatigue rules, while additive manufacturing is covered by PG1, PG2 and PG3. PG1 and PG3 have aging facilities and long-term operation in common. PG2 and PG3 are examining the needs for small modular reactors (SMRs). Finally, PG3 and PG4 are examining the sensitivity and qualification of electrical equipment in relation to an earthquake or the impact caused by an aircraft crash. To manage these cross-functional topics, the decision has been taken to organize dedicated meetings featuring participants from the different PGs concerned.

Note that Roger Garbil, Director of the Fission Sector at the European Commission's Directorate-General for Research & Innovation, presented Eurotom's R&D needs and opportunities. He invited PG managers to take part in the next SNETP forum in February 2021.

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 2020, 54 CSUG meetings had been held in China, during which experts presented and discussed over 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.

As such, a new form of collaboration was launched in 2019, known as PGs or Project Groups. These groups are managed and incorporated into the CSUGs. They are aimed at providing a platform for French and Chinese experts to discuss a more specific range of topics concerning French and Chinese interests in greater technical detail. By December 2020, several PGs were under discussion, and two were officially launched within the RCC-M CSUG.

Activities in 2020

In 2020, AFCEN's main actions relating to activities in China were as follows:

Implementation of the NEA-AFCEN agreement:

. AFCEN continued providing key information to allow China's experts to accurately translate the latest RCC codes into Chinese. At the present time, the translation of the 1st batch of the RCC codes has been completed and reviewed by the relevant experts (in October 2020). The codes are planned to be published in 2021. This action is a key component of the 2017 AFCEN-NEA agreement.

. Since 2019, technical collaboration between experts on standardization activities, which represents the second key component of the AFCEN-NEA agreement, has been hosted in the CSUGs, and experts have the possibility of creating formal working groups to address technical subjects of joint interest (Project Groups - PG). In 2020, the RCC-M PG held two meetings to investigate fatigue analyses and ratcheting analyses (progressive deformation). Both groups were specifically involved in creating digital benchmarks to compile best practices that can be used retrospectively to propose changes for the RCC-M code.

NOV. 2020 – MEETING OF THE FATIGUE AND NON-LINEAR PGS

Users Groups meetings in China, and AFCEN training courses:

. In October 2020 and December 2020, a total of seven CSUG meetings were held between AFCEN's experts and members of the Chinese Specialized Users Groups (CSUGs) in Beijing and Suzhou. Since AFCEN's experts were unable to travel to China, the decision was made to hold virtual CSUG meetings, thereby allowing a larger number of experts to take part. 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).

1.2 AFCEN'S ACTIVITIES AROUND THE WORLD

. After AFCEN formal certification of the Chinese-language RCC-M course in 2016, which was subject to an agreement between SNPI and AFCEN, two new RCC-M training sessions were held in Suzhou in June and August 2020 respectively. AFCEN training completion certificates were issued to the trainees who passed the final exam. A highlight of 2020 was the launch of a course entitled "RCC-M Design By Analysis", featuring a blend of theory and practical elements. The theoretical component, which has received AFCEN's endorsement, explains the content of the RCC-M codes for the stages involved in calculation-based design. The practical component offers a compilation of best design practices for carrying out finite element analyses. Although AFCEN cannot officially endorse this part of the course, it has proven to be extremely useful due to the general trend of using increasingly sophisticated design tools for advanced calculations. The course was attended by approximately 45 participants from across China's nuclear industry.

RCC-M TRAINING DESIGN BY ANALYSIS

Outlook for AFCEN in China in 2021

In 2021, 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, officially publish the Chinese translations of the RCC codes and form Project Groups (PGs) to continue a new type of technical interaction.

. Participation of Chinese experts in the AFCEN Day event in Paris in March 2021, 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.

. Continue organizing a new series of training courses (RCC-M Design By Analysis) 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 reactors:

. Hinkley Point C (HPC): two units (for the construction phase)

. Sizewell C (SZC): two units (for the project design phase - same design as HPC).

The EPR design passed the Generic Design Assessment (GDA) in the United Kingdom in 2013, and the AFCEN codes were approved by the British Safety Authority (ONR – Office for Nuclear Regulation): RCC-M 2007 edition (+ 2008-2009-2010 addenda) for mechanical components, RCC-E 2012 edition for electrical equipment, ETC-C 2010 edition for civil engineering works, and ETC-F revision G of 2007 for fire protection. 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), which are used in design justification studies, against current practices in the United Kingdom (R6 Rules).

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. Several milestones were reached in 2020, including completion of one of the cooling water intake tunnels for the reactors, pouring of the concrete raft for the unit 2 nuclear island, and the lift of a complete liner ring for the unit 1 reactor building.

There are plans to build two reactors at the Sizewell site based on the same design as the two HPC units. In 2020, the Development Consent Order was submitted, followed by a public consultation process.

For monitoring and maintaining in-service mechanical components, in-service inspection rules adapted from the 2018 edition of the RSE-M code to meet the context and operational requirements specific to the United Kingdom were submitted in 2020.

Dissemination of AFCEN's code culture within British industry is essential to facilitate the understanding and use of the codes in projects and align 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 User 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 offer relevant solutions,

. establish effective communication channels with AFCEN's Subcommittees.

Two Users Groups were created, one of which focusing on the RCC-M code, and the other on the civil engineering code (ETC-C / RCC-CW). These Users Groups hold meetings at varying intervals according to the needs and topics requiring discussion. The creation of an RCC-E Users Group is under advisement. Progress on the HPC site (construction of civil works and procurement of electromechanical equipment) and the prospects for the SZC project are just some of the opportunities available to these groups.

1.2 AFCEN'S ACTIVITIES AROUND THE WORLD

HPR-1000 project

The HPR-1000 reactor featuring Chinese technology (CGN) has started Step 4 of 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). The design for the reactor is primarily inspired by AFCEN's codes, thereby taking advantage of the lessons learned from the EPR project (incorporated in the 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 2021.

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 2021, 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.

STYLIZED VIEW OF THE JAITAPUR SITE

1.2.6 Poland

On December 10, 2020, AFCEN took part in the webinar organized by IGEOS (Izba Gospodarcza Energetyki i Ochrony Środowiska = Chamber of commerce for energy and protection of the environment) on the supply chain, alongside Polish industrial firms eager to break into Poland's future nuclear market. AFCEN's presentation dovetailed with the speech given by EDF, which is driving an EPR offering in Poland based on AFCEN's codes. These presentations underlined how French solutions are consistent with the objective to procure equipment on the domestic market when relevant. AFCEN emphasized the codes' European credentials, as illustrated by their close ties with international standards, primarily EN and ISO.

afcen

Shaping the rules for a sustainable nuclear technology

EDITORIAL ACTIVITY

REVIEW

2.1 CODES AND OTHER EDITORIAL PRODUCTS

AFCEN's editorial activities involve authoring and approving the publication of codes and 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:

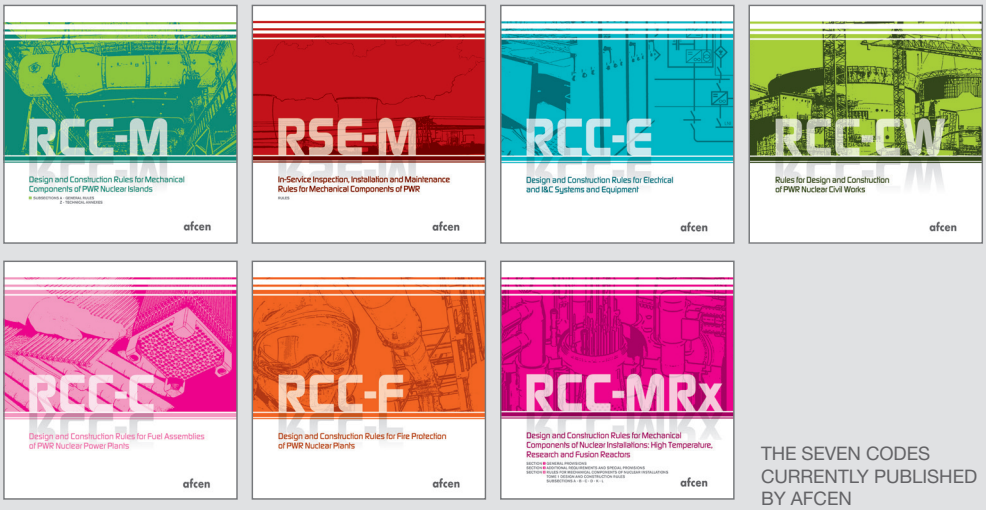
. studies to complement and develop certain topics within the codes,

. 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, changes to legislation and standards, and extensions to the scope of 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:

. RCC-CW: integration of methods to determine the robustness of civil engineering structures against extreme earthquakes (feedback from the Fukushima accident) and revised requirements for implementing post-tensioning systems for containments (feedback from the FA3 and HPC projects).

. RCC-M: feedback on implementing the provisions of the French ESPN Regulation, and industrial feedback on the procurement and manufacturing of materials.

. RCC-MRx: integration of industrial feedback on the welding and inspection of aluminum materials.

. RCC-C: incorporation of industrial feedback on fuel fabrication and inspection methods.

Developments prompted by scientific and technical breakthroughs

These also represent major reasons for updating the codes.

Examples include:

. RCC-MRx: inclusion of new materials (Eurofer, etc.).

. RCC-M: improved methods for sizing torispherical heads, clarification on the classification and definition of stresses, and the introduction of rules for using stress coefficients.

. RSE-M: introduction of TOFD (Time of Flight Diffraction) and multi-element ultrasonic techniques.

. RCC-CW: improved rules for calculating the minimum reinforcement rate for reinforced concrete.

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:

. RCC-M and RSE-M: developments associated with the need to prove compliance with the essential requirements of the European Pressure Equipment Directive (PED) and the French 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).

. RCC-F: appendices focusing specifically on the requirements of fire protection regulations in France and the UK, as well as adjustments to ensure compliance with the WENRA Safety Reference Levels 2014.

Changes in standards

AFCEN codes are supported by conventional industry standards, while providing further content and details for nuclear requirements. International standards are the first to be called when available, followed by European standards.

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

By drawing on the most recent standards, AFCEN strengthens ties with best practices across the nuclear industry.

Examples include:

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

. RCC-M: adaptation of the design and fabrication rules to strengthen alignment with European harmonised standards on vessels and piping (EN 13480 and EN 13445).

. Revision of the quality management requirements specified in AFCEN's codes to reflect the requirements of ISO 19443 "Specific requirements for the application of ISO 9001: 2015 by organizations in the supply chain of the nuclear energy sector supplying products and services important to nuclear safety" (effective in the 2020 edition of the RCC-CW code).

2.1 CODES AND OTHER EDITORIAL PRODUCTS

Extension to the fields covered by the codes

AFCEN codes may be revised by extending their scope of application.

Examples include:

. RCC-M: the inclusion of a new chapter (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).

. RCC-CW: the inclusion of anchor channel systems, a section on the ageing management of civil engineering structures, and the introduction of requirements and rules for deep foundations and geomembranes.

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

. RCC-F: mitigation of the fire risk in extreme event situations, fire sources outside the buildings, and the risks inherent in fire protection equipment.

2.1.2 AFCEN's technical publications (PTAN)

Studies

AFCEN carries out a host of studies to explore topics relating to the fields covered by the codes (review of industry best practices, R&D developments, etc.).

Examples include:

. RCC-CW: a study of seismic dissipative devices.

Criteria

AFCEN is focused on its objective of publishing documents called criteria, which provide background information on the rules in its codes.

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

The guides are designed to help interested parties use the codes by offering recommendations, solutions or alternatives for meeting the requirements in the codes.

Examples include:

. RCC-E: a guide identifying the requirements needed to provide Class III qualification for systems using equipment families certified according to IEC 61508.

. RCC-MRx: a guide containing a series of recommendations for the seismic design rules for components.

. RCC-M and RSE-M: a complete set of guides that explain how to fulfil the essential safety requirements of the ESPN Regulation.

. RSE-M: a guide for qualifying ultrasonic NDT (Non-Destructive Testing) processes

. RCC-C: a guide specifying the measures that need to be taken to demonstrate qualification of the scientific computing tools for fuel core studies in response to Guide 28 issued by the French Nuclear Safety Authority.

2.1.3 ESPN program

In light of the difficulties that the nuclear industry encountered in attempting to apply the requirements of the ESPN Regulation, AFCEN decided to create and lead a "three-year" program between 2015 and 2018. The aim behind the program was to produce technical standards (AFCEN professional guides, and modifications to RCC-M and RSE-M) that would be recognized by all the parties involved in assessing conformity, i.e. ASN and GSEN (association of inspection bodies for Nuclear Equipment Safety). At the end of the program, ASN recognized that "applying the 2018 edition of the RCC-M code provides a solid foundation for implementing the ESPN Regulation". These technical standards can now be used to obtain convincing results when assessing the conformity of new N1 and N2/N3 equipment, as well as for their repairs, modifications and installation.

To go even further, AFCEN and GSEN unveiled their joint vision at the end of 2019 of what constitutes a successful conformity assessment:

> "Stakeholders confidently engaged in a stable, predictable and organised conformity assessment process with manufacturers, who ensure that nuclear pressure equipment conforms to requirements, and with Inspection Bodies, who verify compliance, so that compliant equipment can be provided to operators on time"
>
> AFCEN / GSEN joint vision of the ESPN conformity assessment process

Building on the work for the 2018 edition and in keeping with this vision, AFCEN launched a "four-year roadmap" (2019 – 2022) in 2019 to sustain the momentum and allow manufacturers and operators to integrate the regulation into their industrial processes with greater reliability. The roadmap is designed to address the following major challenges:

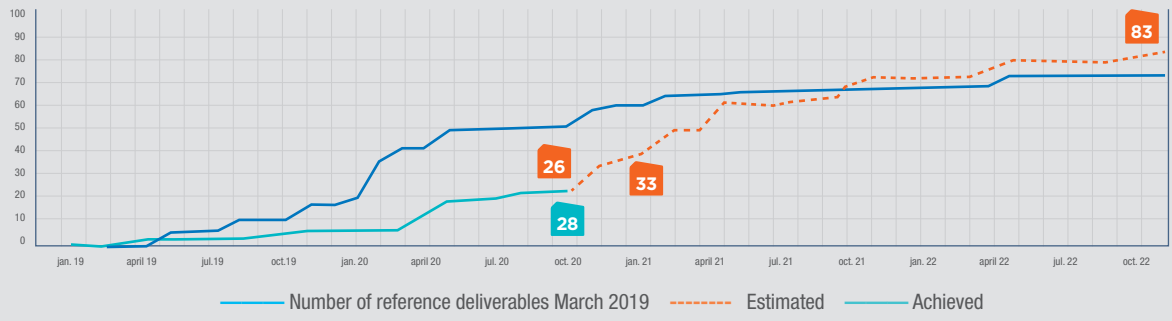
1. Incorporate feedback from the three-year program;

2. Maintain endorsement of the RCC-M code;

3. Reinforce the applicability of the solutions across the industry by developing "standard solutions";

4. Shed greater light on certain aspects of the regulation.

As part of the four-year roadmap, AFCEN's experts will ultimately produce over 80 deliverables for the areas covered by RCC-M and RSE-M.



PROGRESS CURVE FOR THE DELIVERABLES OF THE FOUR-YEAR ROADMAP (NEW CURVE)

2.1 CODES AND OTHER EDITORIAL PRODUCTS

In particular, this ambitious program recorded a number of achievements in 2020:

. In terms of its relations with ASN's Nuclear Pressure Components Division (ASN-DEP), AFCEN's monthly meetings with ASN-DEP and the two AFCEN / ASN / GSEN steering committee meetings for the four-year roadmap (April 1st and December 1st in 2020) allowed AFCEN and ASN to share their priorities. This prompted AFCEN to launch new studies (AFCEN's contribution to the revision of Guide 8 on conformity assessments and management of nonconformities) and accelerate the work rate (feedback on welding and equipment specifications).

. In terms of its relations with GSEN, the six AFCEN / GSEN interface meetings in 2020 played an important role in building trust, improving mutual understanding of the various difficulties and achieving progress in defining industry-level solutions. In 2020, AFCEN and GSEN also signed an agreement for assessing the suitability of the deliverables produced by AFCEN as part of the four-year roadmap. GSEN is currently assessing the following deliverables: Safety Factors and Uncertainties for N1 and N2/N3 equipment, examples of specific evaluations for N2/N3 equipment, and edition 2020 of the RCC-M code.

. In particular, AFCEN has produced the following deliverables for the four-year roadmap:

- "Assemblies and Installations Toolbox"
- "Visual Examinations during Fabrication" (incorporation of feedback)
- "N2 Hazard Analyses" (incorporation of feedback and standardization with "standard solutions")
- "First examples of N2/N3 specific evaluations" and "generic notes for identifying unacceptable defects in basic materials" (standardization with "standard solutions")
- …

AFCEN is also continuing to take part in developing the "ESPN Digital" tool, which aims to standardize and enhance conformity assessments based on the work led by AFCEN and GSEN. AFCEN is checking and endorsing that its technical publications are correctly incorporated into the ESPN Digital process. In 2020, two instances of the ESPN Digital service were opened, including support for producing modification / repair dossiers for N2/N3 equipment (RSE-M professional guides), as well as support for producing hazard analyses for new N1 equipment, and guidance with producing instruction manuals (RCC-M professional guides). AFCEN took part in the ESPN Digital seminar on September 24, 2020 to celebrate the opening of "level 1" of the ESPN Digital service.

ESPN DIGITAL SEMINAR ON 24/09/2020

For further information about ESPN Digital, visit the LinkedIn page for the ESPN Digital project (https://www.linkedin.com/groups/13885206)

2.1.4 AFCEN's editorial situation

AFCEN's editorial activities in 2020 were marked by the publication of the following codes: RCC-M, RSE-M, RCC-F, RCC-CW and RCC-C.

In 2019, AFCEN formalized the four-year development program for its codes, and committed to updating it periodically.

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 . 2020 edition . Next edition: 2022
RSE-M	In-service inspection for PWR mechanical components	. 2010 edition, with addenda in 2012, 2013, 2014 and 2015 . 2016, 2017 and 2018 editions . 2020 edition . Next edition: 2022
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 . Annual RCC-CW editions since 2015 . Next edition: 2021
RCC-C	Fuel	. 2005 edition, with addenda in 2011 . 2015 edition . Annual editions since 2017 . Next edition: 2021
RCC-F	Fire	. 2010 edition, then 2013 (ETC-F) . RCC-F editions 2017 and 2020 . Next edition: 2023
RCC-MRx	Mechanical components in fast breeder, 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 (most recent revisions)
RCC-M	CRITERIA RCC-M 2014: Prevention of damages in mechanical components. Introduction to the design, analysis and construction rules of the RCC-M
	PTAN RCC-M 2018: RCC-M, Editions 2007, 2012, 2016, 2017 et 2018 et leurs modificatifs - Réponses aux Demandes d'Interprétation (DI)
	PTAN RCC-M 2016: Dimensional reference standard of N1 nuclear pressure equipment
	PTAN RCC-M 2016 (Criteria): 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
	PTAN RCC-M 2018 : Guide de radioprotection pour la conception des équipements sous pression nucléaires des centrales REP installées en France
	PTAN RCC-M 2018 : Identification des limites admissibles du CPP/CSP
	PTAN RCC-M 2018 : Identification des limites admissibles des équipements sous pression nucléaires hors CPP/CSP
	PTAN RCC-M 2018 : Guide sur les modalités de réalisation de la vérification visuelle dans le cadre de l'examen final
	PTAN RCC-M 2018 : Guide portant sur la réalisation des contrôles visuels de fabrication issus de l'analyse de risques
	PTAN RCC-M 2018 : Référentiel dimensionnel des équipements sous pression nucléaires de niveau N1*, N2 ou N3
	PTAN RCC-M 2018 : Guide pour le contenu de la notice d'instructions d'un équipement sous pression nucléaire
	PTAN RCC-M 2018 : Guide ADR (Analyse de Risques) pour ESPN N1
	PTAN RCC-M 2018 : Analyses de risques pour les équipements ESPN de niveau N2 fabriqués selon le RCC-M

2.1 CODES AND OTHER EDITORIAL PRODUCTS

RCC-M	PTAN RCC-M 2018: Guide de conception des SRMCR installés sur les REP pour protéger les ESPN de niveau N2 ou N3
	PTAN RCC-M 2018: Guide de l'inspectabilité pour la conception des équipements sous pression nucléaires de niveau N1 des centrales REP installées en France
	PTAN RCC-M 2018: Guide de l'inspectabilité pour la conception des équipements sous pression nucléaires de niveau N2-N3 des centrales REP installées en France
	PTAN RCC-M 2018: Conservation de la matière issue de la fabrication des parties d'un équipement sous pression nucléaire de niveau N1
	PTAN RCC-M 2018: Guide méthodologique pour la rédaction des EPMN pour les équipements de niveau ESPN N2/N3, et notes support associées (corrosion et vieillissement thermique des aciers inoxydables austénitiques et austéno-ferritiques)
	PTAN RCC-M 2018: 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
	PTAN RCC-M 2018 : Guide méthodologique pour la surveillance de la fabrication des composants non soumis à qualification technique spécifique
	PTAN RCC-M 2020: Qualification Technique ESPN
RSE-M	PTAN WPS: Principle and substantiation for taking Warm Pre-Stressing (WPS) into account in PWR vessel fast fracture resistance criterion
	Criteria Appendix 5.4: Principles of and background to the formulation of analytical methods for calculating stress intensity factors and the J integral for a planar defect
	Criteria Appendix 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
	PTAN RS.16.007 ind E: Guide for Periodic Requalification of Class N2 or N3 ESPN piping
	PTAN RS.16.009 ind B: Professional guide to repairs and modifications of nuclear pressure equipment subject to Points 1 to 4 of Appendix V of the amended Order of December 30, 2015. Approved by ASN, decision CODEP-CLG-2019-003687
	PTAN RS.16.010 ind E: Professional guide to significant repairs/modifications of nuclear pressure equipment subject to Points 1 to 4 of Appendix V of the amended Order of December 30, 2015
	PTAN RS.17.022 ind B: Professional guide for the design and manufacture of main pressure parts (MPP) intended for nuclear pressure Equipment in the MPS-MSS. Approved by ASN, decision CODEP-CLG-2019-003685
	PTAN RS.18.003 ind A: Professional guide covering the requirements and procedures for assessing the conformity of permanent joints used to install NPEs that are subject to Appendix V, paragraph 4.1.a of the amended order of 12/30/2015. Approved by ASN, decision CODEP-CLG-2019-003687
	PTAN RS.18.006 ind A: Professional guide to the requirements applicable to repairs and modifications of nuclear pressure equipment subject to Points 1 to 4 of Appendix V of the amended Order of December 30, 2015 and procurement of parts for this purpose. Approved by ASN, decision CODEP-CLG-2019-003687
	PTAN RS.18.007 ind A: Guide professionnel pour les interventions sur des ESPN du CPP-CSP
	PTAN RS.18.004 ind C: Guide méthodologique de la protection pour l'installation d'un ESPN. Approved by ASN, decision CODEP-CLG-2019-003687
	PTAN RS.19.013 ind A: Guide pour la qualification de procédés END par ultrasons – Etablissement des performances
RCC-MRx	PTAN RCC-MRx 2017: Guide for introducing a new material in RCC-MRx – Requirements and recommendations for 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
	PTAN RCC-E 2019: Class III design qualification of systems using equipment families certified according to IEC 61508
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 levels 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 behavior analysis,

. 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 imperfections,

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

The design, manufacture and examination 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 level 1 components (vessels, internals, steam generators, primary motor pump units, pressurizers, primary valves and fittings, etc.), as well as levels 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),

. 50 M310 (4), CPR-1000 (28), CPR-600 (6), HPR-1000 (10) 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.

In relation to the 2016 edition, the 2018 edition includes the remainder of the work on the "three-year ESPN program" (2015-2018). ASN has qualified this latest edition as a "solid foundation" for implementing the ESPN Regulation.

2.2.3 Edition available as of early 2021

The 2020 edition is the most recent version of the code. It integrates 90 modification sheets to reflect users' needs, the latest developments in technology, feedback and changes in regulations and standards.

Some of the modification sheets relate to the commissioned studies into the ESPN Regulation; some modifications concern Appendices ZY and ZZ, while others are improvements resulting from the work on the three-year ESPN program (2015-2018).

The 2020 edition is supplemented by the different guides released as PTAN 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 produced 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 are nevertheless in the process of evaluating the suitability of this edition. The modifications introduced into the 2020 edition reinforce the provisions implemented in the 2018 edition and do not affect the RCC-M code's guidance on how to satisfy the essential safety requirements of the ESPN Regulation.

More specifically, the main changes implemented in the 2020 edition relate to the following provisions:

. Based on the work into FSI/fatigue, further clarification is provided for assessing subcycles during fatigue analysis, especially with reference to ISO 12110-2,

. The NC 15 Fe T Nb A and NC 19 Fe Nb grades have been excluded for pressure parts following the work by the "Technical Qualification" working group

. In response to the FSI commissioned study, limitations have been specified for the scope of application for Section C 3223.6 (minimum thickness for elliptical heads)

. An improvement has been made to C 3200 with clarification about the validity of the formulae used to determine the minimum thickness for torispherical heads

. Based on the FSI commissioned study, further details are proposed for classifying stresses in pipes

. Clarification is also provided for taking account of thermal-hydraulic phenomena, based on the FSI/Fatigue commissioned study

. A method for performing the calculations according to B 3200 with stress indices, resulting from the FSI/Fatigue commissioned study

. A modification to B 3234.8 on thermal ratcheting and a proposed assumption for a parabolic temperature distribution

. Incorporation of the 2017 edition of EN ISO/IEC 17025

. New section M 116 for the specific use of a manufacturing process not listed in RCC-M

CONTENTS OF THE 2020 EDITION OF THE RCC-M CODE

2.2 MECHANICAL FIELD FOR PRESSURIZED WATER REACTORS: RCC-M

2.2.4 Next edition

In accordance with its sales model, AFCEN is now planning to publish editions every two years 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 2022 to leverage initial feedback on the use of the 2018 and 2020 editions. This edition will incorporate the modifications relating to the follow-up work on the ESPN Regulation.

The new 2022 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 and China Users Groups) 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 an initial compilation of 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. An update was published in 2020 to encompass the interpretation requests up to the 2018 edition.

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

Development work has been launched to allow users to view interpretation requests directly on the AFCEN website. The work is due for completion in 2021 and will provide users with an easy way of looking up information about all interpretation requests.

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.

Guides

All PTAN relating to the ESPN Regulation and referenced by the 2020 edition of RCC-M have been made available to users.

In particular, PTAN RCC-M “ESPN Technical Qualification” was published in 2020:

. This PTAN is designed to support sections ZY 320 ESR 3.2 “Technical qualification” and ZY 350 “ Annex relating to ZY 320 ESR 3.2 Technical Qualification “ in RCC-M.

. It applies to the materials used in the pressure parts of N1 equipment, such as defined in Appendix I of the ESPN Regulation.

. The RPSs listed in B2000 in Section I of Volume B of RCC-M have been arranged into component families corresponding to “type of products - type of material grades” pairings (e.g. parts forged from non-alloy steel).

. A hazard analysis has been carried out for each of the component families defined. The analyses are presented in Appendix 4 of the PTAN.

. Subsequently, the RPS requirements and hazard analyses have been reconciled to check that the tests specified in RCC-M (RPS + Appendix ZY) are capable of intercepting the pre-identified hazards. The reconciliations are presented in Appendix 5 of the PTAN.

. Reconciliation helps determine the exhaustiveness of the tests used to check all the risks identified by the hazard analysis.

. If applicable, this PTAN will be revised to reflect modifications made to a subsequent edition of the RCC-M code (modified or new RPS).

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

As part of the three-year ESPN program (2015-2018), the results of the 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 ASN subsequently concluded that “applying the 2018 edition of the RCC-M code provides a solid foundation for implementing the ESPN Regulation”.

Building on the three-year program, the four-year ESPN program (2019-2022) was launched with the aim of:

. continually improving the solutions proposed and taking account of feedback from projects using the code in relation to the ESPN Regulation,

. maintaining the endorsement of the RCC-M code following the three-year program,

. continuing and finalizing the topics identified in the three-year program.

As with the three-year program, the four-year ESPN program is being carried out in liaison with ASN’s Nuclear Pressure Equipment Department and GSEN. With these aims in mind and following on from the 2018 edition, the 2020 edition will be assessed for its suitability to fulfil the essential safety requirements of the ESPN Regulation, aside from the commissioned study on “Safety Factors and Uncertainties”, whose assessment results will be provided at a later date.

2.2 MECHANICAL FIELD FOR PRESSURIZED WATER REACTORS: RCC-M

The four-year ESPN program is focused on the following topics:

. hazard analyses,
. uncertainties and safety factors,
. the dimensions required to ensure conformity with requirements,
. fatigue damage,
. Particular Nuclear Material Appraisal,
. visual inspections during fabrication,
. final examination,
. fabrication of assemblies,
. technical qualification,
. organization of the conformity assessment,
. fast fracture resistance,
. development of codes covering the materials implemented in EPR projects,
. generic notes for identifying unacceptable defects in base materials,
. improved reliability of Pellini testing,
. integration of nuclear pressure equipment under assessment (Section 8.4),
. design by analysis of N1 tube sheet plate,
. the other elements in the supply with an Additional Obligation,
. incorporation of feedback of existing ESPN guides,
. management of nonconformities,
. equipment specification,
. other actions following on from the three-year program.

2.2.7 2019-2022 editorial program

In addition to the topics relating 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 2020 edition and the next edition in 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 supports,

. 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 sheet plates,

. update to Volume S 8000 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 2021, including:

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

. incorporation of EN 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 2020:

. A half-day session was organized in October 2020 for the CSUG (Chinese Users Group) with four experts from the RCC-M Subcommittee. This session was conducted as a videoconference due to the Covid-19 epidemic. A robust logistics effort ensured that the session could go ahead. This meeting 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. A technical presentation of the editorial program and 2020 edition of the code was given to highlight the recent developments to the RCC-M code and the other changes in the pipeline.

In 2020, 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 (launched in 2019) of the GEN II/III Prospective Group (PG1) of CEN workshop WS 64 is continuing and is scheduled to last three years (refer to the dedicated paragraph in Section 1.2.2).

In 2021, there are plans to maintain international initiatives:

. focusing on international comparisons by reviewing the studies performed by WNA/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 Users Groups, and the corresponding international training courses,

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

2.3 MECHANICAL FIELD FOR PRESSURIZED WATER REACTORS (OPERATION): 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 56 units in France's nuclear infrastructure enforce the in-service inspection rules of the RSE-M code,

. operation of 38 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).

The 2017 and 2018 editions supplement the technological, legislative (especially ESPN) and international developments that occurred in 2016.

2.3.3 2020 edition

The 2020 edition is the most recent version of the RSE-M code.

It builds on the technological and legislative developments that have occurred since the 2018 edition. The changes made to this new edition mainly involve:

. Introduction of two ultrasonic inspection methods into A 4220 (TOFD US, echo method and multi-element translators)

. To clarify the case of examinations that should not be considered to be NDTs, incorporation of two new sections on thickness measurements (A 4630) and cleanliness examinations (A 4640)

. Rewriting of section A 4700 - Qualification and certification of testing personnel: supplements and alignment with Appendix 4.3 – IX

. Creation of a section in Volume D, entitled “Aims and techniques of examinations performed during inspections”

. Incorporation of PTAN RS.18.006 for equipment subject to the French regulation in D 8410

. Clarification on the terms for examining significant variation in A 5000

. Further details about the possibility of using the mechanical justification rules in Appendix 5.7 on density defects

. Addition of table B 8500-8-1 specifically relating to the SEBIM RCP controlled valve to the tables in B 8500 for classifying maintenance operations

. Clarification of the terms for performing pre-service inspections of components at the factory (case of replacement steam generators)

. Modification to the status in Appendix 5.2 (changed from “to be defined by the operator” to “for guidance only”)

. Definition of the welding requirements for density examinations during maintenance operations

CONTENTS OF THE 2020 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 MECHANICAL FIELD FOR PRESSURIZED WATER REACTORS (OPERATION): RSE-M

Work relating to France's nuclear pressure equipment regulation (2015/12/31 ESPN order)

As part of its involvement in France's ESPN Regulation, the RSE-M Subcommittee has commissioned studies with the aim of producing professional guides, which have been published since 2016 as modification files for the code and PTAN. The following diagram shows how the PTAN are arranged as Repair / Modification / Installation according to the equipment level as of late 2020.

INSTALLATION OF NPE (Nuclear Pressure Equipment)

NPE subject to appendix V, points 1 to 4

RS.18.003.A
Permanent joining
(30/12/2015 order, appendix V § 4.1.a 1st bullet of 1s § & 2nd §)
- Applicable requirements from 2014/68/UE directive + 30/12/2015 order
- Expected documentation
- Adapted modules: Fi

RS.18.004.C
Protection against exceeding the allowable limits
(30/12/2015 order, appendix V § 4.1.a 2nd bullet of 1st § & 2nd §)
- Method
- Adapted modules: Ap, Bp, Fp
- Applicable requirements for NPE built according to 1926 or 1943 decree

NPE subject to appendix V, point 5

RS.18.005.A
(30/12/2015 order, appendix V §5)
- Permanent joining
- Protection against exceeding the allowable limits

PIPING REQUALIFICATION

RS.16.007.E
(30/12/2015 order appendix V § 3.4)

N2 OR N3 NPE REPAIR OR MODIFICATION

RS.18.006.A
Requirements
(30/12/2015 order, appendix V §4.2.a)
Applicable requirements from PED + 30/12/2015 order

RS.16.009.B
Classification
(30/12/2015 order, appendix V § 4.2.a)
- Classification
- Adapted modules: (A_R, B_M, B_R, B_{PSI}, F_{PS}, F_{RM}, G_{RM}, F_{CDS}, G_{BOU})
- Expected documentation

RS.16.010.E
Documentation
(30/12/2015 order, appendix V § 4.2.a)
- Expected documentation
- Methods :
  . Hazards and risks analysis (& template)
  . Nuclear material appraisal (& template)
  . Material qualification
  . Unacceptable defects
  . Sizes : determination and control to prove essential safety requirements respect
  . Means of examination (& template)
  . Operating instructions (& template)

N1 NPE OF PWR MPS (Main Primary System) OR MSS (Main Secondary System)

RS.17.022.B
MPP (Main Pressure Part) procurement
(10/11/1999 order, art. 10.IV.b)
- Requirements
- Expected documentation
  . For modified MPP
  . For identical MPP
- Methods
  . Hazards and risks analysis (& template)
  . Nuclear material appraisal (& template)
  . Material qualification
  . Unacceptable defects specification
  . Sizes: determinalion and control to prove essential safety requirements respect
  . Means of examination
  . Operating Instructions
- Identical material
- Adapted modules (B_{ppp}, F_{ppp}, G_{ppp})

RS.18.007.A
Maintenance Operation
(10/11/1999 order, art.10)
- on MPP
- on MPS or MSS with MPP
- on MPS or MSS without MPP
- Assessment of welds between MPS or MSS and NPE subject to appendix V of 30/12/2015 order
- Assessment of maintenance operation on a safety device protecting an NPE subject to appendix V of 30/12/2015 order against exceeding allowable limits

Guides approved by ASN: RS.16.009.B , RS.17.022.B, RS.18.003.A, RS.18.004.C, RS.18.006.A
Guides recognised as relevant by ASN: RS.16.007.E, RS.16.010.E, RS.18.007.A

2.3.4 Outlook and next edition

2022 edition

The 2022 edition has the objective to consolidate and build on technological, regulatory and international developments. With this aim in mind, special attention will be paid to the following points:

. inclusion of feedback on the ESPN guides,

. creation of an RSE-M PTAN containing a thesaurus and definitions,

. adoption of a requirements engineering format for the code,

. introduction of the digital radiographic examination technology in A 4000 (digital recording medium),

. addition of material data to Appendix 5.6 (in alignment with the overhaul of Appendix ZG in RCC M),

. improvement of the defect interaction rules in case of a high number of multiple defects (Appendix 5.1).

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”

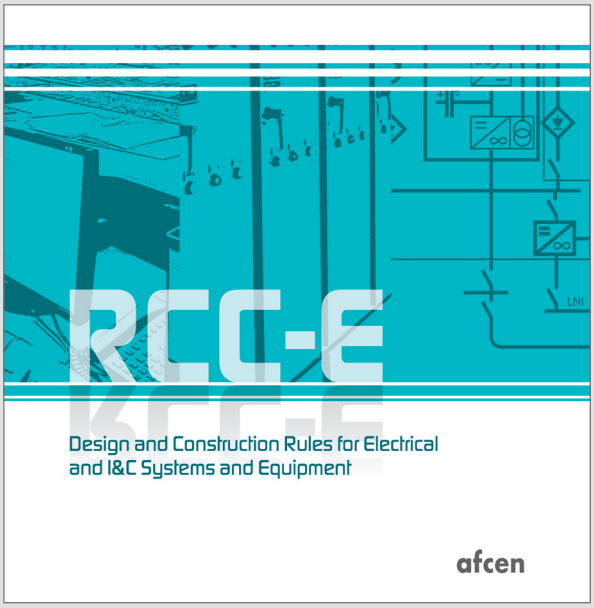
These criteria were finalized in 2018 and published in Q1 2019.

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

PTAN RS.19.013 “Guide for qualifying ultrasonic NDT processes - Definition of performance”

This methodological guide for defining NDT qualifications with ultrasonic processes was published in 2020.

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),

. 50 M310 (4), CPR-1000 (28), CPR-600 (6), HPR-1000 (10) 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 (56 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 2021

The RCC-E 2019 edition is the most recent version. It is available in French and English.

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

. 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.

For the 2019 edition, this document "RCC-E 2019 Gap Analysis" compares the 2019 and 2016 editions, and ties into the former chapters of RCC-E 2012.

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".

In addition, a "Guide to preparing project specifications associated with RCC-E 2019" is provided with RCC-E 2019. This guide aims to simplify the process of identifying the requirements stipulated for the RCC-E 2019 code and help users when producing project specifications. Users can click on the link in this document to download an electronic template of the document to be completed.

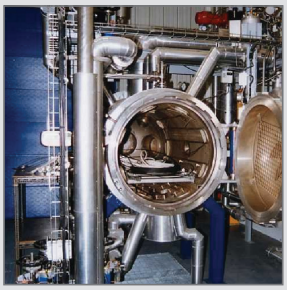
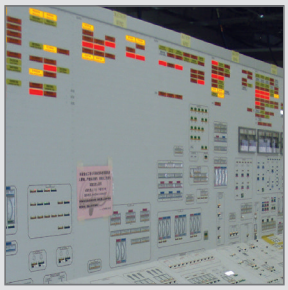
PTAN "Class III design qualification of systems using equipment families certified according to IEC 61508"

This PTAN supplements Volume 3 of RCC-E 2019.

It offers an alternative approach for the Class III qualification of I&C systems based on equipment families with IEC 61508 certification.

This approach has been introduced in addition to the standard qualification method according to the requirements of RCC-E for Class III I&C systems. It can only be used for Class III systems when a number of prerequisites have been satisfied, especially relating to compatibility between the planned safety function and the function for which the equipment family has been certified.

It is available in French and English.


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,

. inclusion of the provisions in the PTAN addressing the 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.

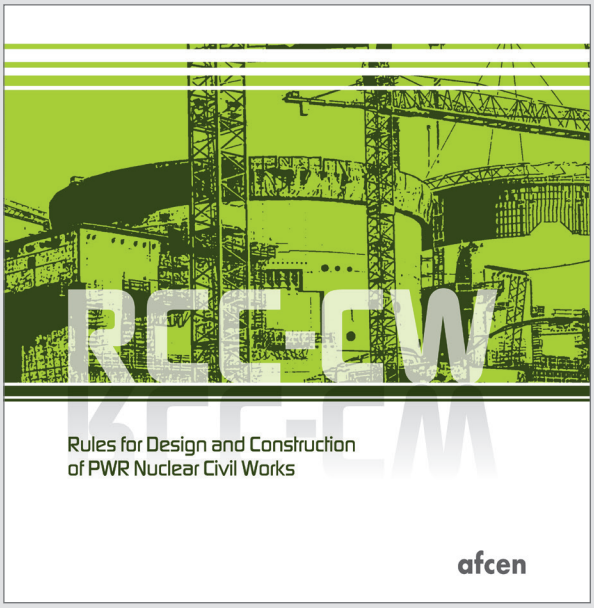
2.4.6 International activities

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.

Due to the health pandemic in 2020, French experts connected online to the CSUG face-to-face meetings held in China.

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 design, construction and ageing management of civil engineering structures 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 by the RCC-CW Subcommittee, which includes all the actors 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, construction and aging management of civil engineering structures 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, coatings and geomembranes,

. 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	HPC, SZC
2015 - 2016 2017 - 2018 2019 - 2020	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 2021

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 assessment 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 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 DANCH and CANCH chapters,

. 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 related 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:

. evolution of the scope of 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),

. evolution of leak detection requirements for pools and tanks (DPLIN & CPLIN),

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

The 2020 edition of the RCC-CW code includes the following improvements:

. update to the requirements of the quality management system (GGENP, GA) with the possibility of applying ISO 19443,

. clarification of the load combination (LC10) for structural steelwork (DGENR 3400),

. requirements relating to deep foundations (DGEOT 7000, CGEOT 8000),

. evolution of leak-tightness requirements SLS (DCONC 6000),

. evolution of durability requirements: reinforced concrete cover (DCONC, CA),

. optimization of requirements for the minimum reinforcement rate: scale effect for containments (DCONC),

. evolution of requirements for the design and installation of anchors (DANCH, CANCH),

. evolution of the seismic appendix (DA),

. general revision of prestress requirements (CPTSS, CC, CCONC, DCONC),

. new CGEOM section on geomembranes,

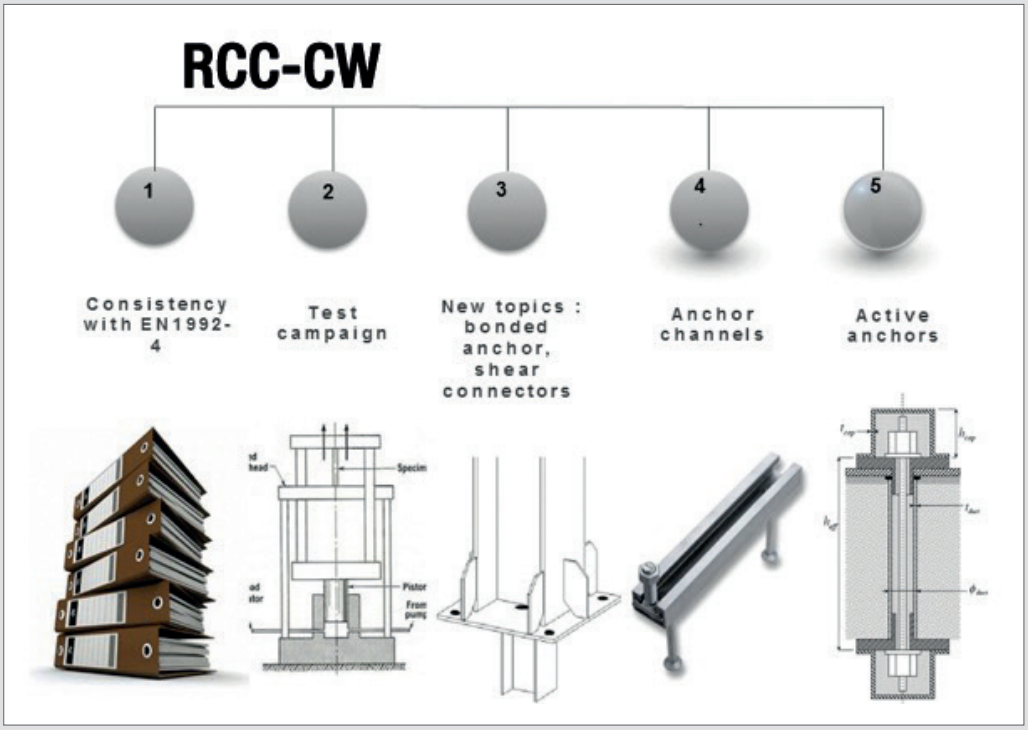
. new CCONT section on containment construction,

. new AM part (aging management) with two new sections:

  . AMGENR: general requirements,

  . AMCONT: containment aging management.

THE RCC-CW CODE COVERS ANCHOR-RELATED TOPICS



2.5 CIVIL WORKS: RCC-CW

CONTENTS OF THE 2020 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
CGEOM - GEOMEMBRANE LEAK-TIGHTNESS SYSTEM
CTOLR - SURVEY NETWORKS, TOLERANCES AND MONITORING SYSTEMS
CCONT - LEAK AND MECHANICAL TESTS AND INSPECTION OF THE CONTAINMENT
CA to CI - APPENDICES

PART AM – AGING MANAGEMENT
AMGENR – GENERAL REQUIREMENTS FOR AGING MANAGEMENT
AMCONT - CONTAINMENT AGING MANAGEMENT

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,

. marine structures,

. improved reinforcement rates,

. evolution of design criteria for metal liners,

. aging management.

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 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)

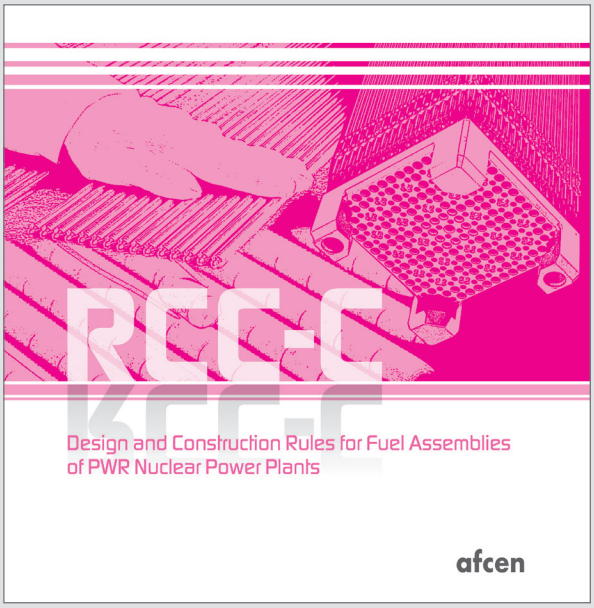
The RCC-CW codes are being shared within the Chinese Users Group, which has held meetings every year since 2015 and is attended by 20 to 30 Chinese experts.

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, 2019 and 2020.

2.6 FIELD FOR FUEL ASSEMBLIES FOR PRESSURIZED WATER REACTORS: 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,

. safety-oriented integrated management systems for all activities concerned by the abovementioned areas.

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 2021

The RCC-C 2020 edition is the most recent version.

The main changes between the 2019 and 2020 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). ASN's follow-up letter for the Permanent Working Group on fuel performance criteria was received in 2019 and is being examined within EDF, which should be completed during the first half of 2021.

2.6 FIELD FOR FUEL ASSEMBLIES FOR PRESSURIZED WATER REACTORS: RCC-C

In terms of manufacturing:

The modifications examined by the working group are as follows:

. further details about product qualification for B4C pellets,

. integration of electrolytic chrome-plating for core component or fuel assembly link screw threads,

. clarification about the metallurgical inspection of Ni-Cr-Fe-based alloy materials,

. use of simplified specimens for the qualification testing of welded fuel rod end plugs,

. integration of zirconium alloy round bars, especially in the section relating to ultrasonic inspections,

. adaptation of the qualified conditions relating to the porogen quantities used when producing fuel pellets with the aim of taking account of the exhaustive inspections performed downstream,

. clarification about the conditions for qualifying welding,

. update to the commercial names of the zirconium alloys in accordance with the suppliers' policies to protect their intellectual property rights.

In terms of management systems:

The modifications examined by the working group are as follows:

. integration of ISO 9001:2015 (replacing the 2008 version),

. clarification of the concepts of activities, processes and tasks, and their requirements.

CONTENTS OF THE 2020 EDITION OF THE RCC-C CODE

The professional guide on the qualification of scientific calculation tools used in the safety demonstration (first barrier) is available in English and French. It provides the elements of industrial practice required by the French Nuclear Safety Authority (ASN) Guide no. 28.

Next edition

The next edition (in French and English) is scheduled for late 2021.

2.6.4 Outlook

The code will be updated in alignment with IAEA general safety requirements no. GSR Part 2 “Leadership and Management for Safety”, superseding GS-R-3.

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’s follow-up letter has been examined. The first modification files concerning the sheath deformation criterion and corrosion are scheduled for the end of the first half of 2021.

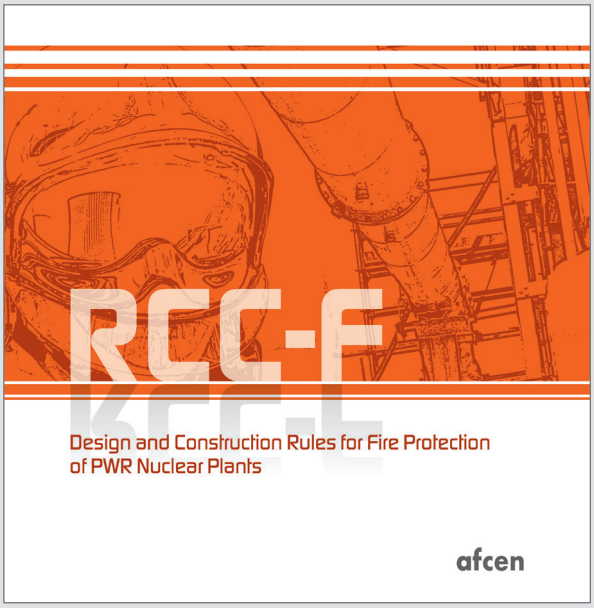
Manufacturing process requirements will be modified according to the proposals and feedback from Subcommittee members. There are also plans to clarify how heat treatment requirements apply to factories. The relevance of introducing new products or processes will be examined on a case-by-case basis in relation to the industry’s current projects.

The cleanliness requirements specified in RCC-C are still being analyzed, and modifications will be issued in 2021 depending on the results of the analysis.

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

Finally, RCC-C is undergoing a global review in an effort to standardize the terminology and references from one section to the next.

2.7 FIRE PROTECTION FOR PRESSURIZED WATER REACTORS: RCC-F



THE RCC-F CODE

2.7.1 Purpose and scope

The RCC-F is intended for the organizations in charge of the design, construction and installation of PWR nuclear power plants to manage the risk of a fire outbreak inside the facility in regard with nuclear safety and the management of the necessary safety functions. The code also defines the rules for analyzing and justifying the means used to assess the safety case.

This code's target readership is therefore:

. engineers in charge of the design, construction and installation of the buildings constituting a PWR,

. engineers responsible for analyzing fire hazards and establishing the safety demonstration from a fire hazard perspective,

. engineers 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.

Compliance with the code requirements can be supported by design studies.

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 (EPR Technical Code for Fire Protection) 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,
. the publication of the RCC-F 2017 code, which is generally suited to light-water reactors, such as PWRs,
. finally, the publication of the RCC-F 2020 code, including various technical improvements.

2.7.3 Edition available as of early 2021

The RCC-F 2020 edition is the most recent version.

The English reference version of RCC-F 2020 was published late December 2020, while the French version is scheduled for release in 2021.

Amendments have been made based on the RCC-F 2017 edition and concern the following key topics:

Technical improvements to the code

. development of an appendix on fire hazard analyses, presenting the different types of analyses and calculation methods to be implemented, while incorporating the previous appendices: G (fire barrier justification) and H (functional criteria),
. creation of a section giving greater consideration to fire protection hazards (sprinklers, gas, etc.) and the management of protection system incidents (e.g. detection),
. clarification on how to factor in external fires within the basic nuclear facility and the site,
. clarifications and additional information on combined hazards,
. creation of a paragraph on BDBE events and feedback on the Fukushima Daiichi accident,
. migration to ISO 9001: 2015,
. minor modifications for the purpose of improving compatibility with WENRA Safety Levels 2014,
. improvements to the fire resistance of ventilation ducts,
. clarification on sizing fire pumps*,
. additional information about cable arrangements*,
. deletion of Appendix F on EDF proprietary documents and dissemination of practical information and relevant requirements in the body of the text,
. various editorial or minor improvements, translations*, organization of certain sections.

(*) Includes requests resulting from the activities of the Chinese mirror committee (CSUG, NEA agreement)

2.7 FIRE PROTECTION FOR PRESSURIZED WATER REACTORS: RCC-F

Update to the appendices on regulations and standards

All the standards used by the code have been analyzed and updated to reflect the latest versions. At the same time, an introductory paragraph has been added to explain the status of the standard versions specified in RCC-F.

Appendix A of RCC-F incorporates the specific changes to French and English regulations. The French appendix has been updated according to the latest standards. The content of the UK appendix remains unchanged, but changes in the standards have been identified and reported in a dedicated section.

Finally, the 2020 edition of RCC-F consolidates the 2017 edition by introducing a number of improvements and additional technical details, especially in the applicable sections and appendices.

CONTENTS OF THE 2020 EDITION OF THE RCC-F CODE

2.7.4 International activities

The RCC-F Subcommittee held a joint meeting with the CSUG (Chinese Specialized Users Group) on October 20-21, 2020 by videoconference. The Chinese working group comprises 19 permanent members and was created in March 2015 (Beijing). Every year, a meeting is organized in China to improve interaction and help address the interpretation and/or modification requests issued by the CSUG. In 2019, the meetings (in November) culminated in a joint visit with RCC-F representatives at CGN's Taishan site.

Several videoconferences were organized in 2020 as part of the AFCEN/NEA agreement on codes and standards (October 30, November 4 and November 25, 2020). A Chinese-language version of RCC-F 2017 is currently being published. Discussions are underway on the prospect of creating a Project Group.

2.7.5 Outlook and preparation of the RCC-F 2023 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).

Requirements engineering

There are plans to incorporate AFCEN's "Requirements engineering" process into the RCC-F code, with aims to publish a prototype of RCC-F-2020 in an appropriate format by 2022. The process will be continued and fine-tuned in successive versions of the code.

RCC-F 2023 edition

The next edition of RCC-F is scheduled for 2023. The general ambition with this version is to include an initial "Requirements Engineering" format and pursue efforts on incorporating the improvements identified in the editorial program.

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 Subcommittee general meetings during the first half of 2021 will decide on which key changes will be implemented in the 2023 version. The following topics have been identified in the editorial program:

. insurance company requirements,

. operators' actions,

. RCC-E and RCC-CW interfaces,

. alternatives to fire hose systems,

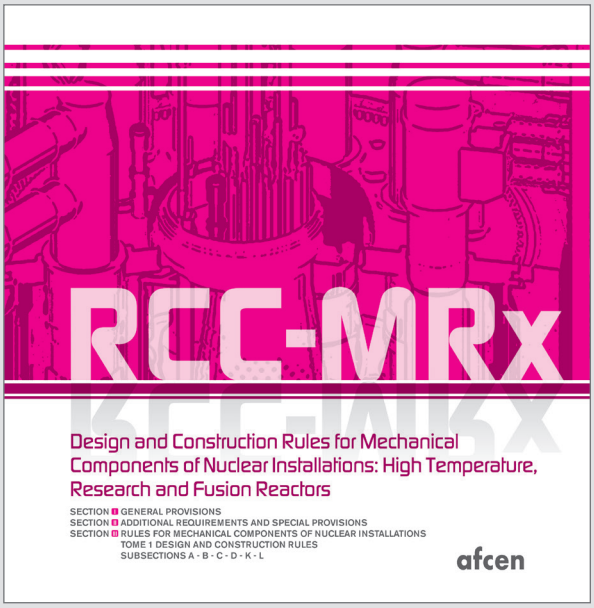
. ad-hoc cable separators (type 4/firestop),

. and so on.

There are plans to update the appendix on UK regulations to reflect feedback on Sizewell C.

The conformity analysis with WENRA Safety Levels 2014 will be published early 2021 (PTAN), as well as the gap analysis between the 2017 and 2020 editions. The process of comparing the code with international reference standards will continue (specifically WENRA 2020 and IAEA DS494 when published). A comparison with US regulations will be scheduled in 2021.

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 2021

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.

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.

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

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 by working in the modifications identified by the workshop (such as an alternative rule for creep-fatigue in materials subject to cyclic softening, the use of small-punch tests, and additional requirements for countries whose quality management regulations are based on NQA-1).

Other improvements will also be incorporated, such as updates to non-linear analyses, quality assurance according to ISO 19443, enhancements to Section II and new materials.

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). This document will be updated in 2021 to include the precautions relating to intergranular corrosion.

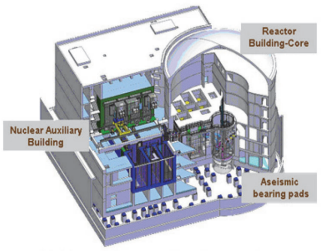
The RCC-MRx Subcommittee launched three commissioned studies in 2017:

. 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.

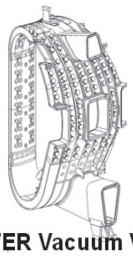
. Update of RCC-MRx – Section II – Part REC 3000 (Special instructions for equipment subject to regulations): the purpose of this commissioned study is to update the sections on French regulations in line with the work carried out for RCC-M. This commissioned study was completed in 2020 and resulted in a modification to the code.

. 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.

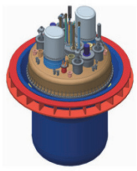


Jules Horowitz Reactor

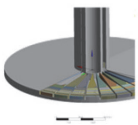


ITER Vacuum Vessel

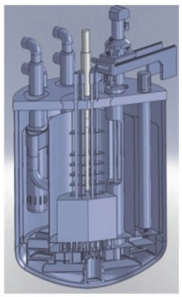
Indian PFBR



MYRRHA primary system



European Spallation Source target



ASTRID

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Shaping the rules for a sustainable nuclear technology

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 Subcommittees periodically review the standards used by the codes to analyze any changes and update the references accordingly. In addition, AFCEN endeavors to identify how many of its expert members take part in the standardization bureaus that produce standards with a potentially significant impact on its codes, and to subsequently promote an increase of their presence if necessary (ISO, IEC and CEN/CENELEC at the European level). Such participation is also conducive to the harmonisation of practices at the international level.

3.2 HARMONIZATION AND COOPERATION INITIATIVES

As a key player in the nuclear codes sector around the world, and as part of its determination to continually incorporate industry best practices 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 through its participation in the international group of standards developing organizations via the SDO Convergence Board. In addition, AFCEN interacts with the dedicated working groups for mechanical codes & standards in OECD/NEA/CNRA (safety authorities) and WNA/CORDEL (industrial organizations).

AFCEN promotes interaction between key players in Europe's nuclear industry through CEN WS 64, which aims to share the different countries' practices and issue recommendations and requests to help make AFCEN codes 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 facilitate the introduction of compatible rules in the different mechanical codes. The SDO Board holds four meetings a year, in the framework of the ASME Code Week sessions.

AFCEN is a member of the SDO Convergence Board, like ASME (US), JSME (Japan), KEPIC (South Korea), CSA (Canada), NIKIET (Russia), NTD (Czech Republic) and ISNI (China). AFCEN voices its development objectives and contributes to convergence opportunities on the topics examined by the group, which incentivizes other SDOs, especially ASME, to cooperate on certain topics. In 2020, AFCEN presented its technical qualification strategy for mechanical components.

The SDO Convergence Board liaises with the relevant working groups of WNA/CORDEL and OECD/NEA/CNRA (groups of 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 issues recommendations accordingly. AFCEN codes (RCC-M and RCC-MRx) are widely represented in these works. In 2020, CORDEL/MCSTF published a report on the comparison of fatigue analysis rules, for which AFCEN was consulted. In 2020, CORDEL/MCSTF also published the results of a benchmark study involving linear and non-linear stress analyses, which included the methods and criteria specified in AFCEN codes.

Safety authorities have taken an interest in the convergence efforts spearheaded by the Standards Developing Organizations (SDO Convergence Board) and WNA/CORDEL association. AFCEN presented its technical qualification strategy for fabricating components to the OECD/NEA/CNRA Working Group on Codes & Standards in 2019.

3.2 HARMONIZATION AND COOPERATION INITIATIVES

3.2.2 CEN WORKSHOP 64

ESNII (European Sustainable Nuclear Industrial Initiative) and AFCEN initially proposed plans for this workshop in 2011 as a European platform for engaging stakeholders in a process to develop a common code, firstly for mechanical components in innovative nuclear installations. CEN/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.

Based on the results of Phase 1 and the recommendations issued by the CEN-CENELEC focus group on nuclear energy, the European Commission decided, as part of the ENEF (European Nuclear Energy Forum), to throw its support behind Phase 2 of CEN/WS 64 with the aim of extending the scope of application to encompass codes on mechanical components in PWRs and civil engineering for Gen II to IV nuclear facilities. CEN/WS 64 - Phase 2 (from mid-2014 to mid-2018) successfully explored a generic model for “Europeanized” codes that could be adopted for specific nuclear projects within the European Union, primarily for new builds and potentially to extend the service life of certain existing nuclear facilities. 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 renewable three-year term. Phase 2 of the workshop comprised 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. AFCEN has delegated a representative from all Subcommittees to guide the groups’ work and provide information on the codes.

The groups issued 13 proposed modifications to the codes. AFCEN agreed to incorporate ten of the proposals, 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. In addition to recommended changes to the codes, R&D programs were identified to support their implementation. Proposals have been prepared and sent to the European Commission’s Directorate-General for Research and Innovation (DG RTD), so that they can be incorporated into Euratom’s work programs. 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).

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.

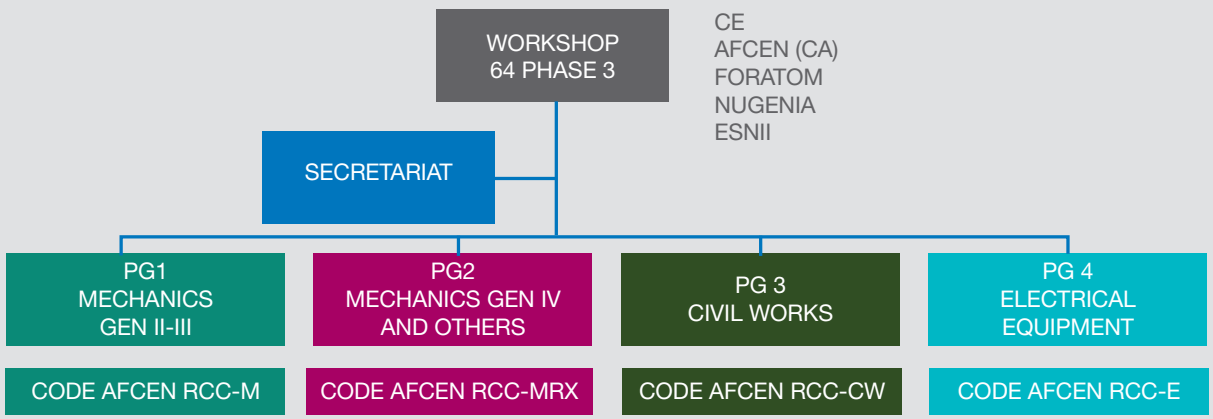
. Allow future nuclear project leaders to raise awareness of their project's constraints and suggest changes to the codes.

. 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 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



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Shaping the rules for a sustainable nuclear technology

SUPPORT THROUGH

TRAINING

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

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

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

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

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

Partnership agreements

In 2020, AFCEN renewed its trust in one partner (EFECTIS) and initiated a partnership with SOCOTEC. In all, the 13 organizations that have signed a partnership agreement with AFCEN to deliver technical training are as follows: APAVE, BUREAU VERITAS, CEF Ingénierie, EFECTIS, Framatome, INSTN, INSTITUT DE SOUDURE GROUP, PONT FORMATION CONSEIL, SICA NUCLEAIRE, SNPI (CGN Group), UFPI, VINCOTTE Academy and SOCOTEC.

PARTNERSHIP AGREEMENTS SIGNED BY AFCEN AND TRAINING ORGANIZATIONS BY THE END OF 2020

4.1 CERTIFIED TRAINING

Following proposals from the training officers, the Committee has certified the content of 39 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 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.


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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 2020 (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	Eight 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
	Use of the RSE-M code and its requirements	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	General introduction	1 day	FR/EN	One partner
	Construction	2 days	FR/EN	One partner
	Design	3 days	FR/EN	One partner
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

4.2 TRAINING COURSES DELIVERED IN 2020

In 2020, 32 training sessions were held and covered all codes, representing 274 trainees and 879 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.

In 2020, AFCEN and its partners finished developing courses focusing on the ESPN documentation (guides, changes to the RCC-M code, etc.). The first sessions will be available early 2021.

By the end of 2020, the certified training catalog was enhanced. Course content was updated to reflect the technical changes made to the new editions of the codes.

The health crisis prompted some training partners to offer their courses through distance learning, which meant adapting the teaching methods in alignment with the certification process.

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 2020, courses were delivered in China.

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 2020, 64 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.

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, for the MNE specialties: 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)

. Nuclear engineering degree offered by ENSI Caen

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.

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Shaping the rules for a sustainable nuclear technology

ORGANIZATION
AND OPERATION OF L'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.

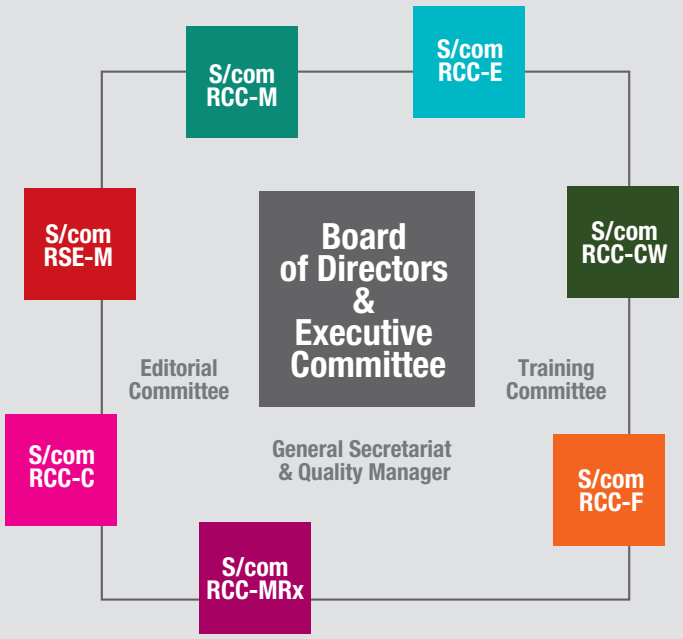
The Board designates an Executive Committee, which is tasked with achieving its work program. The Executive Committee is assisted by a General Secretariat, which is responsible for the general coordination of the association's activities, a Training Committee, an Editorial Committee and seven Subcommittees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

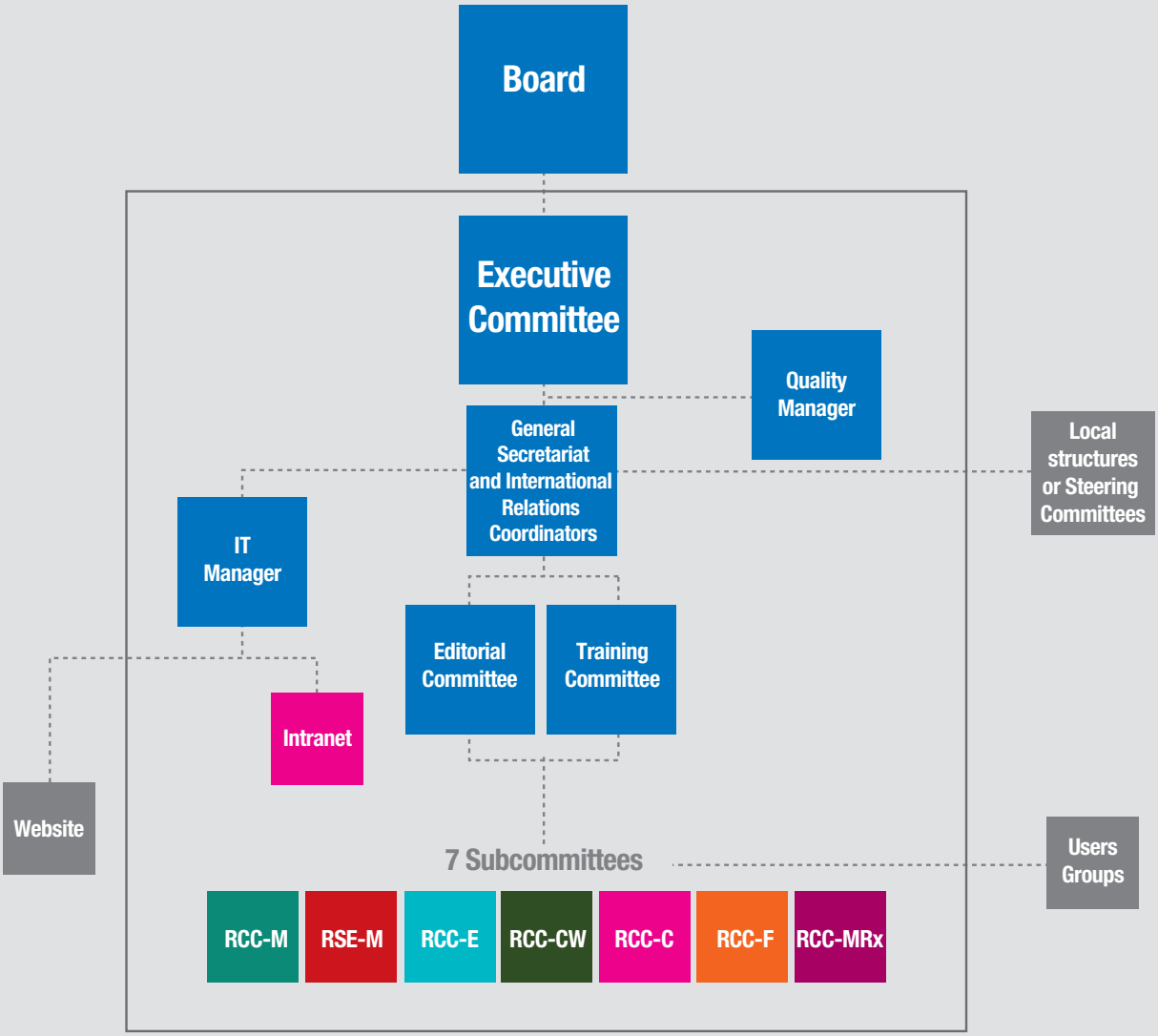
These local structures usually comprise Users Groups, which are not necessarily AFCEN members. In principle, each Users Group is associated with a code.

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.

LAURENT THIEFFRY
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 2020 is summarized in the box below.

ACTIVITY OF THE BOARD OF DIRECTORS AND THE GENERAL MEETING IN 2020

The Board of Directors held two meetings in 2020, while the Executive Committee held nine meetings.

Members held their General Meeting by videoconference on June 22, 2020, and approved AFCEN's strategic directions for 2020:

- Continue implementation of AFCEN strategic roadmap
- In France, keep our commitments for conformity of mechanical construction code with French ESPN regulations
- Support preparation of PWR international nuclear offers (e.g., Jaitapur – KSA) and SMR
- Reinforce AFCEN international position to be reference in Europe
- Keep up the development of our open policy towards new members and reinforce their technical participation
- Strengthen our provision of adapted AFCEN training courses to meet industrial demand
- Reinforce relationships with GIFEN
- Maintain AFCEN financial performance and organization efficiency.

On December 4, 2020, Laurent Thieffry (from EDF) was appointed President of AFCEN by the Board of Directors. The Board members appointed during the same meeting:

- Gilbert TRILLON from EDF DI as Chair of the RCC-C Subcommittee
- Aurélien DI RIENZO from Framatome as Chair of the RCC-M Subcommittee

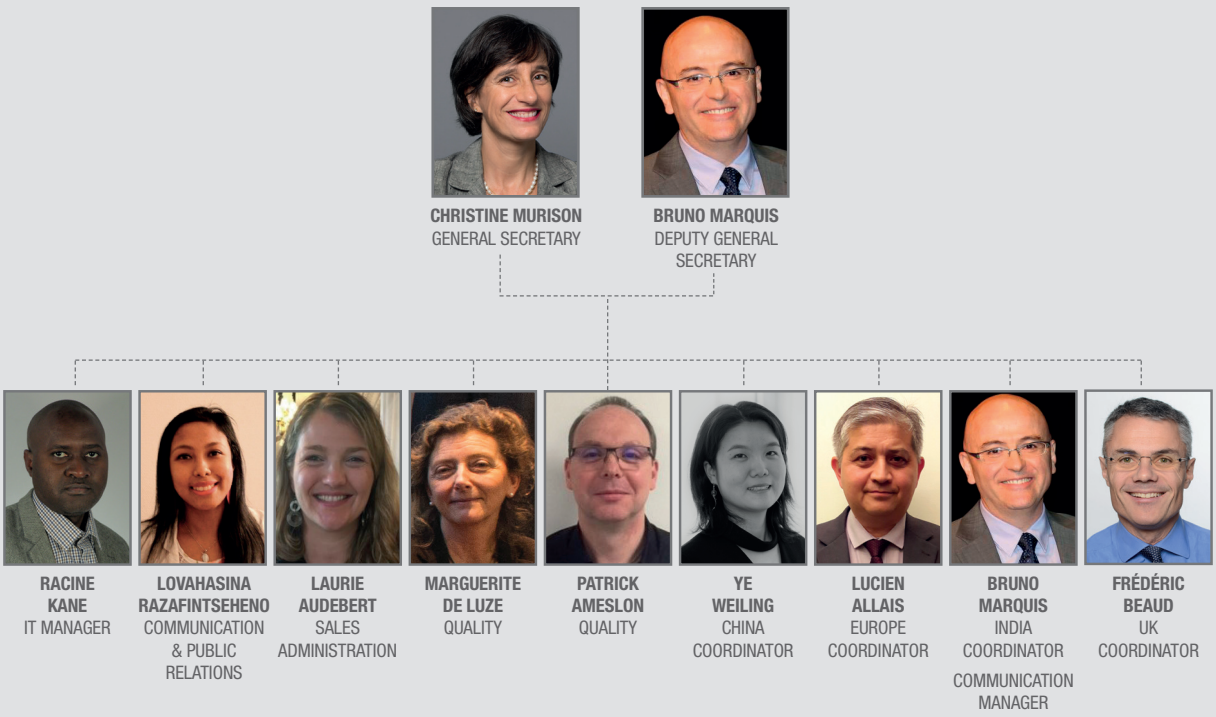
In 2020, the Board of Directors approved the membership of Terrasol and OMEXOM.

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 and publications. The committee defines AFCEN's editorial program, monitors and guides the work of the Subcommittees and approves the code editions and PTAN prior to publication.

The Editorial Committee oversees the quality of AFCEN's publications while giving special consideration to the safety, availability and technical/economic performance of nuclear facilities.

The Editorial Committee's 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 AFCEN's general meetings or any events organized by the Association, as well as during meetings between AFCEN and its different stakeholders (major projects, nuclear safety authority, etc.). The various international schemes set up by AFCEN (Users Groups, CEN/WS 64, etc.) are intended to ascertain potential requirements. These needs are addressed in the different Subcommittees or directly by the Editorial Committee where topics concern several Subcommittees.

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

FRÉDÉRIC BEAUD
CHAIRMAN OF THE EDITORIAL COMMITTEE

CLAUDE DUVAL
DEPUTY

HADRIEN LEROYER
DEPUTY

AURÉLIEN DI RIENZO
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

GILBERT TRILLON
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 2020:

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 five new editions in 2020: RCC-M, RSE-M, RCC-F, RCC-CW and RCC-C.

Codes must be updated to reflect users' needs and feedback, the latest developments in technology and practices, changes to standards and regulations... AFCEN is committed to helping users adopt and understand its newly updated codes for easier implementation in their projects whenever necessary.

In addition to amending the codes in the permanent working groups within each Subcommittee, dedicated working groups are regularly set up to examine specific technical subject areas at the request of the Subcommittees or Editorial Committee.

Various initiatives were launched in 2020, such as standardizing quality management requirements with ISO 19443 (all codes) and managing aging concrete structures (RCC-CW). Work is continuing on other initiatives, including consideration for extreme earthquakes in the resistance of electrical and mechanical components, cybersecurity requirements (RCC-E), and the procurement of pipes of pressure category 0 and specified based on conventional quality class (RCC-M). A new study was launched in 2020 to explore the opportunity of adopting a requirements engineering format in the code development process.

The three-year ESPN program (2016-2018) produced a set of 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. These standards build on the RCC-M and RSE-M codes and a set of ESPN guides. ASN wrote in 2019 that "applying the 2018 edition of the RCC-M code provides a solid foundation for implementing the ESPN Regulation".

A four-year follow-up ESPN program was launched in 2019 to build on feedback and continue exploring specific topics in greater detail. As part of the program, discussions are regularly held with ASN and GSEN.

In addition, AFCEN is contributing to the development of the ESPN Digital tool, which implements the terms for complying with the ESPN requirements defined in AFCEN's standard, with the aim of facilitating their implementation by the different stakeholders (manufacturers, organizations, operators, safety authorities, etc.).

A.2.5 Training Committee

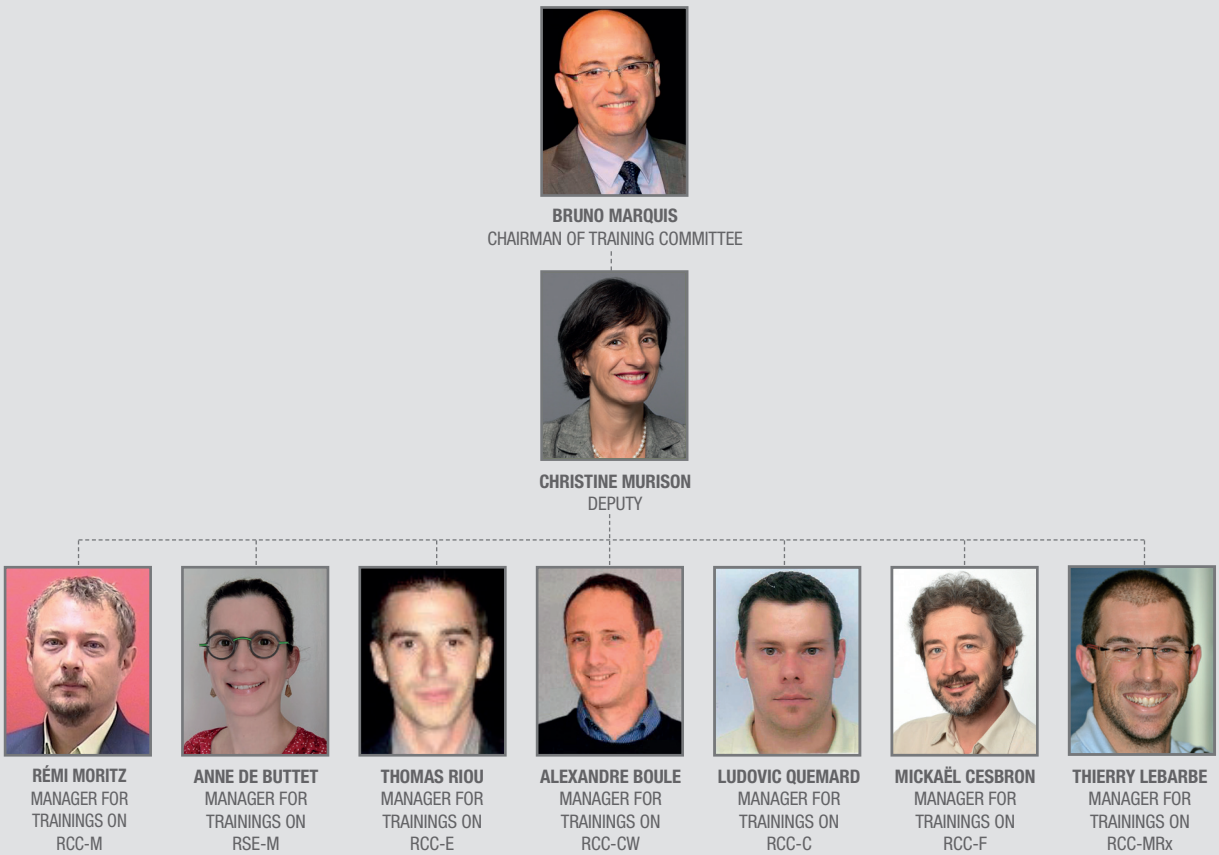
The Training Committee ensures that certified training is available in each field for AFCEN code users.

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.



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 2020:

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

- General information and latest news (conferences, international activities, organization and quality, etc.)
- Certified training (review of all agreements signed and certifications pending, number of training sessions delivered, etc.)
- Subcommittee reporting (certified training strategy, in-class evaluations, feedback from trainees, etc.)
- The actions required to guarantee and/or develop certified training courses, especially in light of the Covid-19 pandemic

The Training Committee has adapted to the health crisis accordingly. As part of a collaborative effort with the voluntary training organizations, virtual training sessions were carried out at the end of summer in accordance with the principles for certification.

The Training Committee consolidated 38 training courses and issued 274 certificates of attendance for courses on AFCEN codes. Two new courses from our partner SOCOTEC, entitled "Introduction to the RCC-M code" and "Understanding and using the RCC-M code", were certified in 2020.

The committee also completed work on creating a training program on the documentation associated with the ESPN Regulation, which is 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 2020

In 2020, seven Subcommittees were active:

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

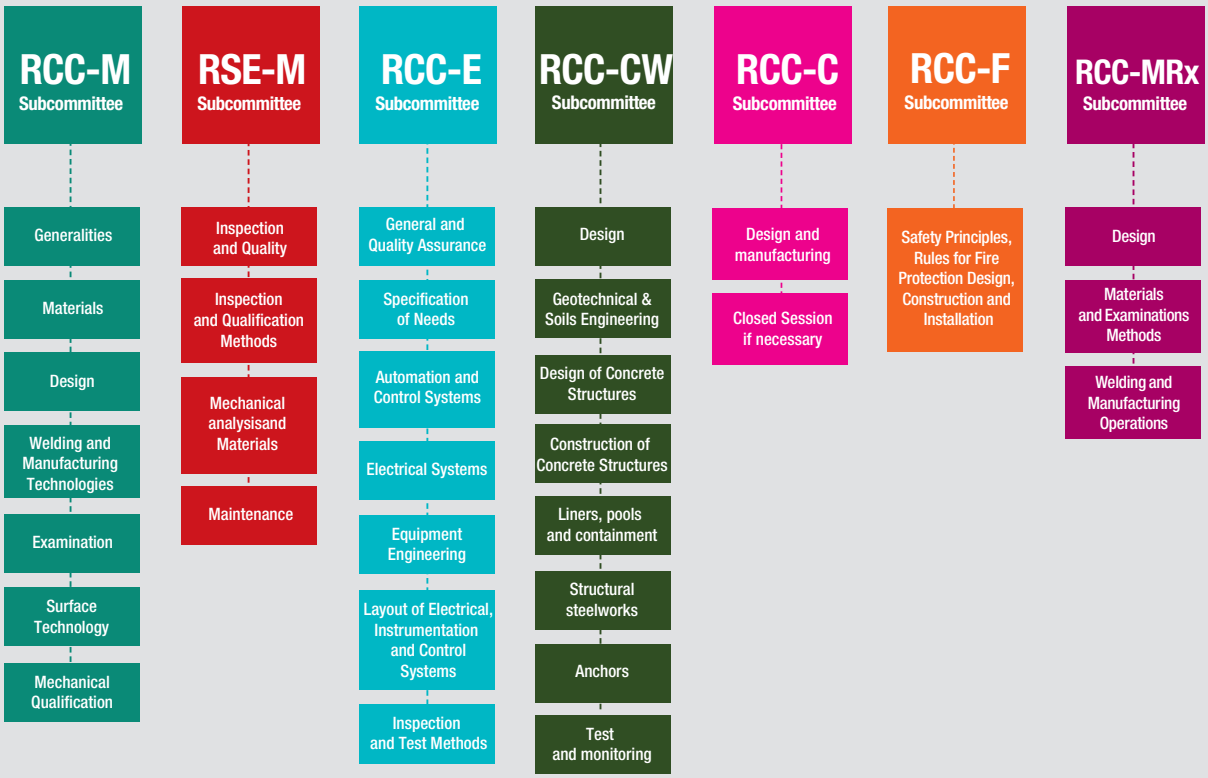
. examining and responding to modification and interpretation requests.

Permanent working groups investigate modification requests, which 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 2020, 32 permanent working groups were active.**
>
> The Subcommittees held between four and nine plenary sessions (RCC-M: 6; RSE-M: 6; RCC-F: 4; RCC-C: 9, RCC-MRx: 4; RCC-CW: 4; RCC-E: 4), thereby managing to maintain the rhythm of activities, despite the knock-on effects of the health crisis and the constraints inherent in remote communication.

GENERAL ACTIVITY OF THE SUBCOMMITTEES IN 2020

A.2 ORGANIZATION AND OPERATION



AFCEN'S SUBCOMMITTEES AND PERMANENT WORKING GROUPS

A.2.7 Users Groups

Users Groups are local structures (for each country and Subcommittee) that are responsible for coordinating code activities at the international level in liaison with local industry. 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. The 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 2020 in the UK:

Two Users Groups are in operation in the UK.

The RCC-M Users Group did not hold any work sessions in 2020.

The Users Group for civil engineering codes held one meeting in October.

The creation of an RCC-E User Group is still under advisement.

In 2020 in China:

The Chinese Specialized Users Groups (CSUGs) for each code held one meeting in the fall of 2020 (except for the RCC-C CSUG, which has postponed its meeting until early 2021). The spring sessions and steering committee meeting (CUG) had to be canceled due to the health crisis. The CSUGs also host the working groups between AFCEN and NEA (National Energy Administration) based on collaborative projects with Chinese standards, including the translation of AFCEN's codes into Chinese.

GENERAL ACTIVITY OF THE AFCEN CODE USERS GROUPS IN 2020

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:

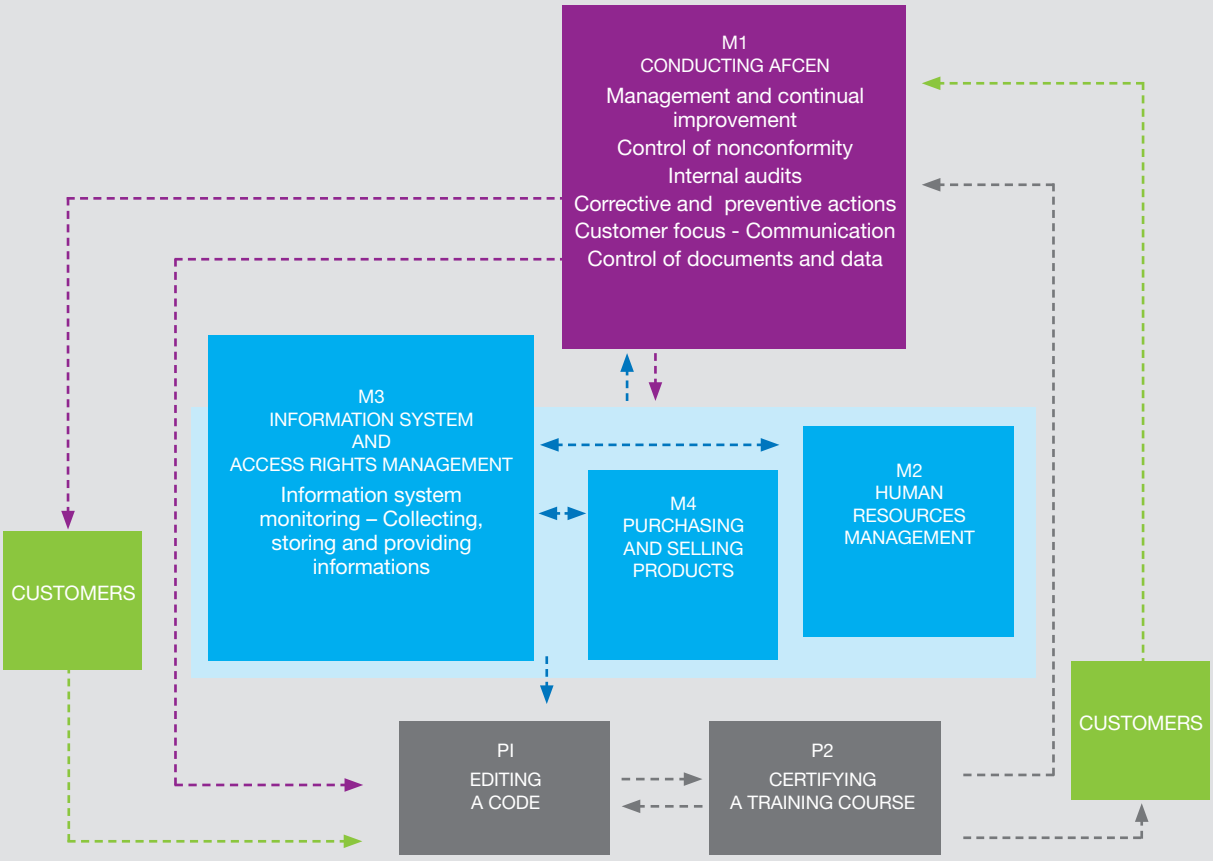
. supervise AFCEN's operation from a cross-functional perspective,

. 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 2020, the certification follow-up audit concluded that AFCEN's quality management system was sufficiently robust and effective. In particular, the auditor highlighted the "strong leadership that has enabled AFCEN to stay on course without using the health crisis as an excuse to abandon its commitments."

AFCEN's general quality management activities in 2020 are summarized in the box below.

Three internal audits were conducted in 2020 into the processes for certifying training, managing skills, conducting purchases and sales of AFCEN products.

Two process reviews were performed for AFCEN's management and code production practices.

The AFCEN management review was held on February 5, 2020. 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 2020 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 Congress in March 2019,

. 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 annexes,
. 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 codes, especially in China and India,
. support partner organizations with implementing training courses to support the ESPN Regulation,
. drive its digital communication by rolling out a new version of the afcen.com website to enhance the user experience,
. encourage presentations at conferences and universities, participation in the ASME Code Week, …
. confirm its participation in GIFEN's decision-making bodies,
. expand its code dissemination platform in partnership with AFNOR.
. formalize standards and legislative intelligence activities in the subcommittees

Certification follow-up audit:

On October 23, 2020, AFCEN passed the certification renewal audit on its quality management system (ISO 9001: 2015). The auditor highlighted a number of strengths, including the leadership and resilience demonstrated during the Covid-19 crisis by maintaining its 2020 editorial program (P1) and launching online training with two partners, its commitment to examining AFCEN's Business Continuity Plan, its process-based management approach with a recording system used by all stakeholders, and the new version of the afcen.com website.

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 2020

By the end of 2020, AFCEN had 67 members:

Membership renewed in 2020 **New member for 2020**

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

AFCEN MEMBERS IN 2020

A.4.2 Member involvement in the Subcommittees

In 2020, AFCEN members were involved in the Subcommittees as described in the box below.

RCC-M (38 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, INTERCONTROLE, JIULI, LISEGA SAS, MANGIAROTTI, NAVAL GROUP, NNB, ONET TECHNOLOGIES, ORANO, ORTEC, PONTICELLI, SIGEDI, SNCT, SPXFLOW, TECHNICATOME, TUV UK Ltd, TRILLIUM FLOW (WEIR), VALINOX NUCLEAIRE, VELAN SAS, VINCOTTE SA, WESTINGHOUSE FR.

RSE-M (21 members)
APAVE, ASAP, BUREAU VERITAS EXPLOITATION, CEA, CGNPC, CNNC, EDF, EDVANCE, ENDEL, ESI GROUP, Framatome, INTERCONTROLE, ITER, NNB, OMEXOM, ONET Technologies, ORANO, ORTEC, PONTCELLI, TECHNICATOME, WESTINGHOUSE FR.

RCC-E (17 members)
APAVE, Bernard Controls, CEA, CGNPC, CNNC, EDF, EDVANCE, Framatome, GENERAL ELECTRIC, JACOBS, NNB, PETERCEM, ROLLS ROYCE CN SAS, SCHNEIDER ELECTRIC, SICA NUCLEAIRE, TECHNICATOME, WESTINGHOUSE FR.

RCC-CW (24 members)
BOUYGUES TP, CEA, CNNC, CSTB, DEXTRA MANUFACTURING, EDF, EDVANCE, EGIS INDUSTRIES, EIFFAGE GC, Framatome, FUSION FOR ENERGY, GEODYNAMIQUE ET STRUCTURE, HALFEN GMBH, HILTI France, JACOBS, NFM SYSTEMS, NNB, ORANO, SITES, TECHNICATOME, TERRASOL, TRACTEBEL Engineering, VINCI CONSTRUCTION, WUERTH.

RCC-C (7 members)
CEA, CGNPC, CNNC (NPIC), EDF, Framatome, NNB, WESTINGHOUSE FR.

RCC-F (10 members)
CEA, CGNPC, CNNC, EDF, EDVANCE, EFECTIS France, EPM Inc, Framatome, NNB, NUVIA PROTECTION (formerly MECATISS).

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

AFCEN MEMBER INVOLVEMENT IN THE SUBCOMMITTEES IN 2020

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 2020, 882 experts contributed to AFCEN's work as follows (not including the Users Groups):

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

Studies related to the four-year ESPN program: 80

Foreign experts in the Users Groups: 239 (China), 43 (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.

In 2020, AFCEN launched its business continuity plan to prevent any external incidents from disrupting its day-to-day operations, such as the health crisis.

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, ensures data security 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 2020, AFCEN continued offering training sessions for its main users in the collaborative space available to its expert members. Over 1,000 users have registered. Each Subcommittee manages its space independently. In 2020, efforts focused on keeping shared information up-to-date by the technical secretaries, using tables for numbering chronological lists and saving information.

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 afcen.com website was given a makeover in 2020 to improve clarity and enhance the navigation experience.

The afcen.com website allows users to:

. purchase AFCEN's publications with access via the online library. Since 2019, users can also sign up for AFCEN's events on the website. Some publications are available free of charge.

. subscribe to the Association,

. access the forms for submitting interpretation and modification requests,

. discover the training courses on AFCEN's codes by our partners.

AFCEN applies the provisions required by the General Data Protection Regulation (GDPR) for information exchanges. AFCEN's data privacy policy and its terms and conditions of sale are available 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

CATALOG

OF AFCEN CODES AND DOCUMENTS AVAILABLE FOR SALE

B CATALOG OF AFCEN CODES AND DOCUMENTS AVAILABLE FOR SALE

Codes and publications	Description	Available lang.	Paper book format (€ excl tax)	PDF single format (€ excl tax)	Subscription format* (€ HT)
Subscription RCC-M	Publications included in the subscription: RCC-M 2020 / - 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 RCC-M 2018 FR / 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 2020 Qualification technique ESPN / PTAN Réponses aux Demandes d'Interprétation Editions 2007 à 2018	•	/	/	2600
RCC-M 2020	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	2 950	/	Cf. Subscription
RCC-M 2018	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	2950	/	
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 parties d'un équipement sous pression nucléaire de niveau N1	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	
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	

Codes and publications	Description	Available lang.	Paper book format (€ excl tax)	PDF single format (€ excl tax)	Subscription format* (€ HT)
PTAN 2018 Rédaction EMPN N2 N3	Guide méthodologique pour la rédaction des EPMN pour les équipements de niveau ESPN N2/N3	FR	/	80	Cf. Subscription
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 2020 Qualification Technique ESPN	Qualification Technique ESPN	FR	/	845	
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 2020 / RSE-M 2018 / RSE-M 2017 / RSE-M 2016 / RSE-M 2010 + mod 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 2020	In-Service Inspection, Installation and Maintenance Rules for Mechanical Components of PWR	FR, EN	1 760	/	Cf. Subscription
RSE-M 2018	In-Service Inspection, Installation and Maintenance Rules for Mechanical Components of PWR	FR, EN	1 760	/	
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	
Criteria Appendix 5.4	RSE-M Appendix 5.4: Principles of and background to the formulation of analytical methods for calculating stress intensity factors and the J integral for a planar defect	FR, EN	/	210	
PTAN RS 16 010 rev E	Professional guide to significant repairs/modifications of nuclear pressure equipment subject to Points 1 to 4 of Appendix V of the amended Order of December 30, 2015	FR, EN	/	110	
PTAN RS 18 007 rev A	Guide professionnel pour les interventionssur des ESPN du CPP-CSP	FR	/	40	
Criteria Appendix 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 for Periodic Requalification of Class N2 or N3 ESPN piping	FR, EN	/	45	
PTAN RS 16 009 ind B	Professional guide to repairs and modifications of nuclear pressure equipment subject to Points 1 to 4 of Appendix V of the amended Order of December 30, 2015	FR, EN	/	Free	
PTAN RS 17 022 ind B	Professional guide for the design and manufacture of main pressure parts (MPP) intended for nuclear pressure Equipment in the MPS-MSS	FR, EN	/	Free	
PTAN RS 18 003 ind A	Professional guide covering the requirements and procedures for assessing the conformity of permanent joints used to install NPEs that are subject to Appendix V, paragraph 4.1.a of the amended order of 12/30/2015	FR, EN	/	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	Professional guide to the requirements applicable to repairs and modifications of nuclear pressure equipment subject to Points 1 to 4 of Appendix V of the amended Order of December 30, 2015 and procurement of parts for this purpose	FR, EN	/	Free	
PTAN RS 19.013 Ind A	Guide pour la qualification de procédés END par ultrasons. Etablissement des performances	FR	/	Free	
Subscription RCC-E	Publications included in the subscription: RCC-E 2019 / RCC-E 2016 / RCC-E 2012 / Gap analysis RCC-E 2016 - 2019 (only EN) / Gap analysis RCC-E 2005 - 2012 (only EN) / Gap analysis RCC-E 2012 - 2016 (only EN) / PTAN Guidebook for defining RCC-E 2019 Book of Project DATA / PTAN Class 3 design qualification of systems using equipment families certified according to IEC 61508	•	/	/	950
RCC-E 2019	Design and construction rules for electrical and I&C systems and equipment + PTAN Guidebook for defining RCC-E 2019 Book of Project DATA	FR, EN	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	/	
PTAN Qualification Classe 3	Class 3 design qualification of systems using equipment families certified according to IEC 61508	FR, EN	/	45	

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Codes and publications	Description	Available lang.	Paper book format (€ excl tax)	PDF single format (€ excl tax)	Subscription format* (€ HT)
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RCC-CW 2020	Rules for design and construction of PWR nuclear civil works	FR, EN	1 500	/	Cf. Subscription
RCC-CW 2019	Rules for design and construction of PWR nuclear civil works	FR, EN	1 500	/	
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 2020 / RCC-C 2019 / RCC-C 2018 / RCC-C 2017 / RCC-C 2015 / RCC-C 2005 + mod 1 / PTAN RCC-C Qualification OCS rev A	•	/	/	820
RCC-C 2020	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	Cf. Subscription
RCC-C 2019	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	
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 + mod 1 mod 1 = modificatif 2011	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	725	/	
PTAN RCC-C Qualification OCS rev A	Qualification of scientific computing tools used in the nuclear safety case – 1st barrier	FR, EN	/	50	
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RCC-F 2020	Design and Construction rules for fire protection of PWR nuclear plants	FR, EN	400	/	Cf. Subscription
RCC-F 2017	Design and Construction rules for fire protection of PWR nuclear plants	FR, EN	400	/	
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 + mod 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	

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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 the RCC-M code	1 d	French	APAVE
	M-003		Control methods according to the RCC-M code	1 d	French	APAVE
	M-006		Understanding of the RCC-M code	2 d	French	APAVE
	M-007		Code RCC-M	2 d	French/English	BUREAU VERITAS
	M-008		Design - Sizing according to RCC-M code Materials Lev. 2 and 3	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	2d	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/English	VINCOTTE
	M-016		Discovering RCC-M code	4d	French / English	FRAMATOME
	M-017		RCC-M code	5 d	Chinese	SNPI (GROUPE CGN)
	M-018		RCC-M 2018 - Level 2 & 3	3 d	French	SICA
	M-019		Knowing and applying the code RCC-M	4 d	French/English	SOCOTEC
	M-020		Discovery of RCC-M code	1 d	French/English	SOCOTEC
	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 d	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
	E-010		Code RCC-E, édition 2019 - Qualification et fabrication d'un matériel électrique	3 d	French	SICA
	E-011		Connaissance du code RCC-E édition 2016, focus matériel	2 d	French	APAVE
Fuel	C-001	RCC-C	Connaître et savoir utiliser le Code RCC-C	2 d	French	CEF INGENIERIE
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AFCEN
1 Place Jean Millier
F-92400 Courbevoie
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