2015 ANNUAL REPORT

RCC-M
RCC-E
CRITERIA
ETC-F
ETC-C
RCC-CW
RCC-C
RCC-MRx
RSE-M
PTAN

afcen

Shaping the rules for a sustainable nuclear technology

Significant events of 2015 in pictures!

1 Challenges and actions

2 Organization and operation of AFCEN

3 Summary and outlook

Foreword by AFCEN's President

AFCEN hereby presents its second complete activity report on behalf of all its 60 members (operators, manufacturers, equipment suppliers, organizations, consulting firms, training providers, and so on), who represent an accurate cross-section of the stakeholders actively involved in both the French and international nuclear industry. By becoming members of AFCEN, companies send out a clear message about their commitment and determination to join forces and work together in raising the bar on the quality, safety and competitive advantage of their nuclear projects and facilities.

Ever since its inception in 1978, AFCEN has been driven by a mission to establish a series of technical rules reflecting on-the-ground practices, feedback from industry and the latest knowledge in a bid to guarantee the superior level of quality and safety required for operating nuclear reactors. These objectives are also the values that guide the tremendous technical work of AFCEN's editorial groups, which currently feature over 600 experts.

Today, AFCEN codes easily cover all the technical fields that are relevant to the construction and operation of nuclear facilities, with three codes for mechanical components: RCC-M (fabrication), RSE-M (in-service inspection) and RCC-MRX (high temperature, research and fusion reactors); one code for electricity and I&C systems (RCC-E); one code for nuclear fuel (RCC-C); one code for civil engineering works (RCC-CW), and one code for fire protection systems (RCC-F). A new code specifying the technical rules for deconstruction operations will soon be added to these seven codes.

AFCEN is clearly focused on increasing the association's international footprint and opening its doors to new members. It is committed to addressing the new challenges inherent in such an outward-looking approach when preparing technical rules that are regularly revised, updated and championed by larger expert focus groups, which in turn offers greater credibility in today's industrial environment. China has long been a hotspot for international deployment of AFCEN codes, which have served as the blueprint for 42 reactors, with 25 currently in operation and 17 under construction. The United Kingdom is the country boasting the second highest contribution with two EPRs slated for construction.

The following report begins by taking a look back at the significant events of 2015 in pictures, before presenting the entire organization, operation, challenges and initiatives spearheaded by AFCEN in its effort to incorporate and promote its members' best practices in the nuclear industry around the world. This report not only aims to highlight the importance of producing technical rules and developing training programs to support those rules, but also the quality of the design and construction codes published, as well as the initiatives that AFCEN is pursuing to continually improve performance.

I hope that you enjoy reading this report!

CÉCILE LAUGIER
President

Significant events of 2015 in pictures!

In 2015, AFCEN released

a new edition for three of its codes!

RCC-CW

CIVIL WORKS

- Geotechnical aspects
- Reinforced concrete structures and galleries
- Prestressed containments with metal liner
- Metal containment and pool liners
- Metal frames
- Anchors
- Concrete cylinder pipes
- Containment leak tests

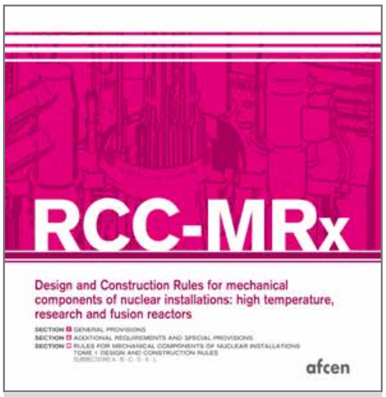
RCC-C

FUEL ASSEMBLIES

- Generalities : definitions, standards, management system and treatment of non-conformities
- Product design aspect for safety justification
- Fabrication aspect :
  . requirements about materials used,
  . qualification requirements for assemblies,
  . qualification requirements for inspection and fabrication processes,
  . control methods,
  . certification of controllers.
- Situations out of the boiler

RCC-MRx

MECHANICAL COMPONENTS



- General provisions
- Additional requirements and special provisions
- Rules for nuclear installation mechanical components
- Materials - Part and product procurement specifications
- Destructive tests and non-destructive examination methods
- Welding
- Manufacturing operations other than welding
- Probationary Phase Rules

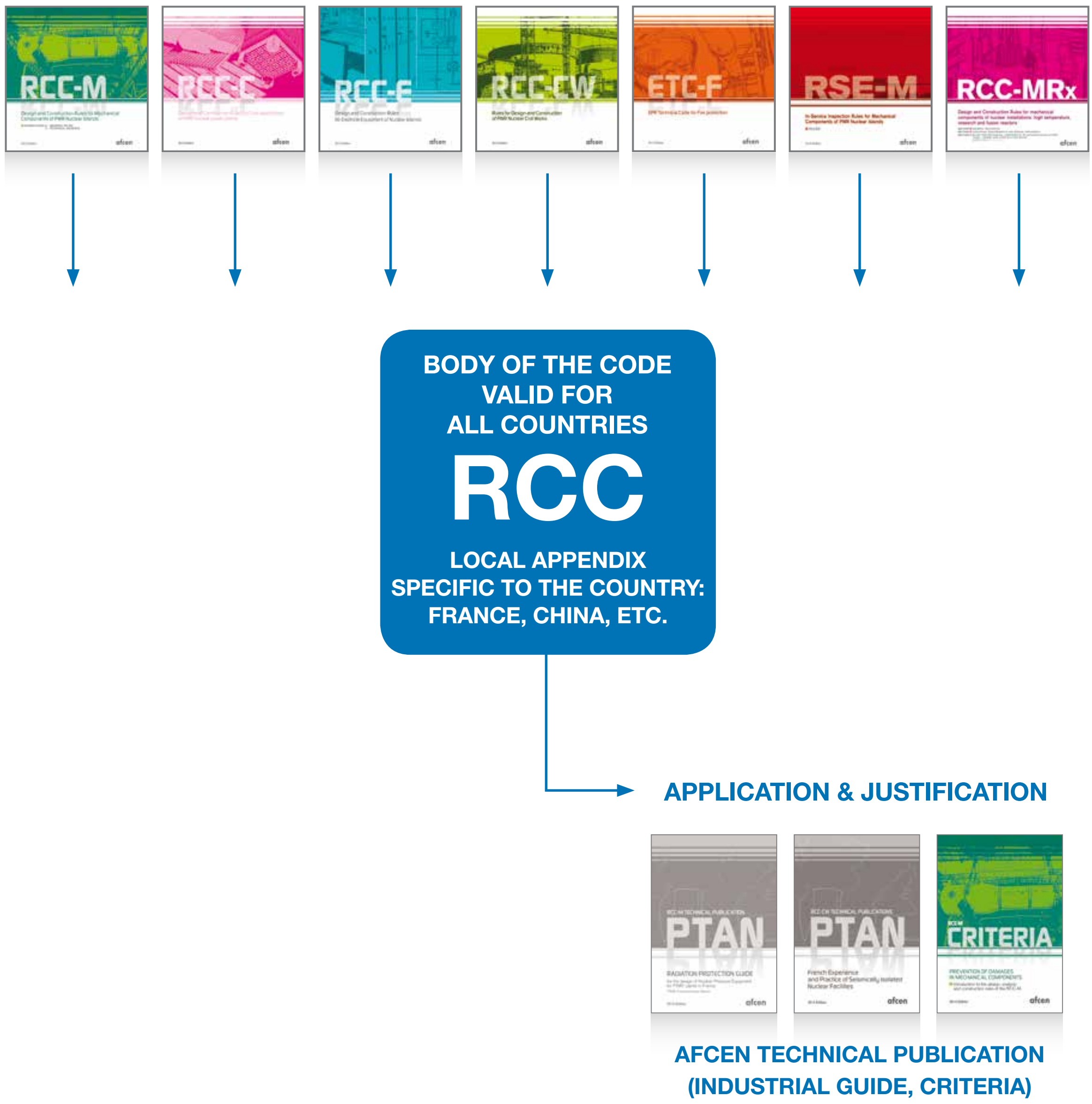
**FOR MORE INFORMATION,
REFER TO SECTIONS 1.2.5, 1.2.6 AND 1.2.8**

In 2015, AFCEN decided

to publish appendices to the codes

to specifically address the local regulations in each country of importance to AFCEN and its members.

GENERAL STRUCTURE FOR EACH RCC - RSE CODE



In 2015, AFCEN launched a three-year program to finalize

the documented requirements of France's Nuclear Pressure Equipment Regulation (ESPN)

with a series of professional guides and addenda to the codes dedicated to France (local appendices)

2015 | **2016** | 2017 | 2018

UNACCEPTABLE DEFECT
- APPENDIX ZG (PROPAGATION)
- EXAMINATION OF BOSSES
- DEFECTS BENEATH THE LINER

UNCERTAINTIES AND SAFETY FACTORS
- CODE MODIFICATION

SPECIFIC EVALUATION FOR NUCLEAR MATERIALS
- CLARIFICATION OF PRINCIPLES
- PENDULUM IMPACT TESTS (LOW THICKNESS)
- MATERIAL RETENTION

REFERENCED AFCEN GUIDE: ADR (RISK ANALYSIS), INSTRUCTION MANUAL, RDE (SIZING STANDARD FOR ESPN)

New AFCEN guides:

- Risk analysis
- Inspectability
- Equipment sizing standard
- Admissible limits
- Final visual examination
- Instruction manual
- Inter-operator repair guide
- Requalification guide

RCC-M 2016 ed | RSE-M 2016 ed | RCC-M 2018 ed | RSE-M 2018 ed

FOR MORE INFORMATION, REFER TO SECTION 1.2.2

In 2015, AFCEN held its

international conferences!

INTERNATIONAL CONFERENCE PARIS

SEMINAR IN WARSAW

SYMPOSIUM IN SUZHOU (CHINA)

In 2015, AFCEN launched

eight User Groups for its codes in China!

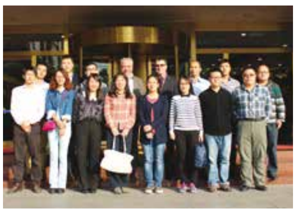
STEERING COMMITTEE MEETING IN MARCH 2015 IN BEIJING

CSUG RCC-MRx
IN MARCH 2015

CSUG RCC-CW
IN JUNE 2015

CSUG RSE-M
IN OCTOBER 2015

CSUG RCC-C
IN OCTOBER 2015



CSUG ETC-F
IN OCTOBER 2015

CSUG RCC-M (DESIGN)
IN OCTOBER 2015

CSUG RCC-E
IN OCTOBER 2015

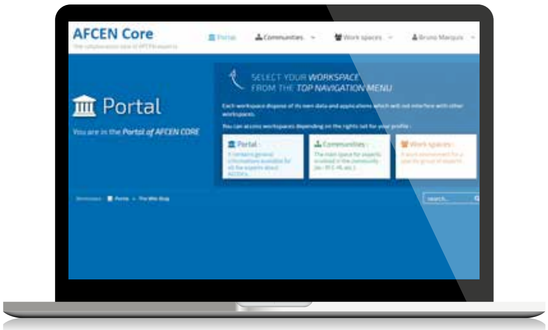
CSUG RCC-M
(FABRICATION)
IN OCTOBER 2015

CSUG IN JUNE & OCTOBER 2015 IN BEIJING, SUZHOU & SHANGHAI
FOR MORE INFORMATION, REFER TO SECTIONS 1.3.3 AND 1.3.5

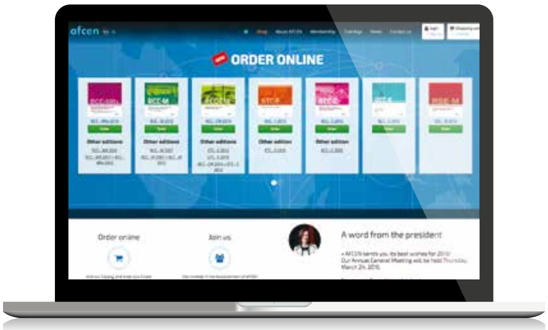
In 2015, AFCEN upgraded

its collaborative workspace...

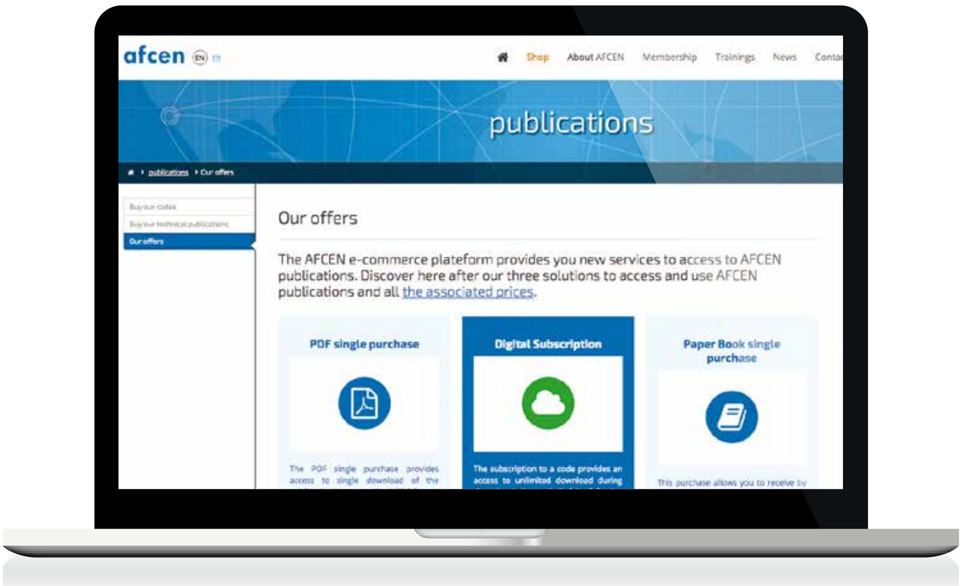
https://afcencore.net



www.afcen.com



... and unveiled its new subscription-based sales model!



FOR MORE INFORMATION, REFER TO SECTION 2.5

In 2015, AFCEN adopted a strategy of releasing

annual editions for all its codes, meaning that addenda are a thing of the past!

In 2015, AFCEN has 60 members and continues its internationalization with

11 new members originate from France, Germany, Sweden, China and Thailand

We wish them a warm welcome!

1

Challenges and actions

1.1 Use of AFCEN codes around the world

AFCEN codes are used as a benchmark for nuclear components in over 100 power plants currently in operation (87), under construction (24) or in the planning stages (1) around the world.

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

Table 1 hereinafter 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 using or have used AFCEN codes for		Codes used						
		P	C	E		design and/or construction	operation	RCC-M	RCC-CW	RCC-E	RCC-C	RCC-F	RSE-M	RCC-MRx
Nuclear Park	France			58	58	16	58	C, O	C, O	C, O	C, O		O	
Type CP1	South Africa			2	2	2		C	C					
	Korea			2	2	2		C	C					
M310	China			4	4	4	4	C, O	C	C, E			O	
CPR 1000	China		11	16	27	27	27	C, O	C	C, E			O	
CPR 600	China		1	5	6	6	6	C, E	C	C, E			O	
EPR	Finland		1		1	1		C						
	France		1		1	1	1	C, O	C	C	C	C	O	
	China		2		2	2	2	C, O	C	C	C	C	O	
	UK		2		2	2	2	C, O	C	C		C	O	
HPR1000	China		3		3	3		C		C	C		O	
PFBR	India		1		1	1								C
RJH	France		1		1	1								C
ITER	France		1		1	1								C
ASTRID	France	1			1	1								P
		1	24	87	112	70	100							

TABLE 1
SUMMARY OF THE USE OF AFCEN CODES AROUND THE WORLD

P: PLANNING
C: CONSTRUCTION
O: OPERATION

In addition to these formal applications of the codes and given their reputation, AFCEN codes have also served as inspiration in France for designing many other nuclear research 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: ITER, RJH, Institut Laue-Langevin, Laser Mega Joule and European Synchrotron Radiation Facility.
- The design of nuclear steam supply systems for marine propulsion.

1.1.1 France

Nuclear infrastructure

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-C, RCC-E, RCC-M and RSE-M codes are used for the operation of all of France's nuclear power plants.

EPR

AFCEN codes serve as a benchmark for licensing of the EPR project in France. RCC-M (2000 edition + addenda), RCC-E (2005 edition), RCC-C (2005 edition + addenda) and RSE-M (2010 edition) are used.

Jules Horowitz Reactor

For the Jules Horowitz research reactor currently undergoing construction at the Cadarache site, the RCC-Mx codes (predecessors to RCC-MRx) were 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.

In terms of experimental devices, application of the RCC-Mx code is recommended, but not mandatory.

ITER

ITER used the 2007 version of the RCC-MR code as a roadmap for its vacuum vessel and blanket cooling pipes. This code was chosen for the vacuum vessel on both technical grounds (the equipment and technology are covered by the code) and regulatory grounds (the code is adapted to French legislation).

OTHER USES OF AFCEN CODES

Nuclear marine propulsion in France

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

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

1.1.2 China

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

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

By the end of 2015, 42 of the 54 units in operation or under construction in China were modeled on AFCEN codes, with 25 in operation and 17 under construction. These units correspond to the M310, CPR-1000, HPR-1000, CPR-600 and EPR projects highlighted in blue in table 2 below.

Type of reactor	Units in operation (no.)	Units under construction (no.)	Total number
300 MWe	Qinshan I (1)		1
M310	**Dayabay (2)** **Ling'Ao (2)**		**4**
CPR1000	**Ling'Ao (2)** **Hongyanhe (3)** **Ningde (3)** **Yangjiang (3)** **Fangchenggang(1)** **Fuqing (2)** **Fangjiashan (2)**	**Hongyanhe (3)** **Ningde (1)** **Yangjiang (3)** **Fangchenggang (1)** **Fuqing (2)** **Tianwan phase III (1)**	**27**
HPR 1000		**Fuqing (2)** **Fangchenggang (1)**	**2** **1**
CPR600	**Qinshan II (4)** **Changjiang (1)**	**Changjiang (1)**	**6**
CANDU 6	Qinshan III (2)		2
AP1000		Sanmen (2) Haiyang (2)	4
EPR		**Taishan (2)**	**2**
AES-91	Tianwan (2)	Tianwan (2)	4
HTR-PM		Shidaowan (1)	1
Total number	**30**	**24**	**54**

TABLE 2
LIST OF REACTORS CURRENTLY UNDER CONSTRUCTION OR IN OPERATION IN CHINA AS OF LATE 2015 (REACTORS HIGHLIGHTED IN BLUE ARE THOSE USING AFCEN CODES)

During 2015:

- Eight reactors, all of which designed according to AFCEN codes, have been commissioned.
- Work has started on the construction of six new reactors: three CPR-1000s and three HPR 1000 (all use AFCEN codes).

1.1.3 Inde

PFBR and FBR

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

FIGURE 1 - INDIAN PFBR REACTOR

1.1.4 United Kingdom

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

The future operator (NNB: Nuclear New Build) has chosen the following AFCEN codes for designing and building the reactors:

- RCC-M 2007 edition + addenda
- RCC-E 2005 edition (this edition is used for the GDA)
- ETC-C 2010 edition
- ETC-F 2013 edition
- RCC-C 2005 edition (this edition is used for the GDA), but 2015 edition for the first fuel refill

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

The British safety authority (ONR: Office for Nuclear Regulation) accepted NNB's choices, subject to an assessment to clarify certain points in some of the codes. For example, in terms of the default methods for analyzing impacts in RSE-M (details in the chapter entitled "In-service inspection: RSE-M"), NNB commissioned a group of independent experts to carry out an assessment to address ONR's concerns and compare the code's methods against current practices in the United Kingdom (R6 rules in this particular area). Upon receiving the group's positive conclusions, ONR recognized the validity of the code's methodology for this particular point.

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).

The RCC-M code was chosen as the benchmark for designing and fabricating the main mechanical components, such as the vessel, pressurizer, steam generators, primary circuits, pressure relief valves and serious 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. However, the use of AFCEN codes in South Africa and South Korea for mechanical and electrical components has been extremely limited. The same cannot be said of civil engineering works, where the 1980 edition of the RCC-G code has been used for containment acceptance testing.

1.2 Design activity review

AFCEN codes

AFCEN's construction codes are generally prefixed with RCC-, while the in-service code is prefixed with RSE-.

In some cases, codes can only be used (provisionally) on the EPR design, in which case the code is prefixed with ETC-. This prefix is likely to be superseded by RCC-.

AFCEN currently publishes seven codes (see fig. 13), including five RCC- codes, one RSE- code and one ETC- code.

RCC-M
MECHANICAL COMPONENTS

RCC-C
FUEL ASSEMBLIES

RCC-E
ELECTRICAL AND I&C SYSTEMS

RCC-CW
GENIE CIVIL

RCC-F
FIRE

RSE-M
IN-SERVICE INSPECTION RULES

RCC-MRx
MECHANICAL COMPONENTS

FIGURE 2
THE SEVEN CODES CURRENTLY PUBLISHED BY AFCEN [UPDATE]

An eighth code featuring the RCC- prefix will be published in 2017; this is the future code for the "deconstruction of nuclear facilities":

RCC-D
DECONSTRUCTION OF NUCLEAR FACILITIES

General presentation of AFCEN's design activities

AFCEN's design activities involve authoring and updating codes.

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

Finally, AFCEN produces code-related documents, including criteria (which present the reasons for the choices in the code) and PTAN (Technical PublicaTions of AFCEN).

Code updates

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

1) Incorporating feedback is a major reason for updating codes. Several examples will be provided in the following sections which describe each of the codes, but one notable example is the change to the "Anchor" and "Liner" chapters in the RCC-CW code to reflect feedback from the Flamanville 3 plant.
2) New developments, scientific breakthroughs and R&D work also represent major reasons for updating the codes.

Of the many examples featured in the following sections, of specific note are the changes to the RCC-M code with respect to the use of radiographic testing with low-energy sources (Selenium 75) under specific conditions, as well as consideration of the environmental effects on components' behavior under fatigue.

To drive the code improvement process, AFCEN has created a preliminary focus group on a European level for three codes (RCC-M, RCC-MRx and RCC-CW), whose mission is to submit proposals for Gen II-III mechanical engineering, Gen IV mechanical engineering and civil engineering works (see Section 1.4.3).

3) Changes to legislation in the various countries in which the codes are used also represent a major reason for updating the codes.

For example, efforts are being made to ensure that the mechanical codes can be applied while guaranteeing a high level of confidence about their compatibility with the essential safety requirements of French legislation governing nuclear pressure equipment (ESPN Regulation).

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

For instance, AFCEN's work on France's Nuclear Pressure Equipment Regulation will either lead to modifications to the body of the code (such as the toughness of low-thickness materials) or the creation of a French appendix.

4) Furthermore, AFCEN codes are updated to reflect changes to the standards on which they are modeled. ISO international standards are the first choice when available, otherwise European EN standards are used.

AFCEN occasionally analyses the standards to determine whether any revisions have been made and updates the codes accordingly (see Section 1.4.4).

For example, RCC-M was updated in 2014 to introduce the new ISO 9712 standard for the qualification of non-destructive testing personnel.

5) Finally, AFCEN codes may be revised following an extension to the subject matter.

One example includes a study that AFCEN launched in anticipation of adding a new chapter to RCC-M to cover the qualification of mechanical components under accidental conditions.

In addition, AFCEN may decide to create a code for new fields of activity, as is the case with the deconstruction of nuclear facilities, for which a code is currently being drafted.

BOX 1
AFCEN'S TECHNICAL PUBLICATIONS AVAILABLE AS OF LATE 2015

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

The studies spearheaded by AFCEN are either code-specific and will therefore be described in the following sections, or apply to several codes.

Overarching studies may address how AFCEN codes in general are drafted, such as establishing guidelines for preparing codes or producing French and English translations.

Studies may also zero in on topics of a more technical nature, such as updating codes in the wake of the Fukushima accident, introducing IAEA GS-R-3 safety requirements into the codes, and introducing the qualification of mechanical components under accidental conditions into RCC-M in line with RCC-E.

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

To date, criteria have been published for the RCC-M code and Appendix 5.5 of the RSE-M code.

Finally, AFCEN produces technical publications aimed at shedding light on specific points.

These publications may have various objectives, as is the case with the technical publication for civil engineering works: "French practice and experience of seismically isolated nuclear facilities". Technical publications may also be produced in response to a specific area of legislation, such as the "guidelines for preparing a risk analysis of Class 1 nuclear pressure equipment, such as replacement steam generators".

RSE-M 2010

Edition 2010

Modificatifs inclus :
n° 1 (2012), n° 2 (2013), n° 3 (2014), n° 4 (2015)

RSE-M 2010

2010 Edition

Addenda included :
n° 1 (2012), n° 2 (2013), n° 3 (2014), n° 4 (2015)

RCC-CW 2015

2015 Edition

ETC-C 2012

Edition 2012

2010 Edition

ETC-C 2010

Edition 2010

2012 Edition

ETC-F 2013

Edition 2013

2013 Edition

ETC-F 2010

Edition 2010

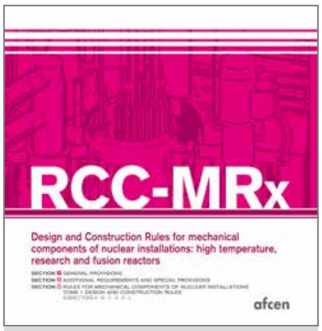
2010 Edition

Available publications on **afcen.com**

RCC-C 2015
Edition 2015

RCC-C 2005
Edition 2005
2005 Edition

RCC-E 2012
Edition 2012
2012 Edition



RCC-MRX 2015
Edition 2015

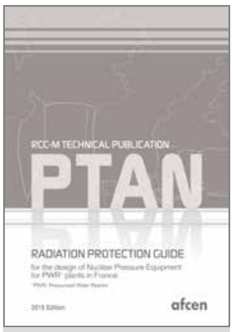
RCC-MRX 2012
Edition 2012
Modificatif inclus : n° 1 (2013)
2012 Edition
Addenda included : n° 1 (2013)

RCC-M 2012
Edition 2012
Modificatifs inclus : n°1 (2013), n°2 (2014), n°3 (2015)
2012 Edition
Addenda included n° 1 (2013), n° 2 (2014), n° 3 (2015)

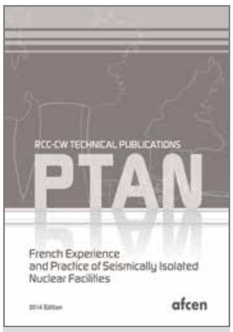
RCC-M 2007
Edition 2007
Modificatifs inclus : n°1 (2008), n°2 (2009), n°3 (2010)
2007 Edition
Addenda included : n°1 (2008), n°2 (2009), n°3 (2010)

RCC-MR 2007
Edition 2007
2007 Edition

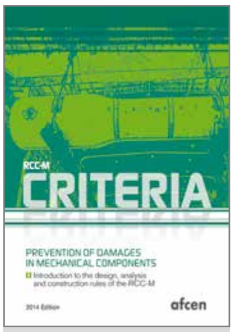
TECHNICAL PUBLICATIONS



PTAN RCC-M 2015
Edition 2015
2015 Edition



PTAN RCC-CW 2015
Edition 2015
2015 Edition



CRITERIA RCC-M 2014
Edition 2014
2015 Edition

1.2.1 AFCEN's editorial situation

AFCEN's editorial activities in 2015 were mainly marked by the following events:

- Publication of the 2015 edition of the RCC-MRx code
- Publication of the 2015 edition of the RCC-CW code
- Publication of the 2015 edition of the RCC-C code
- Publication in 2015 of addenda to the RCC-M and RSE-M codes.
- Overhaul of the RCC-E code, with publication scheduled for late 2016.
- Preparation of the 2016 edition of the RCC-F code.
- Preparation of a draft code for the deconstruction of nuclear facilities

Furthermore, AFCEN launched a three-year work program focusing on the ESPN Regulation, with 14 new working groups specializing in the different aspects of the regulation's implementation.

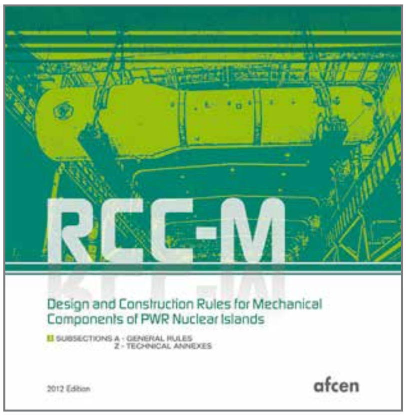
In 2016, AFCEN will release an annual edition for each code. The modification files approved during the year by the Editorial Committee will be incorporated into each new annual edition. As such, AFCEN will no longer publish specific addenda.

Table 3 below summarizes AFCEN's editorial situation and program as of late 2015. Besides the annual changes, the table also specifies the major code editions that are due to be released between 2016 and 2018.

TABLE 3
AFCEN'S EDITORIAL SITUATION AND PROGRAM AS OF LATE 2015

CODE		The 31/12/2014	The 31/12/2015	EDITORIAL OBJECTIVE (major code edition)
RCC-M	Mechanical Components of PWR	2012 Edition, addendum 2013 + 2014 Criteria RCC-M	2012 Edition, addendum 2013, 2014, 2015 + PTAN Radio protection + 14 GTs ESPN + GT Qualification Vol	1 criteria 7 PTAN 2016 Edition (ESPN) 2017 Edition (Vol Q) 2018 Edition (ESPN)
RSE-M	Inspection for Mechanical Components of PWR	2010 Edition, addendum 2012 + 2013 + 2014 Criteria RSE-M (Appendix 5.5)	2010 Edition + addendum 2012, 2013, 2014, 2015	2016 Edition (ESPN) 2018 Edition (ESPN)
RCC-MRx	Mechanical Components of fast-neutron reactor & experimental reactor	2012 Edition, addendum 2013 (published in 2014)	2015 Edition	2018 Edition
RCC-E	Electrical & CC	2012 Edition	2012 Edition	2016 Edition (overhaul of the code)
RCC-C	Fuel	Addendum 2011	2015 Edition	RCC-C English version (2016)
RCC-CW	Civil Work	2010 Editions then 2012 (ETC-C) + PTAN "French Experience and practices of Seismically isolated Nuclear Facilities"	Edition 2015 (RCC-CW) 1st edition not specific to any given project	2017 Edition
RCC-F	Fire protection	2010 Edition then 2013 (ETC-F)	2013 Edition (ETC-F)	2016 Edition (RCC-F): 1st edition not specific to any given project
RCC-D	Dismantling		Work on RCC-D draft	2018 Edition (1st for RCC-D)

1.2.2 Mechanical field for PWR: RCC-M



RCC-M

Design and construction rules for mechanical components of PWR nuclear islands

FIGURE 3
THE RCC-M CODE

a) Purpose and scope

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

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

RCC-M covers the following technical subjects:

- Sizing and design rating.
- Choice of materials and terms of procurement.
- Fabrication and control, including:
  - Associated qualification requirements (procedures, welders and operators, etc.).
  - Control methods to be implemented.
  - Acceptance criteria for detected defects.
- Documentation associated with the different activities covered, and quality assurance.

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

Use

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

- France's last 16 nuclear units (P'4 and N4).
- Four CP1 reactors in South Africa (2) and Korea (2).
- 42 M310 (4), CPR-1000 (27), CPR-600 (6), HPR 1000 (3) and EPR (2) reactors in service or undergoing construction in China.
- Four 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 (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 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.

1.2.2 Mechanical field for PWR: RCC-M

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.

Edition available as of 1 January 2016

The 2012 edition, with three addenda in 2013, 2014 and 2015, is the most recent edition

Revisions of the code are aimed at integrating tried-and-tested international approaches as far as possible and allowing for the possibility of alternatives to the code's basic rules.

FIGURE 4
CONTENTS OF THE 2012 EDITION OF THE RCC-M CODE

SECTION I - NUCLEAR ISLAND COMPONENT
- SUBSECTION "A": GENERAL RULES
- SUBSECTION "B": CLASS 1 COMPONENTS
- SUBSECTION "C": CLASS 2 COMPONENTS
- SUBSECTION "D": CLASS 3 COMPONENTS
- SUBSECTION "E": SMALL COMPONENTS
- SUBSECTION "G": CORE SUPPORT STRUCTURES
- SUBSECTION "H": SUPPORTS
- SUBSECTION "J": LOW PRESSURE OR ATMOSPHERIC STORAGE TANKS
- SUBSECTION "P" : CONTAINMENT PENETRATION
- SUBSECTION "Z" : TECHNICAL APPENDICES
- ZI, ZII, ZIII, ZIV, ZV, ZVI: MANDATORY APPENDICES
- ZA, ZD, ZE, ZF, ZG, ZH, ZM, ZS, ZY, ZZ: NON MANDATORY APPENDICES

SECTION II - "M": MATERIALS

SECTION III - "MC: EXAMINATION METHODS

SECTION IV - "S": WELDING

SECTION V - "F": FABRICATION

SECTION VI - "RPP": PROBATIONARY PHASE RULES

RPP-1: NUCLEAR MANAGEMENT SYSTEM

2013 addendum

This addendum features the addition of a sixth section, entitled Probationary Phase Rules (RPP), in addition to the existing sections, which are divided into subsections, including general rules & design, materials, examination methods, welding and fabrication.

As an alternative to the ISO 9001-based quality assurance requirements in Chapter A 5000, the first RPP introduces IAEA GSR-3 safety requirements for nuclear management systems.

2014 addendum

The RCC-M Subcommittee published the French version of the 06/2014 addendum in September and the English version in November. It integrates 31 modification files covering every part of the code.

This addendum introduces several changes to European and international standards, thereby aligning the code with applicable standards and the latest tried-and-tested technologies. Changes include:

- ISO 9712: 2012 for the qualification of non-destructive testing personnel.
- The introduction of sub-size specimens for destructive testing.
- The introduction of requirements for qualifying design methods in the chapter relating to quality management systems for manufacturers.

2015 addendum

The French version of the 2015 addendum was published in October, with the English version released in December. It integrates 44 modification files.

As an example of the different fields, this addendum incorporates:

- The introduction of Selenium 75 for radiographic testing.
- The introduction of ultrasound for inspecting Class 3 pipe welds as an alternative to radiographic examination.
- The requirement for pendulum impact tests for low-thickness materials based on sub-size specimens.

- The requirements of ISO 17025 for laboratories performing mechanical characterization testing.

b) Future editions

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

2016 edition

A new edition to supplement the code was drafted in 2015 for release in 2016. It will feature approximately 100 modification files.

The vast majority of these modification files were produced after testing the code for conformity with the essential requirements of France's Nuclear Pressure Equipment Regulation (see Box 2)

This edition will also include a host of significant changes, such as:

- Trends in the fatigue curve for austenitic stainless steels and consideration of environmental effects on the fatigue analysis of those steels in the form of two Probationary Phase Rules (RPP).
- The introduction of comprehensive quality requirements for fusion welding in accordance with international standard ISO 3834-2, which builds on ISO 9001.
- The introduction of welding coordination requirements in conformity with ISO 14731 "Welding coordination - tasks and responsibilities".
- The introduction of the new standards for the qualification testing of welders (ISO 9606-1) and welding operators (ISO 14732).
- The introduction of advanced inspection methods (TOFD and multi-element ultrasonic testing) as an alternative to radiographic examination.

2017 edition

Finishing touches are currently being made to a 2017 edition to introduce a new "Q" subsection to address the qualification of active mechanical components.

2018 edition

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

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

The new 2018 edition of the code will also incorporate feedback on the code's use in current projects (EPR UK, TSN, FA 3, replacement steam generators, etc.) and will draw on the results of the studies being monitored by ASN and international groups (UK, China, Europe and MDEP).

c) RCC-M criteria

RCC-M criteria

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

1.2.2 Mechanical field for PWR: RCC-M

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.

Other work in progress

Functional qualification of active mechanical components

In 2014, a new editorial group was created within the RCC-M Subcommittee to address the functional qualification of active mechanical components (valves and pumps).

The group's work will form the basis of the new "Q" subsection in the RCC-M code, which is scheduled for mid-2016 and which is being drafted in close liaison with the RCC-E Subcommittee.

The code will broaden its scope, which is currently restricted to the integrity of pressure-bearing structures, to encompass the operability and functionality of so-called "active" mechanical components. The first edition of the Q subsection will be restricted to pumps and valves, and will be published in the 2017 edition of the RCC-M code.

Technical studies to prove conformity with the PED Directive / France's Nuclear Pressure Equipment Regulation

The Editorial Committee has launched 14 working groups to demonstrate how the RCC-M code can be used to meet the essential safety and radiation protection requirements stipulated in France's Nuclear Pressure Equipment Regulation and the European PED Directive.

These groups have the following missions:

- Risk analyses.
- Uncertainties and safety factors.
- Inspectability and vulnerability criteria.
- Instruction manuals.
- The dimensions required to ensure conformity with requirements.
- Fatigue damage.
- Specific evaluations for nuclear components.
- Toughness of low-thickness materials.
- Unacceptable defects (including defects beneath the cladding and sequential penetration).
- Proof of compliance with essential safety and radiation protection requirements.
- Technical qualification.
- Definition of a component's admissible limits.
- Visual inspections during fabrication.
- Fabrication of assemblies.
- Code compliance for Class 2 and Class 3 equipment.

The mission facing the last group is to extend the previous topics to encompass Class 2 and Class 3 equipment, since work initially focused on Class 1 equipment. The group began work late 2015 and features AFCEN members who manufacture Class 2 and Class 3 equipment in order to draw on their feedback and deliver an appropriate and graded response for this type of equipment compared to the responses provided for Class 1 equipment.

The groups' findings will be published in 2016 as:

- Generic modifications introduced into the body of the code.
- Modifications specific to French regulations and introduced in non-generic appendices ZY and ZZ exclusively for France.
- Technical publications in the form of guides and criteria.

The aim of the working groups is to produce all the requested changes and evidence to ensure that the 2018 edition of RCC-M conforms to the requirements of France's Nuclear Pressure Equipment Regulation of 30 December 2015. This aim and the associated milestones have been shared with ASN.

The objectives and detailed progress of this program are presented in Box 2 below.

BOX 2
DETAILED PROGRESS OF THE PROGRAM TO PROVE CONFORMITY WITH THE PED DIRECTIVE / FRANCE'S NUCLEAR PRESSURE EQUIPMENT REGULATION

As part of its strategy to bring its codes (RCC-M and RSE-M) into greater alignment with the terms that ASN has specified for implementing the Nuclear Pressure Equipment Regulation of 30 December 2015, AFCEN is striving to produce a set of guidelines for implementing the Regulation by 2018.
To achieve this goal, topics have been identified and working groups have been formed involving experts from AFCEN's members:

RCC-M commissioned studies:

Risk analysis according to ESPN: the ESPN Regulation requires a risk analysis to be carried out prior to design and fabrication. Guidelines for carrying out ESPN risk analyses have been prepared following consultation with ASN. The guide will be revised in 2018 to reflect feedback from the initial applications.

Inspectability: this study is aimed at producing a guide on how to write the inspectability report. This guide defines the various stages of the analysis in relation to the risk assessment and the additional information that must be specified in the instruction manual depending on the situation. The guide is based on a revision of Record no. 37 issued by the Nuclear Pressure Equipment Liaison Committee, which restricts the essential safety requirements associated with inspectability in cases where the risk analysis identifies inspection as a way of remedying a significant residual risk.

Uncertainties and safety factor: this study involves checking that the safety factors in the RCC-M code conform to the requirements of the ESPN Regulation and proving that application of the RCC-M code satisfies the requirement of taking uncertainties into account in the sizing and safety factors. In respect of the first point, the study shows that the safety factors generally conform to the requirements of the regulation. The second point is being examined by comparing the requirements of the RCC-M code against harmonized standards, since the uncertainty requirement is stipulated in European Directive 97/23/EC. In addition to this ongoing study, two special investigations have been launched, one of which into the dimensional control of components, which will culminate in a guide published in 2016, and the other into fatigue damage.

Specific evaluation for nuclear materials: this evaluation is intended to explain the reasons for which a given material was chosen for a given application. The study involves documenting test cases for performing a specific evaluation on the materials used in a steam generator, which can then be used as an example.

Toughness of low-thickness materials: the ESPN Regulation requires fast fracture resistance warranties, irrespective of the material's thickness. The study involves defining a method for measuring the resilience of products with a thickness between 5 and 10 mm and demonstrating that the resilience measurement is negligible for austenitic products whose dimensions are less than 5 mm.

Unacceptable defects: the ESPN Regulation specifies that non-destructive testing must be capable of detecting unacceptable defects. In this particular case, a distinction is made between defects of concern in terms of construction quality (a discrepancy in the manufacturing process) and defects of concern in terms of the structure's mechanical integrity. Work during phase one focused on integrity, which prompted a change in RCC-M to factor in the potential evolution of manufacturing defects under fatigue and ensure that such an evolution is not likely to affect the inspection for damage caused by an end-of-life fast fracture. Phase two began late 2015 and zeroed in on quality. The aim of this phase is to provide evidence that the specifications of the RCC-M code are compatible with NDT testing and subsequently define the necessary changes to the codes, especially with respect to any additional action required by the manufacturer. At the same time, a Request for Modification for cladded component inspections will be submitted early 2016. Finally, a working group was specifically created to address sequential penetration issues and define the additional actions required by manufacturers in order to comply with requirement 3.4 of Appendix 1 in the ESPN Regulation.

Visual inspections during fabrication: the objective is to determine changes to the requirements in RCC-M relating to visual inspections during fabrication following a risk analysis (statement of explicit criteria, including a comparative analysis with relevant EN harmonized standards) and incorporate the chosen rules for the Final Visual Examination into the code.

Verification that the RCC-M code satisfies the different essential safety requirements: the purpose of this study is to produce documents that examine all the requirements in the ESPN Regulation, determine whether the requirements in the code satisfy the ESPN's requirements (either directly or by using the other AFCEN studies above) and propose amendments to the code if such is not the case. To date, the study has addressed Class 1 vessels and piping, and culminated in several changes to the 2016 edition of the code. Work will now concentrate on Class 1 pressure accessories and safety devices, as well as all Class 2 and 3 components for the 2018 edition.

Admissible limits: the aim of this study is to produce a methodological guide to accompany the risk analysis guide for identifying the admissible limits of a given item of equipment.

Instruction manual: this group has produced a guide that specifies the contents for instruction manuals in keeping with risk analyses carried out according to the AFCEN guide.

Assemblies: this group is tasked with clarifying the technical requirements and methods for evaluating fabricated assemblies and building facilities by 2018.

Class 2 - Class 3: to date, all specified work has focused on Class 1 equipment. A study was commissioned late 2015 with AFCEN members who manufacture Class 2 and Class 3 equipment with the aim of providing all the information and elements required to bring the 2018 edition of the RCC-M code into alignment with the requirements of Appendices 2 and 3 of the ESPN Regulation. The objective is to adapt and scale the solutions developed for Class 1 equipment to suit Class 2 and 3 requirements, as well as draw inspiration from conventional practices. There are also plans to use harmonized standards EN 13445 and 13480 as an alternative to Subsection D of RCC-M for Class 3 equipment.

RSE-M commissioned studies

Documentation associated with repaired / modified nuclear pressure equipment: the aim is to produce a series of guides for preparing the documents required by the ESPN Regulation, including the Risk Analysis, Specific Evaluation for Nuclear Materials, instruction manuals, inspectability reports, and so on.

Guidelines for classifying repairs / modifications to nuclear pressure equipment (not including main primary and secondary systems): the idea is to upgrade and incorporate the inter-operator guide into the RSE-M code to reflect changes in legislation governing repairs or significant modifications without testing.

Methodology for the periodic requalification of Class 2 or Class 3 piping: the aim is to produce a guide that defines practical terms for the periodic requalification and, if applicable, hydraulic testing of piping as well as the pressure accessories and safety devices that are likely to be concerned.

1.2.2 Mechanical field for PWR: RCC-M

Preparation of future changes to the code

Several focus groups were created in 2015 to pave the way for the code's significant changes:

- A draft appendix addressing non-linear finite element analyses was prepared by 14 experts from seven member companies. This appendix covers excessive deformation damage, plastic instability, fatigue and fast fracture. It defines best practices for performing and validating non-linear finite element analyses and interpretation methods for verifying RCC-M criteria. The draft was submitted to the RCC-M Subcommittee early 2016. The group will subsequently turn its attention to progressive deformation.
- An environmental fatigue working group featuring internationally-recognized independent experts (particularly from Rolls-Royce and EDF) was formed to issue a technical advisory on two Requests for Modification submitted by AREVA, EDF and CEA in relation to the environmental fatigue of austenitic stainless steels and a revision of the fatigue curve for such materials. The group issued a positive advisory subject to a few modifications and justifications, and the two code Requests for Modification will be incorporated as probationary phase rules.
- A working group comprising 18 experts from nine companies is currently carrying out a complete overhaul of the design rules for flanged connections (including Appendix Z V of RCC-M). This work will range from updating sizing rules through to joint characterization testing.
- A permanent expert working group was created to examine and compare the comprehensive quality requirements for fusion welding in ISO 3834-2 against the code's requirements. This group's positive advisory has given the green light for six changes to the code, including the concept of welding coordination.
- A working group was set up to analyze the new standards for the qualification testing of welders (ISO 9606-1) and welding operators (ISO 14732). This group's positive advisory has paved the way for both international standards to be incorporated into the code, which incidentally supersede the previous standards for the qualification testing of welders (EN 287-1) and welding operators (EN 1418).
- In an effort to offer an alternative to radiographic examination, advanced ultrasonic inspection methods (TODF and multi-element testing) have been introduced together with the concept of an equivalence report. This report enables manufacturers to demonstrate that the inspection technology used guarantees a level of performance that is at least equal to the performance of the method specified by the code.
- The technical requirements of ISO 17025 for testing and calibration laboratories have been introduced for mechanical testing (tensile tests, pendulum impact tests, etc.).

PTAN (AFCEN Technical Publications)

In 2015, AFCEN published a radiation protection guide for the design of nuclear pressure components in PWR plants in France.

Commissioned studies into the ESPN Regulation culminated in a series of guides, some of which will be published in 2016:

- A guide featuring a set of methods for preparing risk analyses focusing specifically on steam generators.
- A guide for defining dimensions in accordance with ESPN requirements and measuring dimensions while quantifying uncertainties.
- A guide for examining inspectability during equipment design in relation to the risk analysis performed according to the AFCEN guide and based on Record no. 37 issued by the Nuclear Pressure Equipment Liaison Committee (currently being revised).
- A guide defining visual examinations and visual inspections during fabrication in association with the risk analysis.
- A methodological guide specifying the contents for instruction manuals in keeping with the guide defining risk analyses.

- A methodological guide to accompany the risk analysis guide for identifying the admissible limits of a given item of equipment.

Finally, criteria will be published 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 of thickness less than 5 mm.

Continued activities to address international challenges

In 2015, the RCC-M Subcommittee organized:

- One meeting for the UK User Group in June (see Section 1.3.4).
- Four meetings for the Chinese User Group in March and October (see Section 1.3.3).
- A seminar concentrating on the application of European standards by the RCC-M code, from 15 to 17 April 2015 in Poland.

Furthermore, in 2015, the RCC-M Subcommittee took part in several international working groups and participated in the associated events, such as:

- Contributing to a seminar organized by Poland's Ministry of Economy in Warsaw on 24 and 25 September 2015, offering a technical comparison between AFCEN / ASME codes and the standards and regulations (especially quality) on which they rely.
- Following up the activities of the "Group for the Convergence of Mechanical Codes and Nuclear Coding Organizations" organized by ASME ST LLC, following MDEP's actions for Codes and Standards (see Section 1.4.1).
- Making several contributions to the CORDEL working group through AFCEN (see Section 1.4.2).
- Seven meetings for the European Prospective Group CEN WS 64 - Phase 2 - PG 1 on the RCC-M code, including two special-interest meetings on LTO (see Section 1.4.3).

1.2.3 Field of in-service inspection: RSE-M

RSE-M

In-Service Inspection Rules for Mechanical Components of PWR Nuclear Islands.

FIGURE 5
THE RSE-M CODE

Purpose and scope

The RSE-M code defines in-service inspection operations.

It applies to pressure equipment used in PWR plants, as well as spare parts for such equipment.

The RSE-M code does not apply to equipment made from materials other than metal.

It is based on the RCC-M code for requirements relating to the design and fabrication of mechanical components.

Use

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

To date:

- The 58 units in France's nuclear infrastructure enforce the in-service inspection rules of the RSE-M code.
- Operation of the 25 commissioned units in China's nuclear infrastructure, corresponding to the M310, CPR-1000 and CPR-600 reactors, is based on the RSE-M code (since 2007, use of AFCEN codes has been required by NNSA for Generation II+ reactors).

Background

AFCEN drafted and published the first edition in July 1990.

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

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

Edition available as of 1 January 2016

2010 edition, with addenda in 2012, 2013, 2014 and 2015.

FIGURE 6
CONTENTS OF THE 2010 EDITION OF THE RSE-M CODE

BINDER 1: 4 SECTIONS

SECTION A
GENERAL RULES

SECTION B
RULES FOR RSE-M CLASS 1 COMPONENTS

SECTION C
RULES FOR RSE-M CLASSES 2 AND 3 COMPONENTS

SECTION D
RULES FOR OTHER COMPONENTS

BINDER 2: APPENDICES

APPENDICES 1: IN RELATION WITH CHAPTERS 1000

APPENDIX 2: PROTECTION DURING HYDRAULIC PROOF TEST

APPENDICES 4: NDE METHODS AND QUALIFICATION

APPENDICES 5: INDICATIONS AND MATERIALS

APPENDICES 8: CORRECTIVE MAINTENANCE

BINDER 3: PROPOSAL OF INSPECTION PROGRAMS

In particular, the 2010 edition modifies the way in which pressure equipment is divided into different subsections to reflect the new French regulation governing pressure equipment.

The 2010 edition was supplemented by the following four addenda.

2012 addendum:

- For the section on "Implementation of a maintenance operation", elements were included from the inter-operator professional guide for classifying modifications or repairs to nuclear pressure equipment subject to Appendix 5 of France's ESPN Regulation.
- Additional information on test coupons.
- Further details about pre-service inspections.

2013 addendum:

- Incorporation of changes to requirements and practices for qualifying NDT applications.
- Further details about fatigue analysis methods.
- Clarification concerning the terms for applying RSE-M: company qualification and use of a test coupon.

2014 addendum:

- Updating of the zones subject to examination in case of magnetic particle testing.
- Definition of the requirements for qualifying design and modeling tools.
- Further details concerning regulated pressure equipment, including the small lines in the main primary and secondary systems.
- Modification to the standard deviation value to be taken into account for the upper envelope and the predicted upper envelope for embrittlement under the effects of irradiation for monitoring the effects of neutron radiation on the containment vessel materials.
- Integration of tapped screw holes not involved in pressure resistance.
- Description of the maintenance operation file, by identifying the necessary elements according to applicable regulations (Appendix 1.6).
- Revision of the inspection tables and associated figures for RSE-M Class 1 components (Appendix 3.1.1).
- Further details concerning the analytical methods for calculating stress intensity factors and J integral (Appendix 5.4).

1.2.3 Field of in-service inspection: RSE-M

2015 addendum:

The 2015 addendum integrates 20 modification files covering every part of the code. The changes made mainly involve:

- Updating the edition used for the RCC-M code as modified in 2012, 2013, 2014 and 2015.
- Introducing probationary phase rules (RPP), especially "RPP2" for verifying the fast fracture resistance of the core area in reactor vessels. This rule includes the hot pre-loading phenomenon.
- Aligning the reference date for the first renewal of the hydraulic test for the main primary system with applicable French legislation.
- Update to Chapter B 4000 "Aims and techniques of examinations performed during inspections" and the associated Appendix 4.4 with a view to complying with current practice and requirements. The wording of the following chapters has been completely redrafted for the 2015 addendum:
- B4200 "Examinations of the reactor vessel body"
- B4300 "Examinations of the closure head and vessel bolting"
- Introducing specific rules for analyzing a defect in a Class 1 ferritic pipe (main secondary system), as well as additional information for austenitic stainless steel or nickel-based alloy components in ferritic vessels indicating the need to use the criteria for austenitic stainless steel vessels.

Outlook and the future 2016 edition

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

- Incorporate future developments in technology and legislation.
- Factor in the constraints facing operators-partners.
- Deliver support for all international practices.

The 2016 edition is in keeping with the work that has been pursued since the 2010 edition by:

- Continuing to update the existing version to reflect the latest changes in technology and legislation.
- Incorporating EPR aspects into the entire code by enhancing the components and practices specific to Flamanville 3.

Work on the RSE-M code in relation to France's Nuclear Pressure Equipment Regulation (ESPN)

Refer to Box 2 on ESPN work

AFCEN criteria and technical publication for RSE-M

Sizing components, checking their fitness for service and analyzing the impact of a defect detected during operation are generally based on mechanical analysis methods and criteria involving safety factors that are chosen to reach a fixed severity level.

The publication entitled "Principles of and background to the formulation of the criteria in Appendix 5.5 of RSE-M", relating to the fast fracture resistance of pressure equipment presenting an operational planar defect, describes the basic principles and background to the process of defining the criteria for Appendix 5.5 of the RSE-M code, especially the characteristic values of the main variables and the partial safety factors.

These criteria were published in 2014.

Other AFCEN criteria and technical publications (PTAN) are in the pipeline for 2016:

- Criteria for offering a clearer insight into mechanical analyses such as described in the RSE-M code (Appendix 5.4 and RPP2 concerning the fast fracture resistance of the core area in reactor vessels integrating hot pre-loading).

- Criteria Appendix 1.4 for helping control the specific provisions for applying RCC-M for modifications / repairs.
- Technical publications associated with work on the ESPN Regulation (see point above).

Work of the IEWG

In the United Kingdom, when evaluating the risk of a fast fracture in non-breakable piping and major mechanical components, critical defect size must be assessed for comparison against the size of detectable defects.

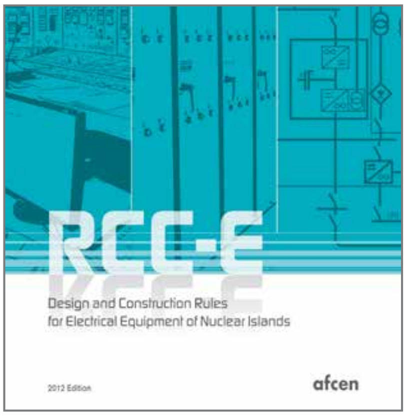
An Independent Expert Working Group (IEWG) carried out a review to determine whether application of the mechanical fracture methods specified in Appendix 5.4 of RSE-M was suitable for a safety case demonstration for the avoidance of fast fracture in the United Kingdom.

The main conclusions are as follows:

- The significant difference in the values of the critical defect size highlighted in the Generic Design Assessment was mainly attributed to differences between the methods in the RSE-M code and legal requirements in the United Kingdom for the treatment of interaction between primary and secondary stresses (R6 rules in this particular field).
- The mechanical fracture methods in the RSE-M code, supplemented by AREVA's proposed methods for the EPR in the United Kingdom, are considered to be accurate and conservative for the loads and geometry of the EPR at Hinkley Point C, and their use for the EPR in the United Kingdom is therefore approved.

In the review's conclusions, operator NNB GenCo has chosen to use Appendix 5.4 of the RSE-M code and the associated supplements for mechanical fracture assessments for the Hinkley Point C EPR in the United Kingdom.

1.2.4 Field of I&C and electrical systems: RCC-E



RCC-E

Design and construction rules for electrical equipment of PWR nuclear islands

FIGURE 7
THE RCC-E CODE

Purpose and scope

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

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

The code's scope covers:

- Architecture and the associated systems.
- Materials engineering and the qualification procedure for normal and accidental environmental conditions.
- Facility engineering and management of common cause failures (electrical and I&C) and electromagnetic interference.
- Practices for testing and inspecting electrical characteristics.
- Quality assurance requirements supplementing ISO 9001 and activity monitoring.

Use

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

- France's last 12 nuclear units (1,300 MWe (8) and 1,450 MWe (4)).
- Two M310 reactors in Korea (2).
- 42 M310 (4), CPR-1000 (27), CPR-600 (6), HPR 1000 (3) and EPR (2) reactors in service or undergoing construction in China.
- One EPR reactor in France.

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

RCC-E has been chosen for the construction of the EPR plants in Hinkley Point, UK.

Users include:

- Equipment suppliers.
- Engineering firms responsible for designing, building and installing equipment and systems.
- Control and inspection organizations.
- 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 and 2012 editions concern Generation II and III reactors. As from the 2005 edition, project specifications must be written to supplement and implement the rules in RCC-E and allow the code to be used in the project.

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

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

Edition available as of 1 January 2016

The RCC-E 2012 edition is the most recent version

FIGURE 8
CONTENTS OF THE 2012 EDITION OF THE RCC-E CODE

PART A: GENERAL REQUIREMENTS AND QUALITY

PART B: QUALIFICATION AND APPROVAL

- RULES GOVERNING THE ENVIRONMENTAL QUALIFICATION PROCESS,
- ENVIRONMENTAL QUALIFICATION PROCEDURES DEALING WITH MILD, RADIATED, HARSH AND SEVERE ACCIDENTS CONDITIONS,
- RECOMMENDED PRACTICE FOR TYPE TESTING

PART C: FUNCTIONAL ASSEMBLY DESIGN

- ELECTRICAL SYSTEMS FUNCTIONAL DESIGN
- AVAILABILITY OF SAFETY EQUIPMENT IN OPERATION
- EQUIPMENT INTERCHANGEABILITY
- PROGRAMMABLE SYSTEMS
- I&C ARCHITECTURE AND HUMAN-MACHINE INTERFACE

PART D: INSTALLATION

- CONDITIONS IMPOSED BY THE ENVIRONMENT
- EARTHING AND, EMI RULES AND DESIGN
- ELECTRICAL AND FUNCTIONAL SEPARATION

PART E: EQUIPMENT COMPONENTS

PART MC: INSPECTION AND TESTS METHOD

APPENDICES ZA:

BOOK OF PROJECT DATA CONTENT,
RPP-1 : NUCLEAR MANAGEMENT SYSTEM
CODE CASE

Outlook and the future 2016 edition

The following sources are used when revising the code:

- Feedback from facilities under construction and in operation.
- The safety authorities' investigation process.
- User inquiries.
- Changes to the standards used and IAEA's requirements.
- Changes to industry's maturity.

The 2016 edition will:

- Represent a departure from previous editions, which have been updates instead of overhauls.
- Address Generation II, III and IV reactors, research reactors and naval reactors.
- Organize requirements into four key areas for easier identification and greater clarity: monitoring, systems, equipment, and component and systems installation. Each key area will cover all lifecycle activities.
- Ensure conformity with IAEA requirements.
- Clearly define the supplements to the requirements in the chosen IEC standards for I&C systems.

Reasons for overhauling the code include:

- Changes to IAEA requirements SSR-2/1, GSR Parts 2 and 4, and recommendations for designing and building electrical and I&C

1.2.4 Field of I&C and electrical systems: RCC-E

systems (SSG 34 and SSG 39), which are used as inputs to the drafting process.

- The WENRA handbook on the design of new reactors.
- Changes to IEC standards relating to the SC 45 Technical Committee and IEC industry standards.
- Feedback from current projects: EPR, ITER, RJH and ASTRID.
- Lessons learned following the British safety authorities' investigation into the UK's EPR as part of the generic design assessment into the electrical and I&C systems.
- Feedback following Fukushima.

Requirements are:

- Adapted so that they can be applied to nuclear projects other than pressurized water reactors.
- Harmonized and coordinated with the requirements of the relevant IEC international standards.

The structure of the code will feature seven chapters:

- Safety, quality and inspection management.
- General requirements.
- Architecture of:
  - I&C systems.
  - Electrical systems.
  - Materials engineering.
  - Installation.
  - Inspection and test methods.

Technical publication of the RCC-E Subcommittee:

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"

1.2.5 Field of civil works: RCC-CW

RCC-CW

Design and construction rules for civil engineering works in PWR nuclear islands

FIGURE 9 - RCC-CW COVERS PWR REACTORS FEATURING A PRESTRESSED CONTAINMENT WITH A METAL LINER

Purpose and scope

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

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

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

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

- Geotechnical aspects.
- Reinforced concrete structures and galleries.
- Prestressed containments with metal liner.
- Metal containment and pool liners.
- Metal frames.
- Anchors.
- Concrete cylinder pipes.
- Containment leak tests.

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

Background and use

AFCEN published the first civil engineering code (RCC-G) in 1980.

This edition included feedback from France's 900 MWe nuclear reactors and mainly drew inspiration from the French BAEL regulation (limit state design of reinforced concrete) and BPEL regulation (limit state design of prestressed concrete). It has been used for the Ulchin project in South Korea and 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 as a roadmap for France's 1,450 MWe PWRs.

In April 2006 in response to the specific needs of its Flamanville 3 EPR project in France, EDF published a reference document called ETC-C for the design and construction of civil engineering works.

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

- Cover both French and German legislative requirements and practices.

1.2.5 Field of civil works: RCC-CW

- Consider new load cases to represent severe accident conditions or events of a more serious nature.
- Integrate application of Eurocodes into the design of nuclear structures.
- Take account of the latest feedback on the operation of in-service nuclear power plants and updated requirements for safety analyses.
- Incorporate the latest knowledge on the behavior of materials and structures (obtained through laboratory and model testing).

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

- Initially, the publication of a specific code for EPR projects: ETC-C edition 2010, followed by ETC-C edition 2012.
- Subsequently, the publication of a generic civil engineering code, called RCC-CW, that is not specific to any given project.

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

Edition available as of 1 January 2016

The RCC-CW 2015 edition is the most recent version

The RCC-CW 2015 edition is the most recent version of the civil engineering code published by AFCEN. This edition does not adhere to the EPR project and can be used for PWR reactors featuring a prestressed containment with a metal liner.

FIGURE 10
CONTENTS OF THE 2015 EDITION OF THE RCC-CW CODE

PART G: GENERAL
- SCOPE AND APPLICATION
- STANDARDS, NOTATIONS
- QUALITY MANAGEMENT
- GENERAL PRINCIPLES

PART D: DESIGN
- ACTIONS AND COMBINATIONS OF ACTIONS
- GEOTECHNICAL ASPECTS
- PRESTRESSED OR REINFORCED CONCRETE STRUCTURES
- METAL CONTAINMENT LINERS
- METAL POOL LINERS
- METAL FRAMES
- ANCHORS

PART C: CONSTRUCTION
- GEOTECHNICAL ASPECTS
- CONCRETE
- SURFACE FINISH AND FORMWORK
- REINFORCEMENT FOR REINFORCED CONCRETE
- PRESTRESSING PROCESSES
- PREFABRICATED CONCRETE ELEMENTS
- METAL CONTAINMENT LINERS
- METAL POOL LINERS
- METAL FRAMES
- ANCHORS
- EMBEDDED PIPELINES
- JOINT SEALING
- SURVEY NETWORKS AND TOLERANCES

PART M: MAINTENANCE AND MONITORING
- CONTAINMENT INTEGRITY AND RATE TESTS

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

- Technical discussions concerning the licensing process for Flamanville 3 and the generic design assessment of the EPR project in the United Kingdom.
- The experience acquired by members through their participation in the Olkiluoto, Flamanville and Taishan projects.

Publication of the RCC-CW 2015 code early 2015 is the first edition that AFCEN has prepared and published of a generic civil engineering code that does not relate to any specific project.

It takes account of the latest changes in European standards.

It includes technological possibilities 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.

Outlook

As already initiated by AFCEN in preparing the RCC-CW code, 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 (anchors, metal liners, and so on).
- Encourage application of the code in the European and international arena by offering greater coverage of the latest international standards and promote the code as a civil engineering benchmark for the Prospective Groups that CEN set up to prepare the future nuclear codes.
- According to AFCEN's requirements and development objectives, develop appendices and addenda specifically addressing how the code can be adapted to the countries targeted by AFCEN.

Technical publication on seismic isolation

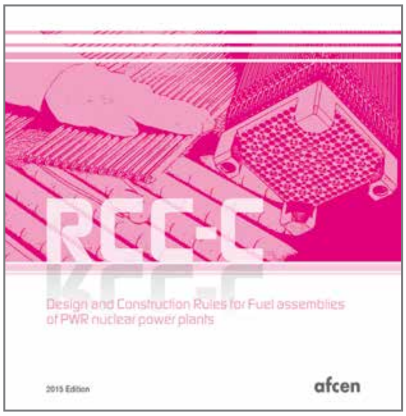
Technical publication "PTAN – French Experience and Practice of Seismically Isolated Nuclear Facilities" was published in 2014.

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

This publication enables European industry to:

- Codify the industrial design and construction practices according to AFCEN: in this respect, RCC-CW 2015 includes a section on seismic isolation.
- Showcase its experience within international organizations and bodies (IAEA, OECD, WENRA, etc.).

1.2.6 Field of fuel: RCC-C



RCC-C

Design and Construction Rules for fuel assemblies of PWR nuclear power plants

FIGURE 11
THE RCC-C CODE (ENGLISH 2015 VERSION)

Purpose and scope

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

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

The code's scope covers:

- Fuel system design, especially for assemblies, the fuel rod and associated core components.
- The characteristics to be checked for products and parts.
- Fabrication methods and associated inspection methods.

Use

The RCC-C code is used by the operator of the PWR nuclear power plant in France as a benchmark 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 fabricated according to the provisions of the RCC-C code.

The code is available in French and English, and the 2005 edition was 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 remains unchanged and prioritizes the fabrication aspects.

In recent years, the RCC-C Subcommittee has been 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 experts are involved in these activities.

Edition available as of 1 January 2016

The RCC-C 2015 edition is the most recent version

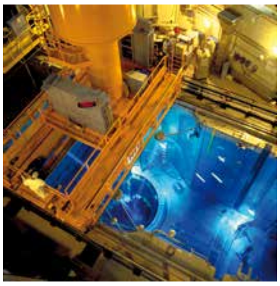
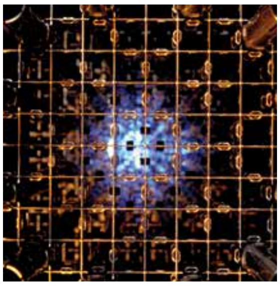
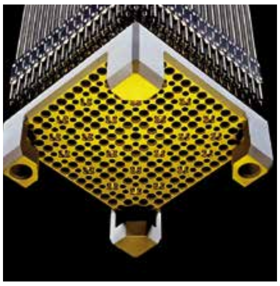





TABLE 4
CHANGES TO THE PLAN OF THE RCC-C CODE, FROM THE 1981 EDITION TO THE 2015 EDITION

Code outline 1981	Code outline 1986 - 2005	Code outline 2015
1 - Generalities 2 - Product and part characteristics 3 - Manufacturing and related testing and inspection 4 - Tables of inspection requirements 5 - Inspection methods Appendix	1 - Generalities 2 - Product and part characteristics 3 - Manufacturing and related testing and inspection 4 - Tables of inspection requirements 5 - Inspection methods 6 - Design Appendix	1 - Generalities 2 - Description of fuel 3 - Design 4 - Manufacturing 5 - Handling and Storage

Review of the changes between the 2005 and 2015 versions:

In terms of the general requirements and description:

- Quality assurance requirements have been improved compared to previous requirements by including the requirements of the IAEA GS-R-3 standard.
- The definitions used for fuel assemblies have been enhanced.
- The procedure for managing nonconformities has been described.
- The fuel description has been improved.

In terms of design:

- The design chapter has been updated to reflect comments from the French nuclear safety authority in 2009 following discussions about the prospect of a draft fuel regulation. The chapter has been restructured for improved clarity. The statement of functional requirements for assemblies and core components has been improved. Paragraphs on thermal hydraulics requirements and neuron transport have been added. A paragraph covering Class 2 pellet-cladding interaction studies has been incorporated.
- Changes have also been introduced to take into consideration the findings of the French Permanent Group on Loss-of-Coolant Accidents.

In terms of fabrication:

- The paragraphs in the fabrication chapter covering zirconium alloys have been updated to include commercial alloys other than Zircaloy 4.
- The paragraphs on stainless steel and inconel materials have been structured according to the same plan as that used for zirconium alloys. The paragraphs covering absorbents and fuel pellets have been enhanced.
- The code now includes requirements for the following inspection and fabrication processes: automatic sorting of pellet diameters, tube expanding, lost-wax casting,

1.2.6 Field of fuel: RCC-C

component marking, thermal treatment and surface treatment.

- The following assemblies have been defined, as well as their qualification requirements: assemblies, skeleton assemblies, grids, fuel rods, bottom end fittings, rod cluster control assemblies and absorber rods.

The overall summary of the code in its 2015 version is detailed below.

Next edition

The work of the RCC-C Subcommittee involved translating the 2015 master version from French into English. The entire document has been retranslated (354 pages) to incorporate the wealth of modifications between the 2005 and 2015 versions.

The English version of the code will be available during the first quarter of 2016.

Outlook

The RCC-C Subcommittee is continuing its work in 2016, with the focus on:

- Adapting assembly qualification requirements.
- Clarifying inspection requirements for parts and assemblies.
- Specifying the requirements for certifying inspectors.

THE RCC-C CODE (FRENCH 2015 VERSION)

FIGURE 12
CONTENTS OF THE 2015 EDITION
OF THE RCC-C CODE

1.2.7 Field of fire: RCC-F

RCC-F

Design and construction rules
for PWR fire protection systems

FIGURE 13
THE ETC-F VERSION OF THE RCC-F CODE APPLICABLE TO EPR PROJECTS

Purpose and scope

The RCC-F code defines the rules for designing, building and installing the fire protection systems used to manage the nuclear hazards inherent in the outbreak of a fire inside the facility and thereby control the fundamental nuclear functions.

This code's target readership is therefore:

- Suppliers of fire protection equipment.
- Engineering firms responsible for designing, building and installing fire protection systems.
- Laboratories carrying out qualification testing of fire protection equipment.
- Nuclear safety authorities responsible for approving the safety demonstration.

The code defines fire protection systems within a finite scope of service buildings in a light water nuclear power plant.

If any one of the requirements in the code is unenforceable due to specific difficulties, a design may nevertheless be implemented provided that justification is duly documented.

The code provides fire protection recommendations in terms of:

- 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 available as an ETC-F version specifically for EPR projects (European pressurized reactor).

a) Background and use

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

The EDF document was not published by AFCEN, but acted as a blueprint 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 for EPR projects, followed by the 2013 edition, which gave less focus to the specifics of EPR projects but which still addresses the main EPR safety principles.
- Subsequently, the publication of a generic fire protection code, called RCC-F, that is not specific to any given project and which promotes the code's application on an international level.

1.2.7 Field of fire: RCC-F

The 2013 edition is compatible with British requirements and has been chosen for the EPR plants in Hinkley Point, UK.

Edition available as of 1 January 2016

The ETC-F 2013 edition is the most recent version

FIGURE 14
CONTENTS OF THE 2013 EDITION OF THE ETC-F CODE

PART 1. OBJECTIVE OF THE ETC-F
PART 2. VALIDITY OF THE ETC-F
PART 3. DEFINITIONS
PART 4. DESIGN SAFETY PRINCIPLES
- MAIN SAFETY OBJECTIVES
- DESIGN SAFETY REQUIREMENTS AND ANALYSIS RULES
- APPLICATION OF RANDOM FAILURE PRINCIPLE
- FIRE AND EVENTS

PART 5. FIRE PROTECTION DESIGN BASES
- PREVENTION
- FIRE CONTAINING
- FIRE CONTROL (DETECTION AND FIRE-FIGHTING)
- PREVENTION OF EXPLOSIONS

PART 6. CONSTRUCTION PROVISIONS
- PREVENTION
- FIRE CONTAINING
- PROVISIONS FOR PERSONNEL SAFETY
- SMOKE PROTECTION, CONTROL AND EXHAUST SYSTEM

PART 7. RULES FOR INSTALLING THE FIRE PROTECTION COMPONENTS AND EQUIPMENT
- PRODUCTION COMPONENTS AND EQUIPMENT
- FIRE PROTECTION EQUIPMENT
- EXPLOSION PROTECTION REQUIREMENTS

The 2013 edition of the ETC-F code incorporated two major changes:

- Removal of the code's adherence to the specifics of EPR projects.
- Inclusion of British regulations, which prompted a significant overhaul to the body of the text, as well as the creation of an local appendix specifically addressing such regulations and designed to improve understanding thereof.

This exercise in anglicizing the code gave AFCEN hands-on experience in updating the code to reflect foreign regulations (in terms of the time, processes and skills required).

It also served as the ideal opportunity to integrate British practices.

b) International activities

In 2015, the RCC-F Subcommittee held two meetings with the CSUG (Chinese Specialized User Group):

- The Chinese working group comprises 19 permanent members and was created during the first meeting in March, which was organized to clarify the CSUG's expectations of the RCC-F code.
- A second meeting was held in October to discuss the contents and interpretation of the code, as well as address the various technical questions raised by the CSUG.

Two new meetings with the CSUG have been lined up for 2016.

c) Outlook and preparation of the RCC-F 2016 edition

Outlook

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

- Integrate feedback from projects currently under development or construction.

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

RCC-F 2016 edition

In 2015, efforts focused on preparing the next edition ahead of its publication in December 2016. Amendments have been made based on the 2013 edition.

AFCEN's aim with the 2016 edition is to make the RCC-F code usable for any project, irrespective of the applicable safety rules.

The initial 2010 version of the ETC-F code featured two types of adherence:

- EPR adherence (specific characteristics of EPRs, mainly semantics (PCC, F2, etc.)).
- Safety adherence, which is also contained in all other EDF fire codes (RCC-I, fire directives, etc.) used on France's other power plants.

The 2013 version of ETC-F addressed the adherence to specific characteristics of the EPR process existing in the 2010 version of ETC-F, but it still needs to address adherence to EPR safety.

The new edition of the code must therefore be formatted and revised to identify the impact of safety principles on the content of the design, construction and installation rules defined within the code.

Current work is organized according to the following five subject areas:

Subject area 1: Analysis of adherence to safety principles (sizing and stresses)

The aim is to analyze adherence to safety principles, which involves identifying the safety criteria and principles in the code by examining any given principle (aggravating, fire combined with thermal-hydraulic transients, combined stresses, fire outbreak following an earthquake, and so on) and how it is addressed by the code.

The analysis of adherence to safety principles may be documented in a safety principle appendix featuring two objectives: improve the code's legibility to better understand the links with nuclear safety principles and provide elements to ensure that the code can be tailored to the safety principles chosen within a specific context.

The specific technical features of the NM EPR basic design project will also be included.

Subject area 2: Improved traceability of requirements

The purpose of this subject area is to satisfy users' need to easily identify the source of the requirements that led to the rules defined within the code.

Subject area 3: Development of requirements on conventional islands

The idea with this subject area is to inject greater flexibility into the rules for designing fire protection systems by adapting and therefore clarifying the rules applied to nuclear islands to reflect the risks relating to the conventional component (challenge of protecting the facility's production assets).

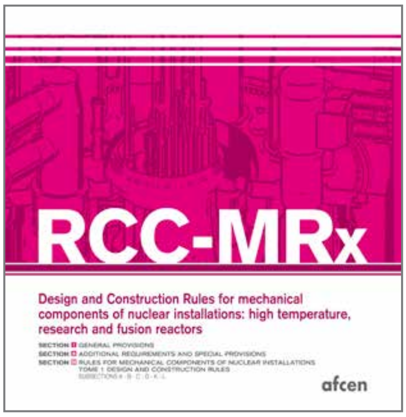
Subject area 4: Clarification of human intervention

The aim is to clarify human intervention within the code, even though such intervention is not evaluated in respect of demonstrating safety. However, human intervention can be used (evaluated) in the safety analyses. The specific prerequisites arising from international practice will need to be integrated.

Subject area 5: Update to Appendix A

to incorporate recent specific changes to French regulations.

1.2.8 Mechanical field for research, fusion and experimental reactors: RCC-MRx



RCC-MRx

Design and construction rules for mechanical components in high temperature, research and fusion reactors

FIGURE 15
THE RCC-MRX CODE

Purpose and scope

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

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

a) Background and use

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

- The RCC-MR code, drafted by AFCEN's RCC-MR Subcommittee together with the Tripartite Committee formed on 16 March 1978 by the Commissariat à l'Energie Atomique, Electricité de France and Novatome, to establish the applicable rules for designing components working at high temperatures. AFCEN published four editions of RCC-MR in 1985, 1993, 2002 and 2007.
- The RCC-MX code, drafted by the RCC-MX Approval Committee formed on 31 March 1998 by the Commissariat à l'Energie Atomique, AREVA-TA and AREVA-NP for the specific needs of the RJH project (Jules Horowitz reactor). This code applies to the design and construction of experimental reactors, auxiliary systems and associated experimental devices. It can also be used for the design and construction of components and systems for existing facilities. CEA published two editions of RCC-MX in 2005 and 2008.

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

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

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

The RCC-MRx code is serving as a blueprint for the design of the ASTRID project (Advanced

Sodium Technological Reactor for Industrial Demonstration), 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).

Edition available as of 1 January 2016

The 2015 edition is the most recent version

FIGURE 16
CONTENTS OF THE 2015 EDITION
OF THE RCC-MRX CODE

1. INTRODUCTION
- ACTIVITIES OF THE AFCEN RCC-MRX SUB-COMMITTEE
- CODE EVOLUTIONS
- SCOPE AND STRUCTURE OF THE RCC-MRX CODE
- FRENCH REGULATIONS FOR PRESSURE EQUIPMENTS ESP/ESPN, REACH REGULATION
- PLAN AND CONTENT OF THIS PRESENTATION DOCUMENT

2. MATERIALS: GRADES, PRODUCTS, PROCUREMENT
- MATERIAL SELECTION
- PRODUCT PROCUREMENT CONDITIONS
- REFERENCE PROCUREMENT SPECIFICATIONS (RPS) CONTAINED IN TOME 2 "MATERIALS"
- PROCUREMENT ON THE BASIS OF REFERENCE STANDARDS
- IMPORTANT POINTS COVERED IN RM 010-0

3. DESIGN - ANALYSIS
- GENERAL DESIGN RULES (RB, RC, RD, RK, RL 3100)
- DESIGN BY ANALYSIS (RB, RC, RK, RL 3200)
- DESIGN RULES FOR SHELLS-VESSELS
- DESIGN RULES FOR SUPPORTS
- DESIGN RULES FOR PUMPS
- DESIGN RULES FOR VALVES
- DESIGN RULES FOR PIPING
- DESIGN RULES FOR BELLOWS
- DESIGN RULES FOR BOX STRUCTURES
- DESIGN RULES FOR HEAT EXCHANGERS

4. PROPERTIES OF MATERIALS (APPENDIX A3) AND WELDED JOINTS (APPENDIX A9).
- INTRODUCTION
- HOW TO USE APPENDIX A3
- PROPERTIES GROUPS IN APPENDIX A3
- PROPERTIES GROUPS OF WELDED JOINTS IN APPENDIX A9

5. EXAMINATION METHODS
- INTRODUCTION OF TOME 3
- MECHANICAL, PHYSICAL AND CHEMICAL TESTS
- ULTRASONIC EXAMINATION
- RADIOGRAPHIC EXAMINATION
- LIQUID PENETRANT EXAMINATION
- LEAK DETECTION METHODS

6. WELDING
- INTRODUCTION OF TOME 4
- DOCUMENTS TO BE PREPARED – RS 1200
- ACCEPTANCE OF FILLER MATERIALS – RS 2000
- WELDING PROCEDURE QUALIFICATION – RS 3000
- QUALIFICATION OF WELDERS AND OPERATORS – RS 4000
- QUALIFICATION OF FILLER MATERIALS – RS 5000
- TECHNICAL QUALIFICATION OF PRODUCTION WORKSHOPS – RS 6000
- PRODUCTION WELDS – RS 7000
- WELD DEPOSITED HARDFACING ON CARBON, LOW-ALLOY OR ALLOY STEELS – RS 8000
- MECHANICAL TESTS – RS 9000
- SPECIAL PROVISIONS OF ALUMINIUM ALLOY WELDING
- SPECIAL PROVISIONS OF ZIRCONIUM ALLOY WELDING

7. FABRICATION
- INTRODUCTION OF TOME 5.
- MARKING PROCEDURE - RF 2000
- CUTTING - REPAIR WITHOUT WELDING – RF 3000
- FORMING AND DIMENSIONAL TOLERANCES – RF 4000
- SURFACE TREATMENT - RF 5000
- CLEANLINESS - RF 6000
- BRAZED AND BOLTED MECHANICAL JOINTS – RF 7000
- HEAT TREATMENTS – RF 8000

8. PROBATIONARY PHASE RULES
- INTRODUCTION OF TOME 6

1.2.8 Mechanical field for research, fusion and experimental reactors: RCC-MRx

A new edition of the RCC-MRx code was released in 2015.

This edition reflects feedback on the use of the 2012 edition and/or its 2013 addendum, especially in current projects and mainly the Jules Horowitz reactor and the Astrid project. Examples include the inspection and welding procedures for 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).

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

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

Outlook

In 2015, efforts centered on finalizing the 2015 edition of the code. Throughout 2016, the focus will be on publishing RCC-MRx criteria and finalizing the two commissioned studies in progress.

Technological commissioned studies

The RCC-MRx Subcommittee launched two commissioned studies in 2014:

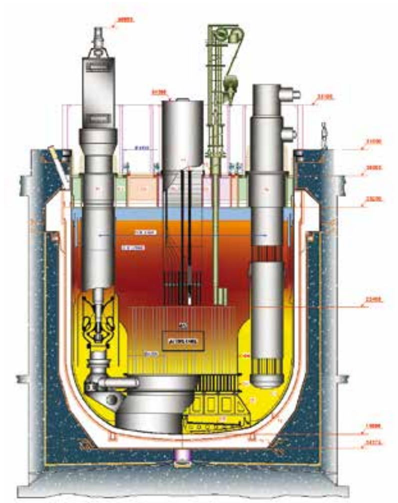
- Improvement to the rules to take account of irradiation when levels become significant.

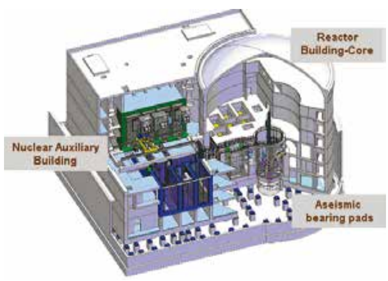
This commissioned study is aimed at assessing the rules currently featured in the code with a view to their improvement. The first Request for Modification relating to an adjustment in the toughness values of 316L(N) was issued following the group's work, while other Requests for Modification resulting from the brainstorming process into the rules and material data should be published in 2016.

- Terms for introducing a new material into RCC-MRx, in keeping with what had already been introduced into the code (concept of a material record).

The aim of this commissioned study is to produce a methodological guide that will be released as an AFCEN technical publication. The purpose of this guide is to explain, when introducing a non-coded material into RCC-MRx, the definition of the methods for obtaining the characteristics in Appendices A3-A9 (expected / possible tests, meaning of the data), the requirements for fabrication and welding in relation to the material properties and positioning of the characteristics codified against probabilistic analyses.

FIGURE 17
PFBR PROJECT IN INDIA
AND RJH PROJECT IN FRANCE





1.2.9 Field of deconstruction: RCC-D

RCC-D

Deconstruction rules for nuclear facilities

The decision to produce a deconstruction code was taken in October 2014 by AFCEN's Board of Directors, based on an opportunity assessment that showed the value on an international and especially European level of publishing such a code. The program for drafting this code is as follows:

FIGURE 18
AFCEN PROGRAM FOR PRODUCING THE RCC-D DECONSTRUCTION CODE

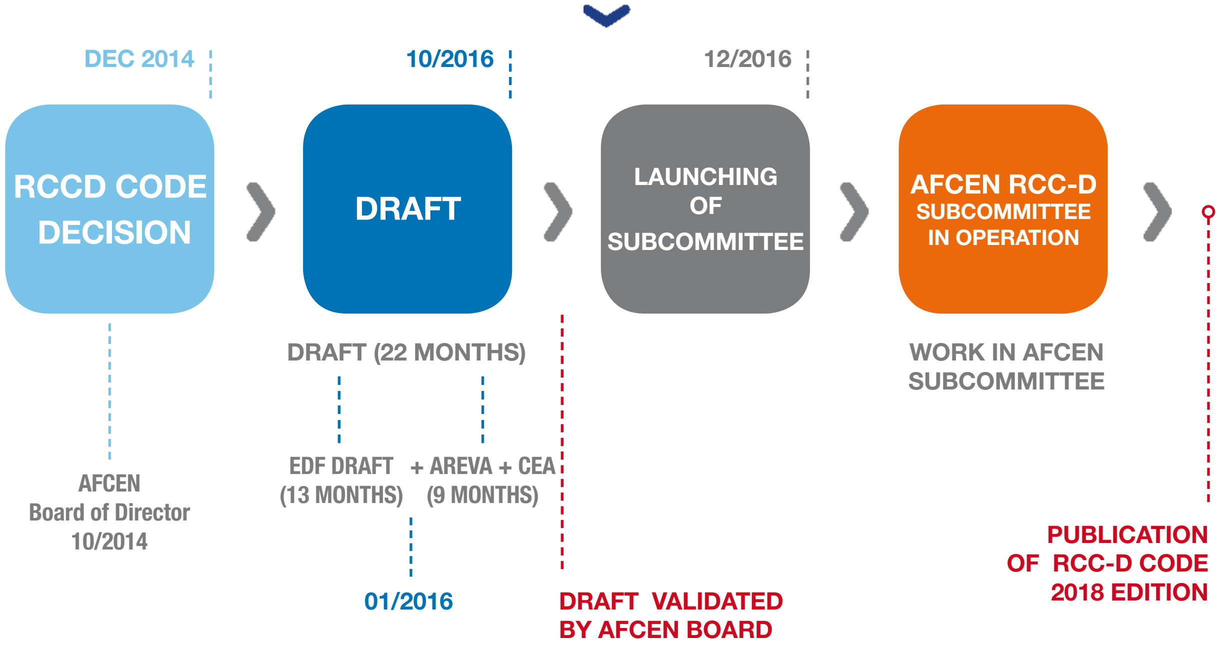


FIGURE 19 - EXTRACTING THE STEAM GENERATORS AT CHOOZ A

The scope of the code will cover all nuclear facilities.

A working group led by an AFCEN member has been tasked with carrying out a draft. Once approved by AFCEN's Board of Directors, the draft will serve as an input for the work of the new RCC-D Subcommittee, which will be created late 2016.

RCC-D is scheduled for delivery in June 2018, subject to confirmation when presenting the draft and proposed Subcommittee during the Board of Directors' meeting in October 2016.

In particular, the code must be in keeping with AFCEN's other codes.

1.3 AFCEN's activities around the world

AFCEN's international activities are strongly focused on the five key objectives below:

1) Provide the nuclear industry with a working platform in each area concerned, mainly Europe and China.
2) Pursue AFCEN's development in its target countries: Asia (China and India), the European Union (especially the United Kingdom and Poland) and the Middle East (Saudi Arabia).
3) Build on the industrial practice of international users (the United Kingdom and China in particular) and the technical instructions relating to the licensing of projects using AFCEN codes as a benchmark (GDA of EPR UK, for example).
4) Be in touch with the needs of the international nuclear environment and potential expectations.
5) Continue the harmonization efforts with the other nuclear codes within MDEP and CORDEL.

AFCEN's international activities in 2015 are summarized in table 5 below.

TABLE 5
GENERAL SUMMARY OF AFCEN'S INTERNATIONAL ACTIVITIES IN 2015

ACTIVITY	The 01/11/2013	The 01/11/2014	The 31/12/15	OBJECTIVE
International members AFCEN	Opening of AFCEN after change of status in 2010 42 AFCEN members including 12 international members	50 AFCEN members including 19 international members	60 AFCEN members including 25 international members	Attracting the EU players through the CEN WS, and the UK and Chinese Industrial through the UG
Creation of User Groups	• Ongoing UG RCC-M in UK (with TWI) • Agreement with CGNPC ready for signing in november 2013	• Signed agreement with TWI 3 UG RCC-M meetings in UK with TWI • Signed agreements with CGN, CNNC et CNEA • Workshop CNEA/AFCEN in June 2014 • First Steering Committee the 18/02/2014	• One UG RCC-M meeting in UK • Steering committee the 10 March 2015 • First UG session for all the codes in March (or june): RCC-M (2 groups), RSE-M, RCC-E, RCC-MRx, RCC-C, ETC-F, RCC-CW. second session (for some) in October • CNEA / AFCEN seminar in 06/2015	Continuing of UG developement in China and in UK
European recognition of AFCEN Codes	Publication by CEN of Workshop Agreement of WS 64, sponsorized by RCC-MRx code	Launch within the EC Workshop WS 64 of Phase 2, sponsorized by the RCC-M, the RCC-MRx and RCC-CW	Continuing of WS CEN activities	Enlargement to all codes
	Poland: First relationship	Poland: Strong development of relations with Poland Germany: meeting with KTA	Continued developments in Poland with a seminar in June 2015 in Krakow, then in September 2015 in Warsaw	Promoting the European nuclear industrial base and support European industrial supply
Harmonization of international codes	MDEP, SDO Board	• MDEP, CORDEL, SDO Board • Ongoing discussions with NEA and ISNI on NB Chinese norms	Negotiations launched with NEA on extensive cooperation on codes	• (Transfer of MDEP activities to CORDEL) • Contribution to Chinese codes in design, construction and operation area

1.3.1 France

a) Relationship with France's nuclear safety authority

With respect to AFCEN's relationship with France's nuclear safety authority, two points deserve a mention:

1) AFCEN's senior management meets the nuclear safety authority's executives approximately every two years.

For instance, on 2 July 2014, AFCEN's Board of Directors was received by ASN's Chairman, senior executives and representatives from the Nuclear Power Plant Department (DCN), the Nuclear Pressure Equipment Department (DEP) and its supporting body IRSN.

AFCEN presented:

- Its activities and general strategic directions (background and creation, organization, ISO 9001 certification).
- Its international operations (China, United Kingdom, "Europeanization" of AFCEN codes, Poland and Saudi Arabia).
- The work of the Editorial and Training Committees.
- Its thoughts about ways of improving recognition of the code, and ASN's and IRSN's involvement in editorial groups.

In conclusion, ASN stressed its interest in AFCEN's activities and its support for AFCEN's objectives. Particularly in its 2014 report, ASN emphasized that "industry, and not ASN, is responsible for drafting these documents [AFCEN codes]. In specific cases, however, ASN may acknowledge that the codes represent a collection of best practices for satisfying certain ASN requirements, taking decisions or publishing guides."

AFCEN wishes to hold discussions about strategies for improving recognition of codes.

2) A progress report on the program aimed at demonstrating conformity of the RCC-M code in France with the French Nuclear Pressure Equipment Regulation (ESPN) has been presented to ASN roughly every three months since 2013 under the responsibility of AFCEN's Editorial Committee and attended by the relevant AFCEN members.

During meetings, the program's directions are discussed, and ASN gives its opinion on the documents submitted.

b) CSFN

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

CSFN subsequently created its own working group entitled "International Codes, Norms and Standards" (CNSI), and AFCEN has been an active contributor since July 2015. The group's operational agenda is clearly on the same page as AFCEN's own strategic directions and objectives, namely:

- Promote its nuclear industry rules of practice around the world.
- Develop local platforms for producing codes in the high-potential countries represented by AFCEN members (e.g. China).
- Effectively incorporate the needs of all its members, particularly SMEs.

c) The AFCEN Congress in March 2015

AFCEN held its congress in Paris on 24, 25 and 26 March 2015. The Congress was attended by 230 participants from across Europe, the United States and Asia to address issues relating to the use of the different codes published by AFCEN and their development at both the national and international levels.

Management representatives from AFCEN's founding companies voiced their view of the association's future activities and drew on support from other members to share their determination to drive AFCEN's commitments even further within the nuclear industry. Nuclear safety authorities from the different countries hammered home the important role that codes and current research play in improving nuclear facility safety during design, construction and operation.

1.3.1 France

Also note the Congress participation of the Directorate General for Energy of the European Commission, which support AFCEN action of harmonization.

The main users around the world, such as Chinese groups CGN and CNNC, demonstrated how extensively the codes are used in various projects in China and the rest of the world.

Various technical issues were raised and addressed during the different Subcommittee breakout sessions. NDT testing (non-destructive testing) occupied a major part of the RCC-M, RSE-M and RCC-MRx Subcommittee sessions on 25 and 26 March, with several conferences spotlighting the importance of NDT in maintenance operations. The members taking part emphasized the quality of the work that had been spearheaded to demonstrate that the objective is to achieve an ever higher level of reliability in terms of their application.

Finally, a valuable round-table discussion on code-related training was attended by stakeholders from different countries, who underlined the importance of delivering AFCEN code training in the local language to guarantee that trainees fully understand the various technical aspects of the codes.

1.3.2 European Union

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

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

Based on what was considered positive feedback by all partners, a continuation of the CEN* Workshop was launched in 2014 to investigate the potential needs for creating a code for mechanical and civil engineering works for Gen II to Gen IV nuclear facilities (see Section 1.4.3).

This activity is in line with the general goal of harmonizing industry practices promoted by the European Commission's Directorate-General for Energy, which has lent its support accordingly.

** CEN: European Committee for Standardization*

1.3.3 China

AFCEN's ties with China can be traced back to 1986 with the construction of the two Daya Bay 900 MW units in the Guangdong province of southern China. At the 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 following authorization from AFCEN between 2008 and 2012.

In 2012 and 2013, Chinese users were able to fully understand 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 clarification requests).

To provide a coordinated response to such 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,

1.3.3 China

engineering firms, manufacturers, and so on). In 2014, these partnerships led to the creation of Chinese User Groups and the first technical seminar between AFCEN and CNEA, which focused on regulations, codes and standards, qualification of equipment, I&C, etc.

Activities in 2015

As of 31 December 2015, 25 plants in operation and 17 plants under construction were using AFCEN codes in China.

In 2015, AFCEN's main actions relating to activities in China were as follows:

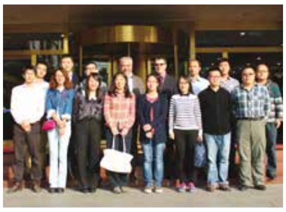
a) **Three meetings were held** between AFCEN's experts and members of the Chinese Specialized User Groups (CSUG) in March, June and October 2015 in Beijing, Suzhou and Beijing/Shanghai respectively. AFCEN's experts and their counterparts discussed the content and interpretation of all the codes, as well as their use in China. These meetings also provided the ideal opportunity to review industry practices between China and France.

The different meetings were attended by over 215 Chinese experts from engineering firms (particularly CGN and CNNC), industry and China's safety authorities. The meetings will also be remembered for their insight into how the CSUGs function and the presentation of AFCEN Core (IT database allowing members to network).

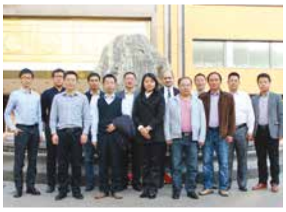
b) **The second AFCEN / CNEA** feedback-oriented seminar was held in Suzhou in June 2015. Discussions centered on two topics: non-destructive testing and qualification under accidental conditions. Over 160 Chinese and French experts took part.

CSUG RCC-CW IN JUNE 2015

CSUG RSE-M IN JUNE 2015



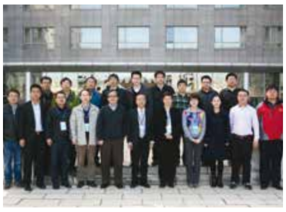
CSUG ETC-F IN OCTOBER 2015



CSUG RCC-C IN OCTOBER 2015

CSUG RCC-M (DESIGN) IN OCTOBER 2015

CSUG RCC-E IN OCTOBER 2015



CSUG RCC-MRx IN MARCH 2015

CSUG RCC-M (FABRICATION) IN OCTOBER 2015

1.3.3 China

c) **During Chinese Premier Mr Li KeQiang's visit** to Paris in June 2015, a joint statement was signed. The statement sets out the policy for cooperation on codes & standards:

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

AFCEN has therefore started working with NEA (National Energy Administration) to build long-term cooperation on the nuclear codes and standards used by AFCEN and China's nuclear entities.

d) **An agreement was signed with SNPI** in March 2015 to set up an AFCEN-endorsed Chinese-language training course on the RCC-M code. This agreement involved an assessment into the content of SNPI's course, as well as the technical abilities and teaching skills of the course leaders. The process for recognizing the course should be finalized in 2016.

e) **Initial talks were held with NSC** (the technical support arm of the Chinese nuclear safety authority) in March 2015 on the prospect of future collaboration and topics associated with AFCEN's mechanical codes.

Outlook for AFCEN in China in 2016

In 2016, AFCEN will pursue its policy of developing cooperation on codes and standards, and will continue honoring its commitments towards its partners in China. The main milestones and prospects are as follows:

a.) **Continue setting up AFCEN code training programs** (starting with RCC-M by SNPI) endorsed by AFCEN and delivered in Chinese.

b.) **Invite AFCEN's Chinese members** to take part in the General Meeting in March 2016, including the Subcommittee meetings and technical breakout sessions associated with the General Meeting.

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

d.) **Hold a third CNEA-AFCEN Chinese-French seminar** on feedback from the nuclear industry; spurred on by the rich discussions and tremendous success of the first two events, there are plans to stage a third seminar.

e.) **Continue fostering cooperative ties with NEA** in a bid to promote interaction on codes and standards, and thereby lay the foundations for a long-term cooperative arrangement for producing codes with Chinese industry.

f.) **Build a partnership with NSC** (the technical support arm of the Chinese nuclear safety authority).

1.3.4 United Kingdom

a) Background and general objectives

The EPR reactor projects in the United Kingdom (Hinkley Point C and Sizewell C) are drawing strength from AFCEN's codes to design the power plant, manufacture the components and build the structures.

Following certification of the EPR reactor in the United Kingdom (GDA, Generic Design Assessment), licensee NNB (Nuclear New Build) has been overseeing relations with the safety authority (ONR, Office for Nuclear Regulation) and investigating all open points relating to AFCEN code implementation. The investigation is targeting the codes covering mechanical components (RCC-M, RSE-M Appendix 5.4), electrical systems (RCC-E), civil engineering works (ETC-C) and fire protection systems (ETC-F). It leverages the NNB-RD relationship (Responsible Designer = EDF/DIPNN), and specific issues are forwarded to AFCEN by the EPR-UK project for analysis and action.

Furthermore, dissemination of AFCEN's code culture within British industry is important, not to say essential for simplifying understanding and use of the codes and benefiting projects.

This observation prompted the creation of AFCEN code User Groups (UK User Groups), comprising the companies concerned and representatives from NNB and AFCEN, with a Steering Committee responsible for overseeing all groups and led by NNB.

These User Groups have the following missions:

- Simplify uptake of AFCEN codes among British industry and partners (designers, manufacturers, contractors, suppliers and consultants).
- Ascertain users' requests and proposals (interpreting and modifying codes, drafting guides or appendices specific to the local context if necessary) for analysis and action by AFCEN's Subcommittees.
- Determine training requirements and facilitate appropriate solutions in liaison with AFCEN.
- Establish an effective communication channel with AFCEN's Subcommittees to address the previous objectives.

The need for AFCEN User Groups in the United Kingdom mainly concerns the RCC-M, ETC-C and RCC-E codes.

The aim is to simplify the roll-out of EPR UK projects by minimizing discrepancies caused by poor interpretation of the codes early into the project lifecycle and strengthening the solidity of AFCEN's codes, particularly their ability to be deployed on an international level.

b) Activities in 2015

The RCC-M User Group has been coordinated by TWI (The Welding Institute) since 2013. The group currently features 13 representatives from manufacturers active in the British market, as well as a dozen other companies (consultancies, inspection bodies, institutes, etc.).

The group only held one session in 2015 (compared to three sessions in 2014) pending a final decision to launch the Hinkley Point C project. During each session, AFCEN's experts and the Group's corporate members share their views on a technical issue mainly concerning materials and fabrication, while also discussing quality and technical requirements (such as for pressure equipment). Furthermore, the Lloyds-APAVE joint-venture organized a one-day event in January 2015 to offer a general presentation of the code, which was attended by approximately 20 companies.

The Group is continuing its activities in 2016 in anticipation of quickly re-mobilizing the project following the final investment decision expected for the Hinkley Point C project. The group will carry out an in-depth analysis of the code (discussions between experts, workshops on specific topics, Requests for Modification and Interpretation, preparation of guides, etc.) and will endeavor to develop training actions for the outsourcing chain.

1.3.4 Royaume-Uni

AFCEN and NNB have confirmed the value of creating an ETC-C User Group, which should be created in 2016.

Plans to create an RCC-E User Group have yet to be confirmed at this particular stage. Work on the opportunity assessment will continue in 2016.

The agreement between AFCEN and NNB for setting up a UK User Group Steering Committee was signed on 24 March 2015 during the AFCEN congress.

FIGURE 20
SIGNING OF THE AGREEMENT BETWEEN AFCEN AND NNB IN 2015 FOR THE UK USER GROUP STEERING COMMITTEE

1.3.5 Poland

a) Background and general objectives

Poland is planning to significantly ramp up its installed capacity requirements for electricity over the next few years, rising from the current 35 GWe to nearly 54 GWe in 2030. The country voted in a nuclear program in 2014 aimed at installing a total capacity of 6 GWe by 2035, thereby introducing nuclear energy into the mix.

French-Polish technical cooperation on codes and standards is aimed at disseminating the AFCEN code culture. Codes have been enhanced since the 1980s using the experience acquired from over 100 reactors around the world. AFCEN codes are recognized as international technical standards and are key to safety, insofar as they simplify and structure dialog and discussions between industry, suppliers, partners and Poland's safety authority, as well as international safety authorities.

b) Activities in 2015

Initiatives focusing on codes and standards are mainly generated during discussions at seminars aimed at providing a clearer insight into AFCEN's codes and European standards. Sessions are regularly organized for sharing feedback on the use of French codes for the design and construction of nuclear power plants around the world.

For instance, AFCEN, working in cooperation with the French Embassy in Poland and the AGH University of Science and Technology in Krakow, organized an AFCEN code briefing session and forum from 23 to 25 June 2015.

The session was held at EDF's cogeneration plant in Krakow and attracted around 50 champions of Polish industry and representatives from PGE EJ 1 (the future operator of Poland's nuclear power plant), the Nuclear Energy Department of Poland's Ministry of Economy, the Gliwice Welding Center of Excellence and national research facilities.

1.3.5 Pologne

Participants were welcomed on 23 June by Professor Jerzy Cetnar, Director of the Department of Energy and Fuel at AGH, who kicked off the session. The first day featured a series of presentations on the RCC-M code and European standards for mechanical components and their implementation. Specialized workshops were held on the second day to explore and provide practical explanations on the use of the code with examples of EPR reactors currently under construction around the world. This highlight of the seminar gave the French and international experts from various companies and organizations chance to field questions from the Polish participants. The final day was spent reviewing Polish and French legislation governing nuclear projects, as well as listening to testimonials from AFCEN code users and authors (Bureau Veritas, EDF, AREVA and AMEC Foster Wheeler).

Another significant event in 2015 was AFCEN's participation in the seminar organized in Warsaw from 22 to 24 September 2015 by the Nuclear Energy Department of Poland's Ministry of Economy, in partnership with the Gliwice Welding Center of Excellence and the Polish Office of Technical Inspection (UDT). The seminar was held in UDT's offices and focused on preparing Polish industry ahead of the construction of Poland's first nuclear power plant. Accepting the invitation from the Nuclear Energy Department of Poland's Ministry of Economy, AFCEN presented the RCC-M (Mechanical Components) and RCC-CW codes (Civil Engineering Works). The discussion-packed seminar, a red letter day in Poland's nuclear calendar, proved a tremendous success and brought together representatives from the main stakeholders in Poland's nuclear program, including industrial firms who enrolled their welders, engineers and technicians.

Finally, another highlight of 2015 was the participation of representatives from the stakeholders in Poland's nuclear program in AFCEN's International Congress from 24-26 March in Paris. Attendees included the Nuclear Energy Department of Poland's Ministry of Economy, PGE EJ 1 (the future operator of Poland's nuclear power plant) and Warsaw University of Technology (WUT).

Other initiatives and seminars throughout 2016 will help cement French and Polish technical cooperation on codes and standards.

1.3.6 Germany

Franco-German cooperation on nuclear issues was subject to strong activity in the 1990s as part of the development of the EPR and, to a lesser extent, the EFR. Such cooperation led to joint work on codes.

Following successive decisions by German governments to abandon nuclear energy, cooperation drew to a standstill in the early 2000s.

However, AFCEN was keen to restore ties with its German counterpart KTA. The motivation for fostering a close working relationship can be explained by the fact that both countries have compiled significant feedback on the design and operation of nuclear reactors and the importance of capitalizing on the technologies involved.

Initial contact between representatives from both organizations was established during the summer of 2014, and the principle for cooperation was approved in the autumn by their governing bodies. Both parties discussed the terms of their cooperation in 2015, and initiatives will be put into practice in 2016.

1.4 Harmonization and cooperation initiatives

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

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

Similarly, AFCEN is represented in the "Codes & Standards" task force of the working group (formed by the World Nuclear Association WNA, which includes industry's main stakeholders) on cooperation in reactor design evaluation and licensing (CORDEL).

Furthermore, at the European level, AFCEN has taken the initiative to create a workshop within the European Committee for Standardization (CEN) to bring the various European stakeholders together and thereby anticipate needs for codes.

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

1.4.1 MDEP

SDO Convergence Board

AFCEN has taken part in the group of Standards Development Organizations (SDO) ever since it was created by the MDEP (Multinational Design Evaluation Program) Mechanical Codes and Standards Working Group (CSWG) in 2006. In 2011, the SDO group published a report entitled "Code Comparison Report for Class 1 Nuclear Power Plant Components".

Box 3 below provides a preview of the conclusions of the SDO group concerning the comparison of RCC-M with ASME code BPVC Section III.

In this respect, CSWG highlighted the major difficulties in completely converging codes on an international level, but indicated that it would support any industrial initiative looking to harmonize codes and standards between the SDOs. In particular, CSWG recommended that a process be implemented to minimize any divergences between future editions of the codes.

With this aim in mind, the SDOs created the "Convergence Board [for nuclear mechanical codes]" to identify and facilitate the introduction of compatible rules in each of the mechanical codes (ASME, AFCEN, JSME, KEPIC, CSA and PNAE). AFCEN is a member of the Convergence Board. One of the first topics on the Convergence Board's agenda was welding practices, for which a comparative study will be published in April 2016 (see Section 1.4.2 CORDEL).

During the round-table discussion on the convergence of MDEP codes, which was held on 15 May 2014 in Washington, AFCEN supported the work that is currently targeting convergence towards ISO practices (qualification of welding operators and inspectors) and convergence in terms of the design approach.

1.4.1 MDEP

BOX 3
EXTRACT FROM SDO REPORT STP-NU-051-1 ON THE COMPARISON OF RCC-M CODES AND ASME SECTION III

Extract from document STP-NU-051-1: CODE COMPARISON REPORT for Class 1 Nuclear Power Plant Components; §4.11. Copyright © 2012 by ASME.

....To summarize the preceding, the first point concerns the prescriptive nature of the RCC-M Code compared to the ASME. The RCC-M dictates the specific design of a respective component to a greater degree than ASME Section III, which, due to the broader scope, leaves more responsibility to the owner (designer and/or manufacturer). As defined in the foreword, the ASME BPVC is intended to apply broadly to the mechanical equipment industry, while the RCC-M focuses on PWR components and is derived from the industrial experience in France. The ASME BPVC is intended to apply more generally and does not attempt to represent the specific experience of a single industry, as is the case regarding the RCC-M Code. In practice, the owners (individual utilities, designers and/or manufacturers) define the additional experience-based requirements used in conjunction with the requirements defined in the ASME BPVC to achieve an end result.

The second point concerns the evolutionary nature of the RCC-M, which tends to include more experience feedback, as can be illustrated by the part of the code on cleanliness, stemming directly from practical cases. Since its first edition in 1984, materials have been added, paragraphs have evolved, and new results from R&D have been integrated.

These are two different approaches. The RCC-M approach, being more prescriptive, will guide the user to attain the desired end result, whereas, although a similar end will likely result through implementation of the ASME Section III rules by an experienced designer, the ASME does not provide the same level of direction. This difference is particularly apparent with respect to selection of materials. While, except for a few instances particularly based on French experience, the materials applied to address either RCC-M or ASME Section III requirements are very similar for like components, the RCC-M typically explicitly defines the material to be applied for a particular component while the selection in the case of the ASME component is generally based on design/manufacturing experience.

The comparison between the RCC-M Code and ASME Section III indicates that two types of differences can be identified: purely technical differences and differences resulting due to regulatory requirements. The former can be identified based on the work presented in this report with the responsibility left to the owner (designer and/or manufacturer) to address these differences. Concerning the latter, those differences resulting due to regulatory requirements are therefore related to some degree to cultural and political decisions resulting from the interpretation of industry developments. Addressing these kinds of differences requires discussion and reconciliation between the regulatory authorities of the respective countries. .....

1.4.2 CORDEL

The World Nuclear Association (WNA) created the Cordel working group (Cooperation in Design Evaluation and Licensing) in 2007 to stimulate dialog between the international nuclear industry and safety authorities.

Cordel called on AFCEN's RCC-M Subcommittee in 2010 to share its insight into ways of ultimately improving the licensing process for PWR mechanical components, whether for raising safety or improving industrial processes on an international level.

In 2015, AFCEN experts and the Cordel Mechanical Codes & Standard Task Force (Cordel MCSTF) developed their joint activities.

Early in the year, AFCEN endorsed the publication of a document comparing the qualification of non-destructive testing personnel*. This document will serve as a baseline for future nuclear codes on mechanical components.

AFCEN's members are involved in defining the technical structure for the work aimed at comparing welding practices** in nuclear codes, commissioned from WNA/Cordel by ASME Standard and Technology, LLC. AFCEN's members also kept a close eye on the Cordel study into the comparison of non-linear analysis methodologies in the codes. The study is divided into three parts: Part I "Reviews of the existing nonlinear rules in these different codes", Part II "Set of proposals to improve codified rules for a potential harmonization" and Part III "Typical benchmarks based on nozzles under pressure, thermal loads and

1.4.2 CORDEL

complex piping loads". Part I will be published early 2016.

AFCEN and Cordel continued coordinating their actions in support of the MDEP Steering Committee and the Committee for the Convergence of Mechanical Codes and Nuclear Coding Organizations (SDO Convergence Board). Their efforts culminated in direct discussions in 2015 with the MDEP group of nuclear authorities and industry based on the documents published by MDEP, which are actually available to all stakeholders in the nuclear industry, whether authorities, third parties, operators, manufacturers, suppliers, laboratories or standardization bodies. New work topics are currently under discussion at Cordel, including the extended service life of equipment, fatigue analysis and nuclear management systems. They are being monitored by AFCEN's experts, insofar as they can influence the approach promoting codes.

Participating in the Cordel working group, including the task forces in China in January 2015, brought AFCEN into contact with new stakeholders in the nuclear standardization industry, such as Chinese, Russian and Korean organizations, while enabling AFCEN to promote its recommended best practices around the world.

Cordel is a useful platform for AFCEN and its members to harmonize coded best practices at the international level.

* *"Qualifications for NDE Personnel, Harmonization of International Code Requirements", © WNA CORDEL 2015*

** *"Comparison report on Welding Qualification and Welding Quality Assurance", STP-XX-YYY © ASME Standard & Technology, LLC, 2016*

1.4.3 CEN-WORKSHOP 64

AFCEN's determination to rally Europe's nuclear industry to a set of codes geared towards the needs of future nuclear projects in Europe has found a conducive framework for the development of its action with the 2007 creation of the Sustainable Nuclear Energy Technology Platform (SNETP).

A proposal was initially made within CEN to set up a workshop to encourage the different organizations and stakeholders in the ESNII (European Sustainable Nuclear Industrial Initiative affiliated with SNETP and covering Generation IV fast neutron reactors) to help with enhancing the RCC-MRx code draft.

The European Commission has been associated with AFCEN's initiative since day one and has lent its support ever since.

This proposal was accepted by CEN and joined by 14 European organizations.

Workshop 64, named "Design and Construction Code for mechanical equipment of innovative nuclear installations", was created on 3 February 2011. Its terms of reference were compared to those in force within AFCEN's Subcommittees.

Workshop 64 ran until October 2012 and produced 33 modification proposals for the RCC-MRx code, 20 of which were incorporated into the edition published that year. Furthermore, 8 of the 13 other proposals, which could not be converted into modification files due to a lack of technical justification, highlighted the need for mid-term changes to the code.

Feedback on the first initiative was considered to be highly satisfactory and rewarding by all stakeholders.

Spurred on by these results, AFCEN took the initiative of continuing this action by fine-tuning objectives according to two focus areas:

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

1.4.3 CEN-WORKSHOP 64

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

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

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

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

Workshop 64 - Phase 2, entitled “Design and Construction Code for Gen II to IV nuclear facilities (pilot case for process for evolution of AFCEN codes)” was created on 6 June 2014 for a three-year term, which may be renewed if necessary according to the participants’ needs and interests.

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

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

2015 provided the groups with the ideal occasion to get to grips with the associated AFCEN codes, identify subject areas for which a modification to the codes would be desirable and try to establish an order of priority. The groups also discussed the prerequisites in terms of R&D.

Three groups are on the verge of submitting recommended changes for each code in 2016 to AFCEN. Their examination by the Editorial Committee and AFCEN’s formal response to the workshop should happen during the year and thereby “close” the first round of discussions between both parties.

Based on the performance of this first stage, AFCEN will propose the terms for continuing this initiative.

1.4.4 Standards

AFCEN codes are based on standards.

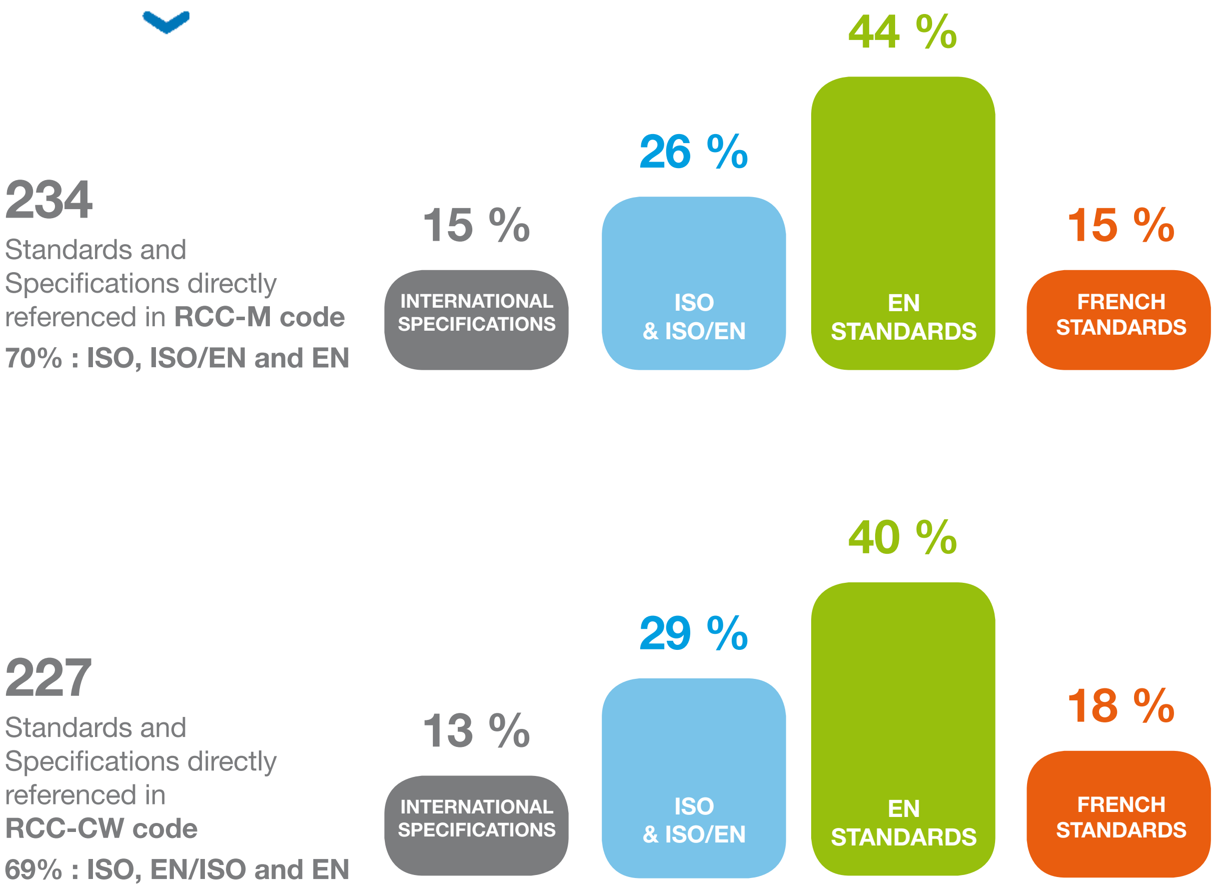
When drafting codes, ISO international standards are the first port of call when available, otherwise European EN standards are used.

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

The standards used by a code are specified in one of the chapters in AFCEN's codes. The Subcommittees occasionally analyze the standards to determine whether any revisions have been made in order to ensure that codes are up-to-date.

The two diagrams in Figure 35 below illustrate AFCEN's approach for prioritizing the use of international or European standards in the RCC-M 2012 and RCC-CW 2015 codes.

FIGURE 21
USE OF STANDARDS IN THE RCC-M 2012 AND RCC-CW 2015 CODES



1.5 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.

As such, the Training Committee delegates training to external providers and consequently assesses their ability to provide such training.

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

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

Partnership agreements

AFCEN has signed partnership agreements with 12 organizations that are qualified in the field of nuclear pressure equipment:

AIB VINCOTTE INTERNATIONAL, APAVE, AREVA UNIVERSITY, BUREAU VERITAS, CETIM, ECOLE DES PONTS PARIS TECH, EFECTIS, INSTITUT DE SOUDURE INDUSTRIE, INSTITUT NATIONAL DES SCIENCES ET TECHNIQUES NUCLEAIRES, INTERNATIONAL NUCLEAR ACADEMY, NUCLEXPERT, SICA NUCLEAIRE.

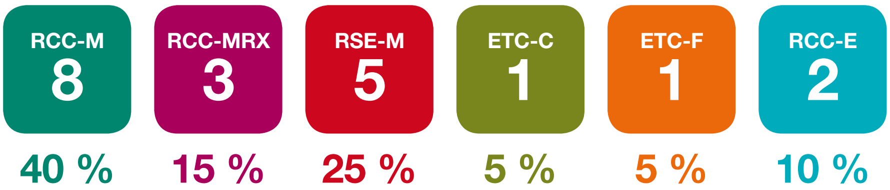


FIGURE 22
PARTNERSHIP AGREEMENTS SIGNED BY AFCEN
AND TRAINING ORGANIZATIONS BY THE END OF 2015

Certified training:

Following proposals from the training officers, the Committee has certified the content of 24 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.

FIGURE 23
AFCEN CERTIFICATE OF ATTENDANCE

1.5 Support through training

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

Training courses delivered in 2015:

In 2015, 51 training sessions[1] were held and covered all codes, representing 357 trainees and 1101 days of training. Training quality was assessed by codes and organizations, with specific attention to ensure that all associated safety messages were effectively driven home.

During this period, the Training Committee stabilized the training catalog. It launched a brainstorming process to enhance the courses on offer, such as modules covering several codes or addressing specific topics (fabrication, materials, etc.). The committee is also looking into the prospect of developing a range of more specific tools, including distance learning (videoconferences and webinars) and e-learning.

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 2015, two courses were held in China, and one in the United Kingdom.

A partnership agreement has been signed in China with SNPI (CGN Group). By the end of 2015, the first training aids had been examined by the RCC-M Subcommittee.

A “general-purpose” training module for the RCC-CW code is currently being prepared. There are plans to implement the module in Saudi Arabia and Poland.

1 Not including international training

2

Organization and operation of AFCEN

2.1 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 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 (fig.24) 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.

FIGURE 24
AFCEN CODES

RCC-M MECHANICAL COMPONENTS

RCC-C FUEL ASSEMBLIES

RCC-E ELECTRICAL AND I&C SYSTEMS

RCC-CW GENIE CIVIL

RCC-F FIRE

RSE-M IN-SERVICE INSPECTION RULES

RCC-MRx MECHANICAL COMPONENTS

Codes are continually updated to incorporate feedback from international industry best practices and changes to legislation, 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 users' inquiries.
- 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 (fig. 2) and Russian with AFCEN's consent.

The broad outline of AFCEN's organizational and operational structure is described in Section 2.2, along with the various bodies that were active during 2015.

FIGURE 25
TRANSLATION OF AFCEN CODES INTO CHINESE AND THE CODE TRANSLATION CEREMONY IN 2011

2.2 Organization and operation

a) 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 at least one General Meeting a year for its members, during which its general strategic directions and budget are approved.

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

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

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

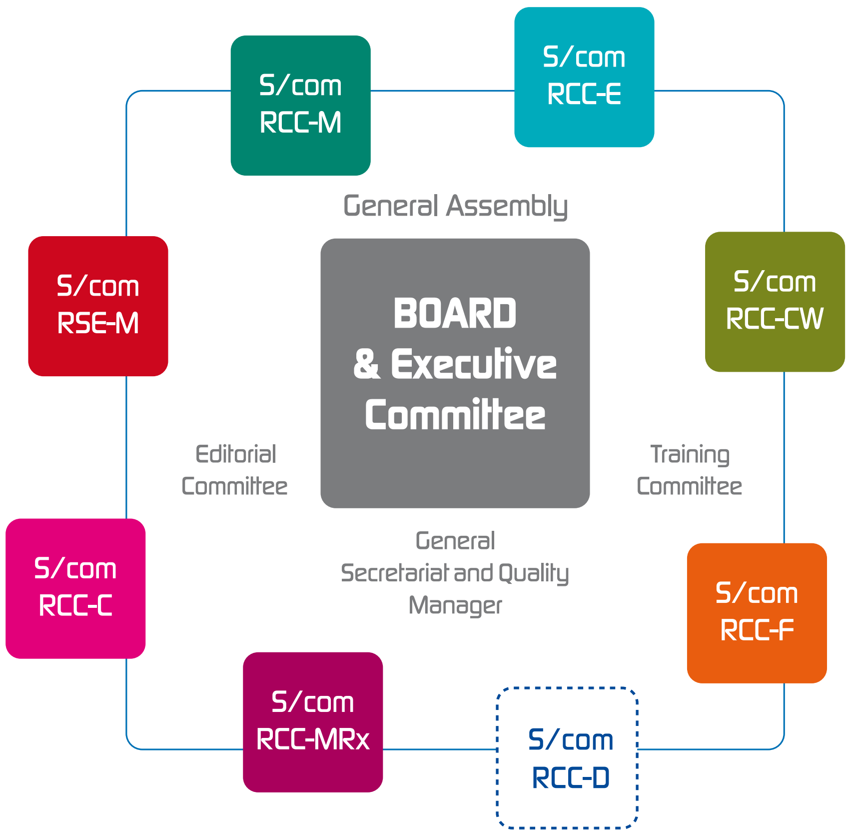


FIGURE 26
AFCEN'S ORGANIZATIONAL STRUCTURE

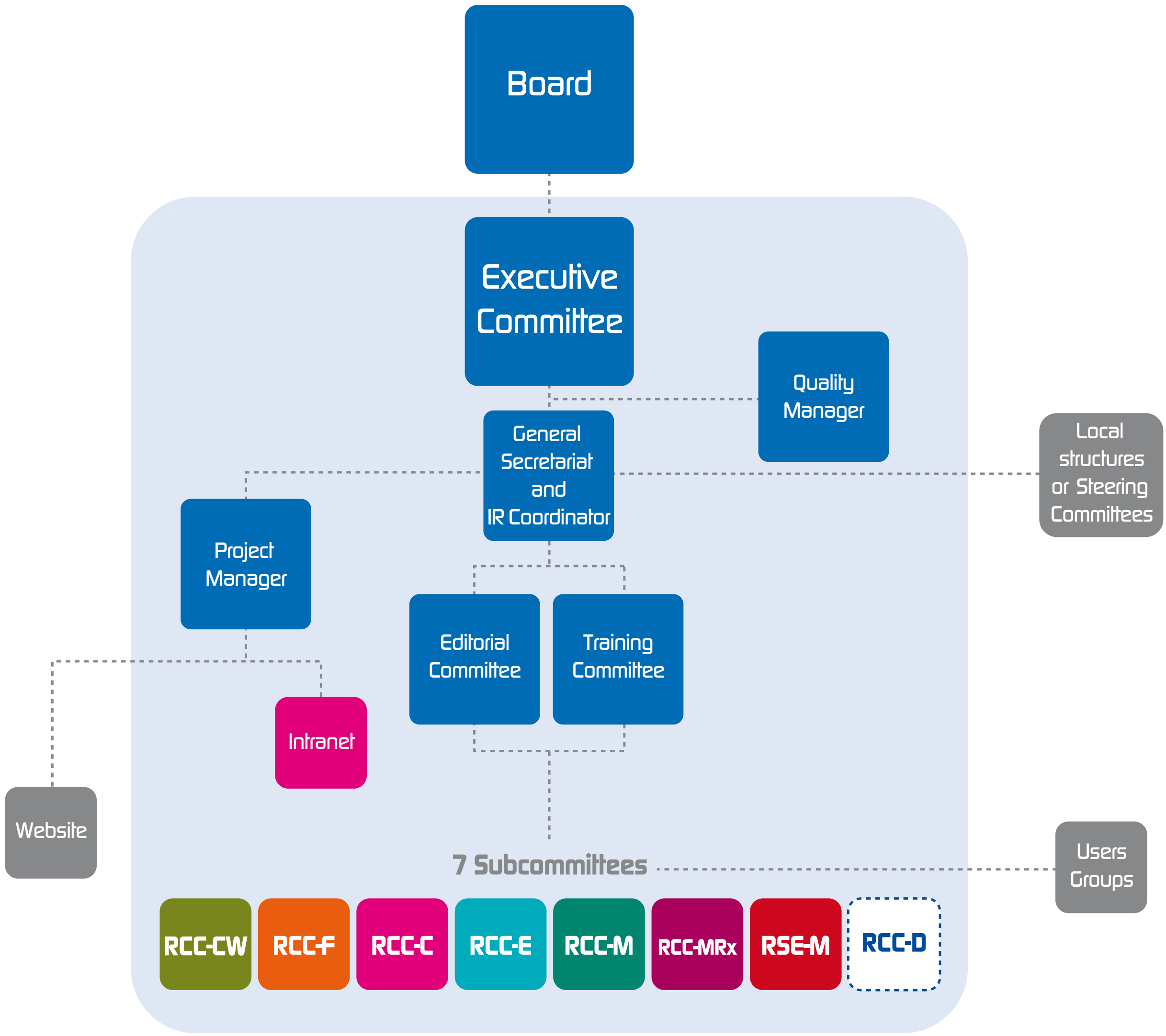


FIGURE 27
GENERAL ORGANIZATION OF AFCEN

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

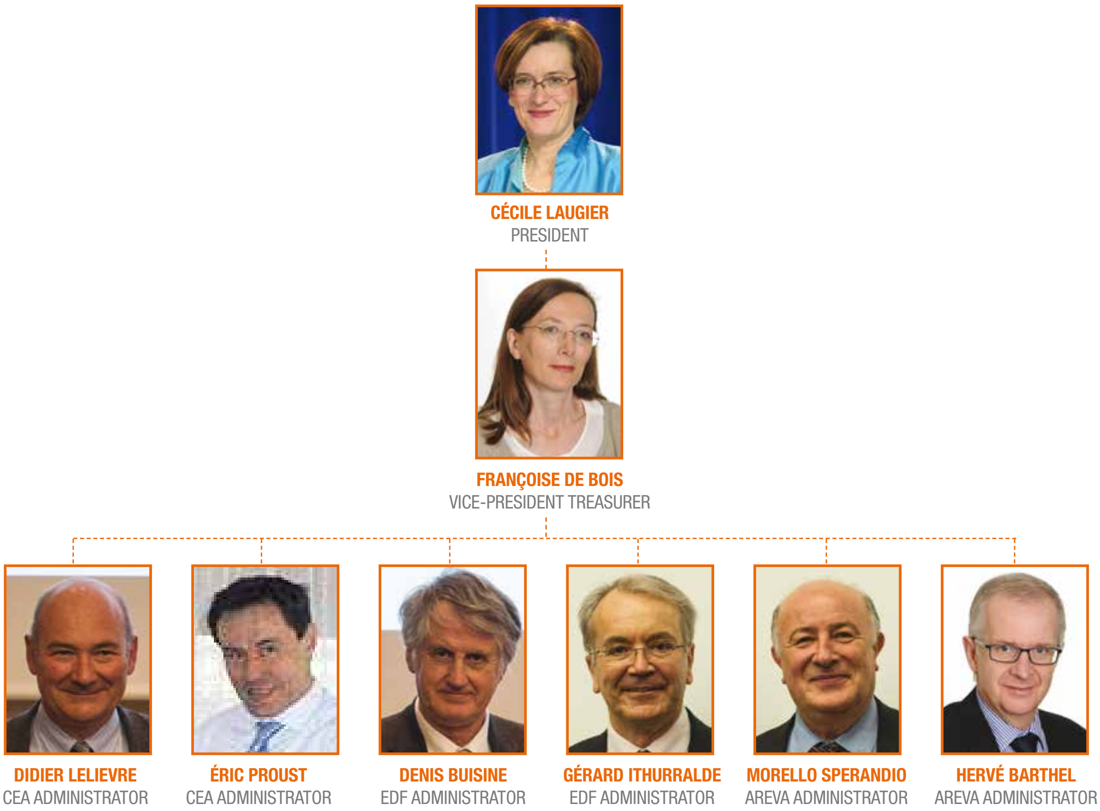
These local structures usually comprise User Groups, which are not necessarily AFCEN members. Each User Group is associated with a code.

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

b) 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.

FIGURE 28
AFCEN'S BOARD OF DIRECTORS



The general activity of the Board of Directors and the General Meeting in 2015 is summarized in Box 4 below.

Both the Board of Directors and the Executive Committee held three meetings.

The General Meeting was held on 26 March 2015.

During the 2015 General Meeting, members approved the following:

- Continuation of AFCEN's internationalization policy in the United Kingdom, European Union and China, including the launch of the first User Group sessions and a memorandum of understanding with NEA.
- The 2015-2017 editorial program.
- Implementation of a new subscription-based sales model.
- Launch of a draft for a new deconstruction code.

Furthermore, specific inquiries were raised by members during the meeting and were dealt with during 2015 (see "customer focus" in Box 11 in Section 2.3).

BOX 4
ACTIVITY OF THE BOARD OF DIRECTORS AND THE GENERAL MEETING IN 2015

c) General Secretariat

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

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

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

In 2015, the General Secretariat reinforced its organization in China with a local structure led by an "AFCEN representative in China" and a "Local AFCEN coordinator in China", under the authority of the International Relations Coordinator in China.

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

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

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

For everyday communication with code users and more generally with the interested public, AFCEN offers a website (www.afcen.com) containing information on the codes and their environment, membership forms and the sale and subscription of its publications.

For the routine management of AFCEN's activities, the General Secretariat holds:

1. Weekly meetings that are open to the Committee Chairs and Vice-Chairs and the International Relations Coordinators.
2. Twice-monthly external communication meetings with communication stakeholders (chief information officer, public relations, sales administration, etc.) and external partners (website publishers and operators, and AFCEN Core).

Such meetings are often in the form of a conference call.

FIGURE 29 AFCEN'S GENERAL SECRETARIAT

MORELLO SPERANDIO
GENERAL SECRETARY

GÉRARD ITHURRALDE
DEPUTY GENERAL SECRETARY

ROMAIN GOY
PROJECT MANAGER

DAVY VUN
COMMUNICATION & PUBLIC RELATIONS

SYLVIE LAGADEC
SALES ADMINISTRATION

MARGUERITE DELUZE
QUALITY

BRUNO MARQUIS
CHINA COORDINATOR INTERNATIONAL RELATIONS

DIDIER LELIEVRE
EUROPE COORDINATOR INTERNATIONAL RELATIONS

BADIA AMEKRAZ
POLAND COORDINATOR INTERNATIONAL RELATIONS

FRÉDÉRIC BEAUD
UK COORDINATOR INTERNATIONAL RELATIONS

WEBSITE PUBLISHERS AND OPERATORS, AND AFCEN CORE

2.2 Organization and operation

d) Editorial Committee

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

The Editorial Committee comprises the Chairs from each Subcommittee, the Secretary-General and the Deputy Secretary-General.

The Editorial Committee is responsible for authoring and updating the codes published by AFCEN, as well as carrying out the associated technical studies.

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

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

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

FIGURE 30
AFCEN'S EDITORIAL COMMITTEE

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

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

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

The general activity of the Editorial Committee in 2015 is summarized in Box 5 below.

In 2015:

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

a) Latest news (conferences, international activities, relations with safety authorities, feedback, and so on).

b) Changes in the organization and practices.

c) Cross-functional studies and commissioned studies.

d) Subcommittee reporting.

The Editorial Committee approved the publication of:

- Three 2015 editions of the RCC-MRx, RCC-C and RCC-CW codes.
- Two 2015 addenda to the RCC-M and RSE-M codes.

Furthermore, the Editorial Committee launched 14 temporary working groups to demonstrate how the RCC-M code can be used to meet the essential safety and radiation protection requirements stipulated in European and French regulations (PED Directive / France's Nuclear Pressure Equipment Regulation).

BOX 5
GENERAL ACTIVITY OF THE EDITORIAL COMMITTEE IN 2015

e) Training Committee

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

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

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

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

To raise the profile of the range of certified training courses, the Training Committee publishes an AFCEN certified training 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.

FIGURE 31
AFCEN'S TRAINING COMMITTEE

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

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 Box 6 below:

In 2015

The Training Committee held three meetings in February, June and November. These regular meetings enabled members to discuss:

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

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

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

The Training Committee consolidated 24 new training courses and issued 357 certificates of attendance for courses on AFCEN codes.

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

It also launched a focus group to examine the possibility of training modules in response to the needs voiced by AFCEN members during the 2015 congress.

BOX 6
GENERAL ACTIVITY OF THE TRAINING COMMITTEE IN 2015

f) Subcommittees

The Subcommittees are responsible for carrying out AFCEN's technical activities, with each Subcommittee covering a field associated with a given code (Box 7):

In 2015, seven Subcommittees were active:

- **RCC-M:** Design and construction rules for PWR mechanical equipment
- **RCC-E:** Design and construction rules for electrical and I&C systems and equipment
- **RCC-CW:** Design and construction rules for PWR civil engineering works
- **RCC-C:** Design and construction rules for PWR fuel assemblies
- **RCC-F:** Design and construction rules for PWR fire protection systems
- **RSE-M:** In-service inspection rules for mechanical components of PWR nuclear islands
- **RCC-MRx:** Design and construction rules for mechanical components in nuclear facilities subject to high-temperature structures and the ITER vacuum vessel

An eighth Subcommittee is due to be launched by the end of 2016 for a deconstruction code (RCC-D).

BOX 7
AFCEN SUBCOMMITTEES IN 2015

The Subcommittees are responsible for:

- Working as part of the Editorial Committee and drafting the industry rules of practice 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 User Groups.

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

Each Subcommittee comprises:

- A Subcommittee General Meeting
- A Subcommittee Board
- Working groups

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

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

- Drafting and continually improving the parts of the code corresponding to the sub-fields.
- Investigating and responding to Requests for Modification and Interpretation submitted by code users.

Figure 32 below presents the different working groups within each Subcommittee.

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

Texts approved by the Subcommittee Board are submitted to the Editorial Committee by the Subcommittee Chair.

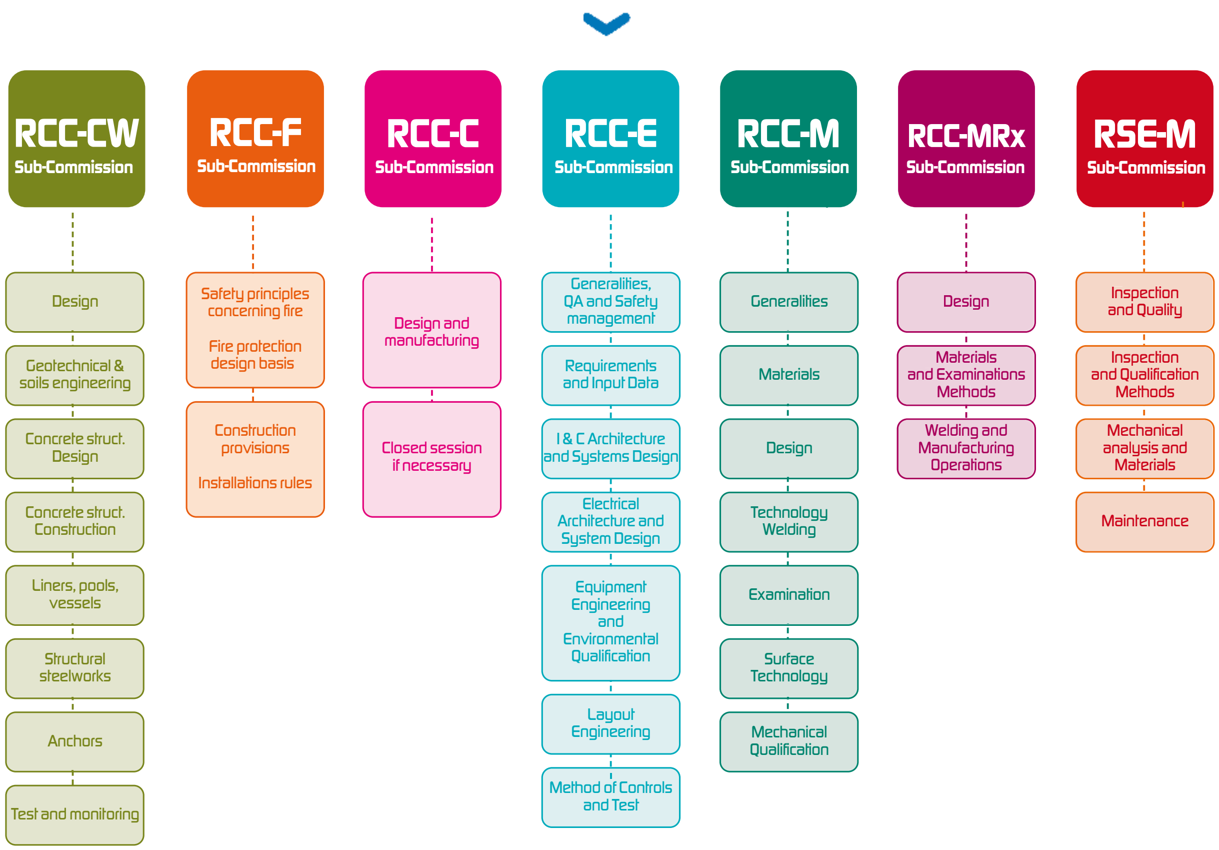
In 2015:

33 working groups were active.

The Subcommittees held between five and ten plenary sessions a year, depending on the Subcommittee.

BOX 8
GENERAL ACTIVITY OF THE SUBCOMMITTEES IN 2015

FIGURE 32
AFCEN'S SUBCOMMITTEES AND WORKING GROUPS



g) User Groups

User Groups are local structures that are responsible for coordinating local activities within the scope of the relevant Subcommittee.

User Groups' missions involve:

- Pre-investigating Requests for Modification and Interpretation submitted by local AFCEN code users.
- Informing users about the activities of AFCEN's Subcommittees and any changes to the corresponding codes.
- Sharing feedback from the country's nuclear industry.
- Facilitating adaptation of AFCEN codes to the local context (especially the country's regulations and industry best practices).
- Helping to provide training for the AFCEN code users in their country.
- Assisting with identifying communication needs (seminars, conferences, etc.) and their implementation in the country.
- Helping ensure consistency in the various multi-lingual versions of the codes.

In 2015:

The RCC-M User Group in the United Kingdom held one meeting chaired by member TWI (The Welding Institute) and was attended by over 15 representatives from the UK's nuclear industry.

In China, two sessions of the Chinese User Groups each attracted over 150 participants and were held as follows:

- The first seven Chinese User Groups concerning RCC-M (design), RCC-M (fabrication), RSE-M, RCC-MRx, RCC-E, RCC-C and RCC-F met on 10 and 11 March 2015, chaired by CGN and CNNC. The civil engineering User Group was launched in June 2015.
- A second CSUG meeting was organized in October 2015 for RCC-M (design), RCC-M (fabrication), RSE-M, RCC-E, RCC-C and ETC-F.

BOX 9
GENERAL ACTIVITY OF THE AFCEN CODE USER GROUPS IN 2015

h) Steering Committees

Steering Committees are local structures that are responsible for coordinating and prioritizing the activities of all User Groups according to the challenges specific to their country.

Steering Committees are governed by agreements with AFCEN.

At the very least, Steering Committees comprise:

- One representative from AFCEN's General Secretariat: the designated International Relations Coordinator.
- The Chairs of each User Group in the country.

In 2015:

The Steering Committees in the United Kingdom and China, chaired by NNB and CGN respectively, each held one meeting during the year. Preliminary meetings between AFCEN and the Steering Committee Chairs were held in the run-up to AFCEN's General Meeting in March 2015. The Steering Committee in China held its meeting on 10 March 2015 in Beijing.

BOX 10
GENERAL ACTIVITY OF THE STEERING COMMITTEES IN 2015

2.3 AFCEN Quality Management

AFCEN has implemented a process-based management system that covers the main missions of the association's purpose and the internal activities supporting those missions.

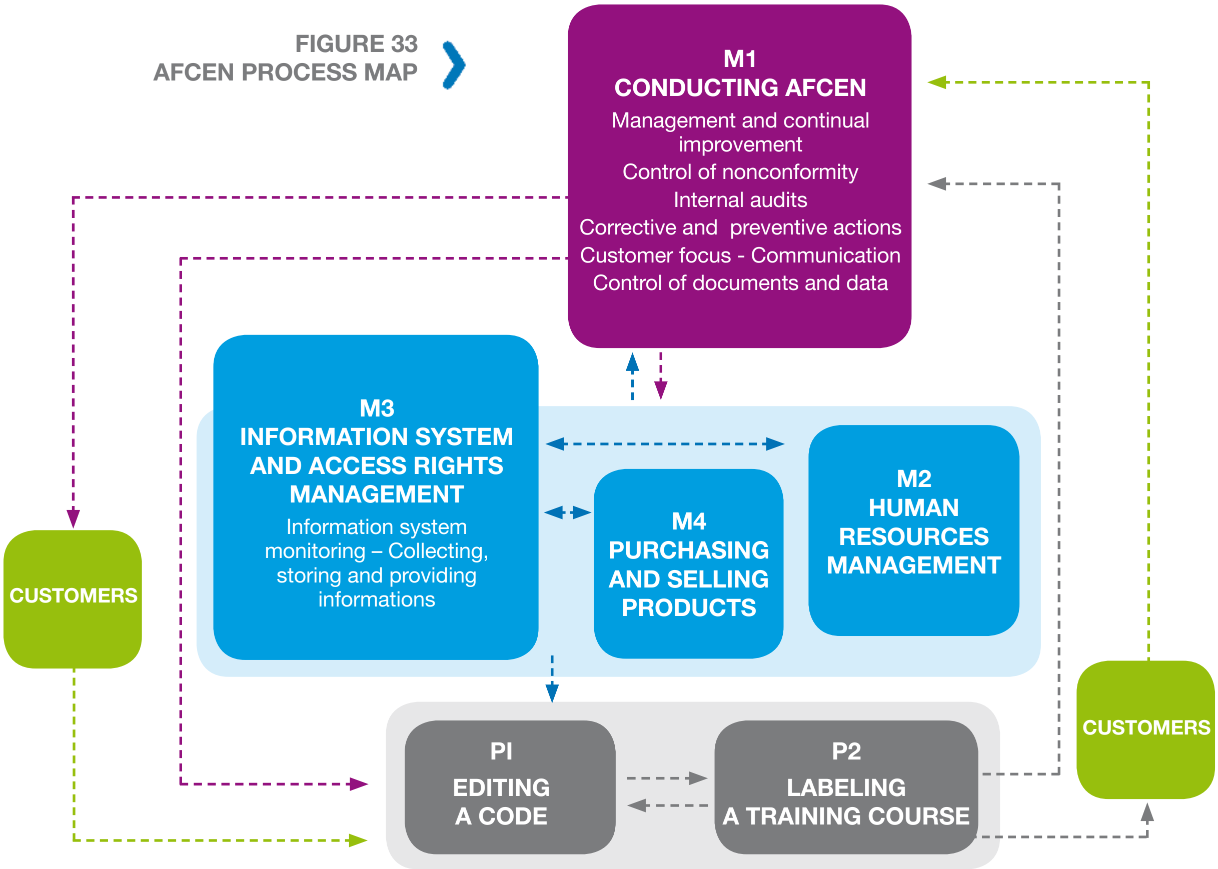
This process-based organization enables AFCEN to:

- Look at AFCEN's operation from a cross-functional perspective.
- Manage the interfaces and resources.
- Clearly define the responsibilities.

This process-based organization is especially suited to the specific characteristics of managing an association that relies on the voluntary participation of its members. This organization also allows AFCEN to coordinate actions on an international level and create a framework geared towards the individual context in each country.

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

FIGURE 33
AFCEN 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 required by the production processes, and the sale of AFCEN's products (M4).

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

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

2.3 Management de la Qualité de l'AFCEN

AFCEN was awarded ISO 9001 certification by Bureau Veritas in January 2014 (audit conducted late October 2013)

AFCEN's general quality management activities in 2015 are summarized in Box 11 below.

Two internal audits were conducted in 2015 into the training certification process and the operation of the purchasing/sales process respectively.

On 22 October 2015, AFCEN passed the second certification follow-up audit. The audit was conducted in a constructive atmosphere. The effectiveness, maturity and appropriateness of AFCEN's management system were highlighted. The audit findings also emphasized the consistency between the quality policy, objectives and targets. In addition, the auditor examined AFCEN's ability to adapt to identified internal and external challenges and the continual improvement strategy. In terms of opportunities for improving efficiency, the auditor indicated the need to streamline the association's management tools and thereby simplify consolidation of the elements for the operational processes (P1 and P2).

AFCEN's Management Review on 29/07/2015 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 deviations.
- Monitor the associated corrective and preventive actions.
- Plan the risk analyses for each process in the quality management system.
- 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 implemented the following actions or pursued the following objectives:

- Undertaking towards ASN to align with the ESPN Regulation by producing guides and local appendices specific to France.
- Prepare criteria for the RCC-M, RSE-M and RCC-CW codes.
- Disseminate the safety culture at the international level via the first User Group meetings in China and the United Kingdom.
- Decide which training modules should be shared for all or part of AFCEN's codes and think about the possible ways of providing specialized support.
- Promote activities using brochures for each code, the activity report, the website, and so on.
- Relaunch the European workshop.
- Provide an English-language version of the quality documents applicable to the operational processes (P1 and P2).

BOX 11
AFCEN'S GENERAL QUALITY MANAGEMENT ACTIVITIES

2.4 Resources (members, resources by Subcommittee)

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

a) AFCEN members in 2015

By the end of 2015, AFCEN had 60 members:

1	ADOLF-WUERTH (Germany)	21	DOOSAN (Corea / UK)	41	NUCLEXPERT
2	AIB VINCOTTE (Belgium)	22	DOUCE HYDRO	42	NUVIA PROTECTION (MECATISS)
3	ALSTOM	23	EDF	43	OGER INTERNATIONAL (Saudi Arabia)
4	AMEC (UK)	24	EFECTIS France	44	ONET TECHNOLOGIES
5	APAVE	25	EGIS (Groupe IOSIS)	45	OXAND
6	AREVA NP	26	EIFFAGE TP	46	PETERCEM
7	AREVA TA	27	EMERSON PM (USA)	47	ROLLS ROYCE FR (UK/FR)
8	ASAP	28	ENDEL GDF SUEZ (Belgium)	48	ROLLS ROYCE PLC (UK)
9	BOUYGUES TP	29	ESS AB (Sweden)	49	SAMT
10	BUREAU VERITAS	30	GEODYNAMIQUE ET STRUCTRES	50	SCHNEIDER ELECTRIC
11	CEA	31	GERB SA	51	SCK CEN (Belgium)
12	CETIM	32	GIS MIC Nucléaire	52	SOGETI
13	CITA PRODUCTION	33	HALFEN GmbH (Germany)	53	TRACTEBEL ENGINEERING (Belgium)
14	CLYDE UNION (UK)	34	HILTI (Lichtenstein)	54	TWI Ltd (UK)
15	CGN (China)	35	INSTITUT LAUE LANGEVIN	55	UGITECH
16	CNIM	36	INTERCONTROLE	56	VALINOX
17	CNNC / ISNI (China)	37	JORDHAL (Germany)	57	VATTENFALL / Forsmark (Sweden)
18	DAHER VANATOME	38	LISEGA (Germany)	58	VELAN
19	DCNS	39	NFM TECHNOLOGIES (China)	59	VINCI CONSTRUCTION
20	DEXTRA MANUFACTURING (Thailand)	40	NNB (UK)	60	WESTINGHOUSE FR (USA)

FIGURE 34
AFCEN MEMBERS IN 2015

Eleven new organizations became AFCEN members in 2015:

9 EUROPEAN GROUPS

GERMANY
ADOLPH-WUERTH
HALFEN GMBH
JORDHAL

FRANCE
DOUCE HYDRO
GERB SA
CITA PRODUCTION
SOGETI
UGITECH

SWEDEN
VATTENFALL / FOSMARK

2 OTHER INTERNATIONAL GROUPS

CHINA
CNNC

THAILAND
DEXTRA MANUFACTURING

2.4 Resources (members, resources by Subcommittee)

b) Member involvement in the Subcommittees

In 2015, AFCEN members were involved in the Subcommittees as shown in Box 12 below.

RCC-M (32 members)

AIB VINCOTTE INTERNATIONAL, AMEC, APAVE, AREVA NP, AREVA TA, ASAP, BUREAU VERITAS, CEA, CETIM, CGN, CITA Production, CNNC, CLYDE UNION, DAHER VANATOME, DCNS, DOOSAN, EDF, EMERSON PROCESS MANAGEMENT, ENDEL, GIS-MIC, HILTI, LISEGA, NNB, NUCLEXPERT, ONET, ROLLS ROYCE PLC, SOGETI, TWI, UGITECH, VALINOX NUCLEAIRE, VELAN SAS, WESTINGHOUSE France.

RSE-M (17 members)

APAVE, AREVA NP, AREVA TA, ASAP, BUREAU VERITAS, CEA, CETIM, CGN, CNNC, DCNS, DOOSAN, EDF, ENDEL, INTERCONTROLE, NNB, ONET, WESTINGHOUSE France.

RCC-E (14 members)

ALSTOM, APAVE, AREVA NP, AREVA TA, CEA, CGN, CNNC, EDF, EMERSON PROCESS MANAGEMENT, HILTI, NNB, PETERCEM, ROLLS-ROYCE CIVIL NUCLEAR, SCHNEIDER ELECTRIC.

RCC-CW (26 members)

ADOLF-WUERTH, AMEC, AREVA NP, AREVA TA, BOUYGUES TRAVAUX PUBLICS, CEA, CGN, CNNC, DEXTRA MANUFACTURING, DOUCE HYDRO, EDF, EGIS, EIFFAGE, GEODYNAMIQUE ET STRUCTURE, GERB SA, HALFEN GmbH, HILTI, JORDHAL GmbH, NFM TECHNOLOGIES, NNB, OGER INTERNATIONAL, OXAND, SAMT, TRACTEBEL Engineering, VATTENFALL FORSMARKS, VINCI.

RCC-F (7 members)

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

RCC-C (8 members)

AREVA NP, BUREAU VERITAS, CEA, CGN, CNNC, EDF, NNB, WESTINGHOUSE.

RCC-MRx (18 members)

AIB VINCOTTE, APAVE, AREVA NP, AREVA TA, BUREAU VERITAS, CEA, CGN, CNNC, CLYDE UNION, CNIM, EDF, ESS AB, ENDEL, INSTITUT LAUE LANGEVIN, ONET, SCK CEN, TWI, VALINOX NUCLEAIRE.

BOX 12
AFCEN MEMBER INVOLVEMENT IN THE SUBCOMMITTEES IN 2015

c) 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 (see Box 13 below):

In 2015, over 600 experts contributed to AFCEN's work as follows:

Note also the participation of foreign experts in the User Groups:

China: 149 experts - UK: 53 experts

BOX 13
EXPERTS' PARTICIPATION IN THE WORK OF AFCEN'S SUBCOMMITTEES AND USER GROUPS

RCC-M	RSE-M	RCC-E	RCC-CW
179	84	83	158
RCC-F	**RCC-C**	**RCC-MRX**	**COMMANDITES ESPN N1& N2/N3**
19	45	61	135

TOTAL 764 *some experts are involved in several Subcommittees*

2.4 Resources (members, resources by Subcommittee)

d) 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.

2.5 AFCEN and the Internet

Several years ago, AFCEN began overhauling its web tools and updating its sales model to reflect the new technologies.

a) AFCEN-Core collaborative workspace

AFCEN provides its members with a new restricted-access AFCEN-Core collaborative workspace. It hosts all the work of the working group members, as well as CSUG members. The workspace improves interaction and provides all members with a portal featuring the latest information from their community.

Visit us at https://afcencore.net.

b) The AFCEN website gets a makeover

In 2015, the new-look AFCEN.com website went online. Visit it at www.afcen.com.

c) The new AFCEN code sales model implemented in 2015

The new AFCEN code sales model is aimed at prioritizing simplicity in alignment with the needs of AFCEN code users. Since 1 October 2015, the AFCEN e-commerce platform has offered the following functionality:

- The option of subscribing (for 12 months) to a code in order to gain access to all the publications relating to that code (initial edition, addenda, criteria and technical publications) in digital format. Users can then enjoy unlimited downloads during the subscription period (12 months) of the following publications in personalized pdf format (watermark):
- Up-to-date version of the code, including addenda.
- Earlier editions of the code (according to the type of subscription).
- Code-related criteria and technical publications.

Advantages of subscriptions:

- Guaranteed access to the most recent versions of the code (including addenda) upon annual publication.
- Unlimited and anywhere access to publications throughout the subscription period.
- Access to the French and English-language versions of the publications.
- Low-cost access to the code history (earlier editions).
- Access to the code-related technical publications and criteria.
- Preferential offers (re-subscription and multiple subscriptions).

Purchase of pdf versions of the publications:

- Code editions, criteria and technical publications.
- Seven-day access to download the purchased publication in personalized pdf format (watermark).

Ordering of hardcopy versions of the publications:

Sale of AFCEN's different publications: codes, addenda, criteria and technical publications.

A new pricing scheme has been created to accompany the new sales platform.

Note: addenda will no longer be available for sale from 2016 onwards. They will be incorporated directly into the new editions of the codes. Each new edition of the codes will identify any differences from the previous version, thereby enabling readers to easily pinpoint each amended section.

3

Summary and outlook

One of AFCEN's first defining features is its assets and its drive to produce technical rules. AFCEN's seven codes represent over 9,500 pages leveraging the technical expertise and feedback that have been acquired over more than 30 years from manufacturing equipment and operations in over 100 nuclear reactors around the world. The three mechanical codes (RCC-M, RSE-M and RCC-MRx) account for nearly 80% of all content published and constitute the vast majority of code sales, just like their widespread use.

A dynamic editorial process is a top priority at AFCEN, and the objective is to publish a new annual edition of the code to incorporate the year's modifications by each Subcommittee and the revised technical standards referenced by the codes. As such, mention should be made of the considerable efforts realized over several years to specify ISO, IEC and EN standards in AFCEN codes: over 1,050 standards are specified, close to 80% of which are European or international.

The latest RCC-M news includes a number of highlights: pending the release of a new edition in 2016, the 2015 addendum already features major changes relating to non-destructive testing (new alternatives to radiographic examination) and consideration of environmental effects on fatigue analyses. Note that the criteria for the RCC-M code have been available for sale since last year; this specific publication is designed to explain and justify the rules featured in the code. Particular mention should be made of the many working groups poring over the French Nuclear Pressure Equipment Regulation (ESPN) in a bid to deliver a response from industry to the difficulties inherent in applying the regulation: AFCEN has brought all of industry and experts together to focus on a major three-year work program.

Furthermore, an important prospect for RCC-M is the preparation of Subsection Q, which will cover the functional qualification of active mechanical components.

The activities of both the RSE-M and RCC-M Subcommittees were heavily influenced by the ESPN commissioned studies. In terms of mechanical fracture assessments, the work of an independent expert working group was instrumental in obtaining approval for Appendix 5.4 of the RSE-M code in the United Kingdom.

A new edition of the RCC-MRx code was released in 2015. This edition reflects feedback on the use of the 2012 edition and/or its 2013 addendum, especially in current projects and mainly the Jules Horowitz reactor and the Astrid project.

In terms of electricity, the latest edition of the code dates back to 2012. This code is currently undergoing a major overhaul, with publication slated for 2016.

With regard to fuel, a new edition of the RCC-C code was published in 2015 and represents the culmination of the RCC-C Subcommittee's efforts in recent years at 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.

The Fire Protection Subcommittee master-minded an ETC-F version in 2013 and is preparing an RCC-F code for 2016.

In terms of civil engineering works, the Subcommittee has been remarkably active since 2010, the date on which it was broadened to encompass manufacturers: the 2015 edition of the RCC-CW code has been extensively revised and improved compared to the ETC-C code to take account of recent changes in European standards.

This new edition builds on feedback from a number of recent projects, as well as technological possibilities and improvements relating to prestress, seismic isolation systems and external hazards, with an approach for design extension situations.

AFCEN is constantly preoccupied with the quality of the training courses that serve to provide a clear insight into the different codes and therefore help with their rigorous application. That is why AFCEN has set up a certification system to both satisfy demand and keep course content firmly under control: the strategy has proved successful with over 20 approvals issued. Today's priorities include developing new CPD modules and prioritizing hands-on exercises in the courses.

In terms of operation and organization, AFCEN is committed to pursuing major progress initiatives aimed at harmonizing and improving teamwork, while obviously providing proof of its quality assurance credentials (IS0 9001 certification renewed in 2015).

Since 2010, an outward-looking approach and international development have formed the bedrock of AFCEN's new strategic focus areas.

In China, where AFCEN codes are widely known and used on the majority of nuclear reactors in operation or under construction, AFCEN fosters regular relations with the main industrial and institutional stakeholders, with which it is developing User Groups.

In the United Kingdom, AFCEN codes are an integral part of the technical standards used for the future EPR units; as such, they have been thoroughly examined by the British safety authority. AFCEN also lends its support to the creation of User Groups, which play an essential role in improving industry's uptake of the codes.

AFCEN has developed a significant footprint in Poland in keeping with the interest of the Polish authorities and industry in future nuclear projects.

Spurred on by the success of its initial collaboration with CEN via Workshop 64, AFCEN is pursuing its work in the European platforms with the support of the European Commission's Directorate-General for Energy.

In conclusion, AFCEN's activities in 2015 bear testament to both the driving force of its editorial team and its determination to embrace an outward-looking approach and promote international development. As for what lies ahead, AFCEN will continue incorporating new members and satisfying their needs, as well as preparing and promoting appropriate technical and operational standards that help demonstrate the safety of nuclear reactors and facilities.

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Shaping the rules for a sustainable nuclear technology