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Shaping the rules for a sustainable nuclear technology

ANNUAL REPORT

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FOREWORD
BY AFCEN'S PRESIDENT

Laurent THIEFFRY,
President

"In 2023, the nuclear industry was clearly recognized as having a key role to play in turning the tide on global warming. For the first time, nuclear energy was explicitly mentioned as a solution in the final COP28 declaration, and 29 nations have appealed for a concerted effort to triple nuclear capacity by 2050. The Nuclear Alliance, which currently features 16 European countries, was masterminded by France with the aim of bringing together all the European countries wishing to use nuclear energy alongside renewables to successfully lead their energy transition roadmaps. 2023 also saw life return to normal after emerging from the aftermath of the health crisis, as illustrated by the AFCEN Congress in March, the China Week event in November, and AFCEN's participation in WNE in November. These three events owe part of their success to the wind of change blowing through the nuclear industry. As members of AFCEN, these developments oblige and compel us to assume our major responsibility of ensuring that our association supports the nuclear industry and takes performance to even higher levels by producing publications of the highest quality.

AFCEN is again sending out a strong signal of its determination and mission to serve the nuclear industry by developing and disseminating reference publications and codes for building and operating nuclear facilities. Expertise, collaboration and responsibility are the hallmarks that define AFCEN. Our ambition is to see our codes continue gaining traction and achieving greater recognition for their ability to guarantee safety and raise the efficiency bar in industry. The key directions in our 2021-2025 strategic plan are focused on addressing three major issues, namely the editorial policy for our codes, interaction with major projects, operators and safety authorities, and support for fostering proficiency in the codes. This plan also includes a resources component with the aim of drafting in the experts that AFCEN needs.

In 2019, AFCEN decided to formalize and highlight its editorial program to meet internal management needs and also improve information for users. This program is designed to fulfill code users' expectations, incorporate feedback, introduce innovative practices, keep pace with the latest standards and regulations, and finally improve editorial practices. One of the highlights of 2023 included the publication of the English versions of the 2022 editions of RCC-M (mechanical components of PWR nuclear islands) and RSE-M (in-service inspection rules for mechanical components of PWR nuclear islands), as well as an enhanced edition (French and English) of the RCC-C code (fuel assemblies) and the RCC-CW code (nuclear civil works). Work is continuing on the RCC-F code (fire protection), with plans to release a new edition in 2024.

AFCEN is working alongside ASN and GSEN to set up an organization that will help see the 2018 edition of the RCC-M code endorsed as "appropriate for providing provisions and methods allowing manufacturers to ensure that their N1 nuclear pressure equipment conforms to the essential safety requirements of the ESPN Regulation and allowing authorized organizations to verify compliance." Producing an explicit, shared standard will enable certificates to be obtained on a more industrial scale, while promoting greater interaction between manufacturers and authorized organizations. AFCEN, ASN and GSEN are currently wrapping up the process.

Finally, in response to the need for improved harmonization and standardization across the nuclear industry, several initiatives are being spearheaded in Europe to develop codes. A prime example is CEN Workshop 64, whose inception can be credited to AFCEN in 2010. This workshop led to a series of proposed changes to the codes. Industry professionals across Europe continue to keep a close eye on the workshop's activities, and AFCEN decided to launch Phase 4 in 2023, which will take place over the next four years. Phase 4 is aimed at meeting the essential need to harmonize practices and processes for deploying SMRs and AMRs. Several startups with innovative reactor projects have joined CEN Workshop 64. AFCEN is also a partner in Euratom's HARMONISE project. I would like to pay tribute to our experts' unwavering commitment and thank our members for actively participating in our endeavors. On behalf of all our members, it gives me great pleasure to present the 2023 AFCEN Annual Report. This report clearly illustrates the many achievements and events that our association has organized and supported over the previous year.

I look forward to seeing you on March 21, 2024, during the next AFCEN meeting."

SIGNIFICANT EVENTS
2023

In 2023, the AFCEN Congress: March 29 - 31

The seventh edition of the AFCEN International Congress was held from March 29 to 30, 2023, in Paris and brougth together 250 participants from 80 different companies around topics such as “AFCEN and its stakeholders”, “the international use of AFCEN codes”, and “harmonization initiatives in Europe”.

SIGNIFICANT EVENTS
2023

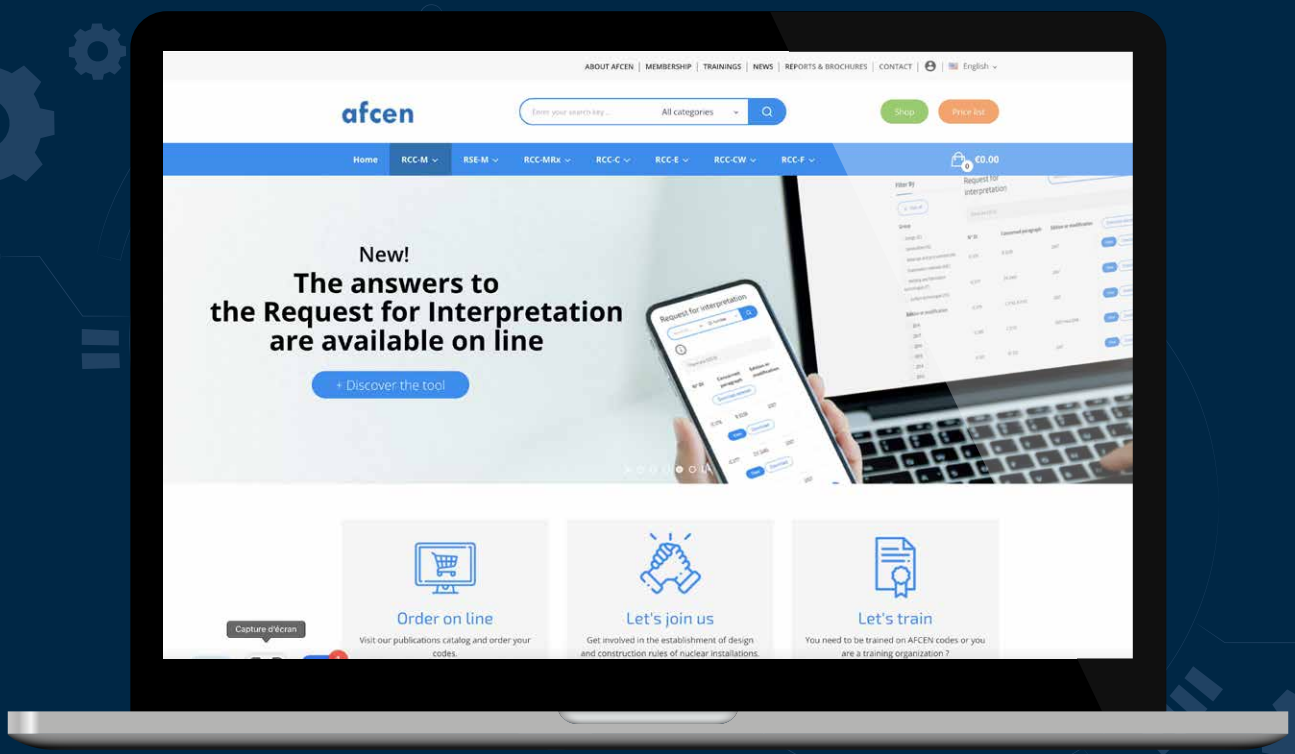
In 2023, AFCEN China Week: November 6 - 14

After the chapter had been closed on the health crisis, AFCEN was able to resume face-to-face meetings with its Chinese partners during a week of events focusing on AFCEN's codes (CUG and CSUG), as well as codes development and innovative construction (AFCEN - CNEA seminar), rounded off by visits to the Zhangzhou and Sanmen sites.

SIGNIFICANT EVENTS
2023

In 2023, the IRs and MFs for RCC-M and the errata for all codes were published

In keeping with the association's initiatives to digitize its processes and its aim of supporting code users, AFCEN uploaded all the interpretation requests (IRs) for the RCC-M code since the first version to its website at www.afcen.com. AFCEN also uploaded the modification forms (MFs) for the 2020 and 2022 editions of the RCC-M code, which are available to users who have purchased the code. Lastly, all the errata for all the codes are now available on the www.afcen.com website.



In 2023, AFCEN pursued its efforts to strengthen skills in the nuclear industry

In 2023, AFCEN provided the nuclear industry with a set of tools for self-assessing the level of proficiency in using the RCC-M and RCC-E codes.

In 2023, launch of Phase 4 of CEN Workshop 64

The very satisfactory results of the third phase and the need to promote good industrial practices in the nuclear industry at European level led AFCEN to launch the fourth phase of the workshop for a period of 4 years.

workshop 64
European forum for nuclear codes

SIGNIFICANT EVENTS
2023

In 2023, AFCEN welcomed 10 new members

AFCEN opened its doors to 10 new members in 2023. MONTEIRO, ACM, ALCO, UGITECH and SBS Forge have joined the RCC-M Subcommittee, and ARTELIA, PEIKKO, NVENT-ERICO and LINXION (formerly BARTEC) have joined the RCC-CW Subcommittee. Finally, startup NEWCLEO has become a member of the RCC-MRx Subcommittee.

RCC-M code

ACM – A COMPANY OF FOURÉ LAGADEC
ALCO Tubes & Fittings
MONTEIRO Groupe
SBS
Ugitech

RCC-CW code

ARTELIA
linxion The Original
bartec by linxion · cergil by linxion · linxion international
nVent | ERICO
peikko®

RCC-MRx code

newcleo
Futurable Energy

afcen

Shaping the rules for a sustainable nuclear technology

NATIONAL AND INTERNATIONAL CHALLENGES

RELATIONSHIPS WITH STAKEHOLDERS

1.1 AFCEN'S MISSIONS AND AMBITIONS

Founded by EDF and Framatome in October 1980, AFCEN launched its first four-year strategic plan in 2018. The appointment of a new president at AFCEN's helm in December 2020 prompted AFCEN to take its strategic plan back to the drawing board and invite members across the association to engage in the process and share their views.

AFCEN's strategic plan 2021-2025 can be credited to their collective efforts. This new plan draws strength from the association's previous work and features a number of ambitions that are geared towards the opportunities and requirements in the current environment, while providing a new insight into the role that nuclear codes play in our industry. The Executive Committee is responsible for keeping regular tabs on the actions arising from the plan.

Our mission: Develop and provide codes and reference documents offering accurate and practical rules for the design, construction and in-service inspection

Our Ambition: provide codes chosen worldwide which contribute to the safety and economic performance of sustainable nuclear facilities

Our core values: Expertise, Collaboration, Accountability

The strategic plan is complemented by a reflection on the industrial character of AFCEN's activities to: AFCEN, being in industrial means:

- Making nuclear safety a priority and industrial performance a goal:
  . Offer industrial solutions the Safety Authorities can trust.
- Aiming for performance and efficiency:
  . Propose graded requirement,
  . Deliver explicit and accessible codes,
  . Highlight the gain for all the stakeholders,
  . Enable the introduction of innovations.
- Meeting the needs of projects and industry manufacturers:
  . Take into account the feedback from field experience over time,
  . Select practices supported by standards (European and ISO) and applicable by industry manufacturers,
  . Strengthen the stability and reliability of projects by standardizing industrial practices.

It proposes a vision based on three major issues with a resource component. It renews the analysis of Threats, Opportunities, Strengths and Weaknesses. The levers of action are then described, in coherence with this framework of reflection.

Thus, three major issues are identified:

1. Editorial policy for codes

To develop and update, at a pace shared by stakeholders, a set of consistent rules, shared with industry manufacturers, proven and optimized to ensure compliance with nuclear safety requirements and regulations:

- An editorial policy which defines: the content and pace of development for each code, objectives relating to the structure of codes, the statement of requirements, the coverage of technical topics,
- An experience feedback loop based: the participation of key business experts, experience feedback meetings with the Clients (including projects) and industry manufacturers, an experience feedback loop embedded in the subcommittee processes,
- Rules for drafting codes inspired by Requirements Engineering,
- Modification Sheets guarantying that the solutions proposed by the codes are endorsed by industry manufacturers and compliant with the regulations.

2. Interaction with stakeholders: major projects, operators and authorities

To be recognized by prospects and European regulators, to support projects (choice of code editions, etc.) and operators, with key levers of action:

- Increase influence in Europe and the world (China in particular),
- Interact with authorities to increase recognition of codes,
- Support major projects: AFCEN tools to strengthen control and stability of the project technical reference basis:
  - . Guarantee the forward compatibility of successive editions,
  - . Provide tools to justify the stability of the project technical reference basis.
- Support the French NUWARD SMR project in choosing AFCEN:
  - . Respond to the need for codification of the project, build an international offer.
- Provide guidance to operators.

3. Support and foster proficency in the codes

To develop knowledge and proficiency in the codes, disseminate good practices to ensure the adoption of the content of codes by all users, from the owner or achitect engineer to all tiers of suppliers, with key levers of action:

- Assimilation and evaluation :
  - . Develop self-assessment guide and guides to assess the proficiency of suppliers in RCC-M and RCC-E codes, as part of the supplier qualification process,
  - . Assist with the use of codes in the course of a contract.
- Provide specialised training and support for all stakeholders: client, manufacturer, authorities,
- Expand the AFCEN-certified training catalogue,
- Responsiveness in project support :
  - . Improve organization to provide quick responses (currently 3 months on average) to code Interpretation Requests (IRs) to keep up with the pace of projects.

And finally, a Resources component is committed, to ensure AFCEN's availability and quality of the experts needed to carry out its missions:

- Increase memberships among companies bringing key experts,
- Give credit for the time spent within AFCEN in an expert's career,
- Build a stronger presence of industry experts in the working groups of each subcommittee,
- Experiment with the production of Modification Sheets by Chinese experts, for selected topics of the RCC-M code in the «design», «materials» and «technology and manufacturing» working groups.

1.2 AFCEN'S ACTIVITIES IN FRANCE AND AROUND THE WORLD RELATIONSHIPS WITH PROJECTS

AFCEN's activities in France are aimed at achieving the following objectives:

- Support the major reactor projects in France: Flamanville EPR, ITER and RJH,
- Lay the foundations for the future reactor projects: EPR2 and NUWARD SMR,
- Offer assistance and guidance to nuclear operators.

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

- Implement the proposed changes to the codes voiced by participants in CEN/WS64 "Design and construction codes for Gen II to IV nuclear facilities", a workshop that contains leading players in Europe's nuclear industry looking to improve their expertise in AFCEN's codes,
- Continue developing working platforms for the local nuclear industry in each area where its codes are used, mainly the UK and China,
- Support the MYRRHA project, developed by the SCK CEN, which has chosen the RCC-MRx as technical standards for the primary circuit,
- Support the HPC and SZC EPR projects in the UK and the JNPP EPR in India,
- Pursue AFCEN's development around the world: Asia (China, India), Europe and the UK, South Africa and the Middle East by supporting projects in France's nuclear industry,
- Build on the industrial practice of international users (United Kingdom and China in particular) and the technical instructions for certifying projects that have used AFCEN codes as a reference,
- Continue the policy of comparing and harmonizing AFCEN codes with the other nuclear codes within the SDO Convergence Board and in liaison with the OECD/NEA/CNRA/WGCS (Working Group on Codes & Standards, safety authorities entities) and the WNA/CORDEL association (Cooperation in Reactor Design Evaluation and Licensing).

1.2.1 France (EPR, EPR2, ITER, RJH, NUWARD SMR, Reactors currently in operation)

FA3 activity

Feedback from the construction of reactor 3 at Flamanville continues to be incorporated into the different codes used for the project. As far as RCC-M is concerned, the aim is to build on the changes introduced into the 2022 edition relating to welding and heat treatment, and incorporate new material specifications and inspection techniques in the 2024 edition.

EPR2 activity

The EPR2 project has chosen AFCEN's codes to design and build the reactors. The EPR2 project has established its technical standards and is keeping a close eye on changes to the codes (such as integrating feedback and responding to project requirements). In 2023, the RCC-F Subcommittee examined the modification requests resulting from IRSN's review of the code (the technical support arm of France's Nuclear Safety Authority), which will be incorporated into the 2024 edition of the code. In 2023, the RCC-M Subcommittee published a set of rules for designing and manufacturing low-risk pressure piping ("Category 0"), QC piping or Class 3 piping, as an alternative to volumes D or E in RCC-M (AFCEN-PTAN-07006-2023). Based on AFCEN's classification of the 2020 and 2022 modification forms for the RCC-M code (AFCEN-PTAN-07001-2023), the EPR2 project has analyzed the impact that the code's changes will have on its technical standards (which rely on the 2018 edition of the code). The 2023 edition of the RCC-CW code updates the rules for justifying containment metal liners in the presence of shape defects. AFCEN will continue delivering support to the EPR2 project throughout its development.

ITER activity

As members of the RCC-MRx Subcommittee, ITER project members are actively involved in the code. Their feedback was instrumental in suggesting changes to include the material used for the Vacuum Vessel (316L(N)). Members are also actively working to factor the specific characteristics of the fusion process into RCC-MRx, such as integrating copper alloys as a probationary phase rule in the 2022 edition.

RJH activity

Feedback from the project continues to shape the RCC-MRx code through the modification requests submitted by Framatome and TechnicAtome. Support from the RJH project played a key role in incorporating some 110 modification requests into the 2022 edition of the RCC-MRx code.

NUWARD SMR activity

The NUWARD SMR project has chosen AFCEN's codes to provide guidance for all the project's technical aspects.

The agreement signed with NUWARD on April 15, 2022, sets out the way and manner in which AFCEN will support and contribute to defining the project's technical standards.

In 2023, AFCEN made moves to align the RCC-E and RCC-CW codes with the needs expressed by NUWARD. In addition, AFCEN has included a number of developments into its work program for the purpose of adapting its codes to address the specific features of SMRs in general and especially the NUWARD project. Some changes have already been introduced into RCC-E (2022 edition) and RCC-CW (2023 edition). Follow-up action is expected, particularly for the RCC-F and RCC-C codes.

Activities relating to the operating fleet

In 2023, changes were introduced into the in-service units as part of the Grand Carénage (GK) program, which involves the use of AFCEN's codes.

1.2.2 European Union

1.2.2.1 CEN Workshop 64 "Design and construction codes for Gen II to IV nuclear facilities"

CEN Workshop 64 (CEN/WS64) represents one of AFCEN's main institutional activities on a European level. CEN/WS64 was created by AFCEN in 2010 and is currently in Phase 4 which was launched in mid-2023.

With the aim of injecting new driving force into the process, special efforts were made to attract new participants. Those efforts ultimately paid off, since 15 or so new members have joined the workshop. The new topics covered by the workshop relate to the design of SMR components and the needs arising from the innovative systems in AMRs. Note that many startups with innovative reactor projects have joined or intend to join CEN/WS64.

Members will examine the prospect of using standards from other sectors of industry and integrating digital technologies.

A link has also been established with the Euratom HARMONISE project, in which AFCEN is a partner. By the end of the project, the work package focusing on codes and standards must produce a map of any needs that are not covered (or only partially covered) by existing codes, along with recommendations to address such gaps. This information will represent valuable inputs for CEN/WS64.

Motivations for initiating Phase 4

The reasons that prompted AFCEN to pursue WS64 with Phase 4 remain unchanged and have even been accelerated by the international context and the importance in fighting against global warming.

1.2 AFCEN'S ACTIVITIES IN FRANCE AND AROUND THE WORLD RELATIONSHIPS WITH PROJECTS

The first goal is to maintain and even develop the community of European experts working on nuclear codes.

The need to increase nuclear power generation capacities by 2030 with the aim of attaining the objectives to reduce greenhouse gas emissions defined in the Nuclear Illustrative Program (PINC) produced by the EC's Directorate-General for Energy in 2017 is now recognized. For first time, nuclear power has been mentioned as a solution in the final COP28 declaration. In addition, the international context (such as the Ukrainian crisis) is leading European countries to embark on a path towards energy sovereignty, for which nuclear power holds one of the keys.

A certain amount of preparation is required before this market can expand, since national regulations and industry practices tend to be fragmented. The challenge involves sharpening the competitive edge of the nuclear industry, which requires a harmonized set of industry best practices, and ensuring the highest levels of safety across Europe, especially in those countries without nuclear power plants. The decision to pursue the WS64 workshop responds to this challenge by opening up the process to include EU countries without nuclear power generation capacities.

Phase 4 objectives

The objectives of CEN/WS64 – Phase 4 are as follows:

- Strengthen synergistic ties between European experts on nuclear codes, working in different countries on different projects, with the aim of minimizing fragmented best practices across the nuclear industry, while offering a platform for technical discussions and creating possibilities for coding practices across Europe.
- Allow future nuclear project leaders to raise awareness of their projects' constraints and suggest changes to the codes. The workshop also allows all participants to express the changes that they would like to make to the codes and lets them incorporate their industrial expertise or the lessons learned from their own practices.
- Engage nuclear power plant operators who are open to the prospect of suggesting and discussing code proposals to address the issues of aging facilities and the difficulties in sourcing spare parts. These proposals are aimed at delivering appropriate solutions to the challenge of downsizing the nuclear supply chain in Europe.
- Raise awareness of AFCEN's codes among all entities involved in evaluating large commercial nuclear reactors during invitations to tender for the purpose of enabling them to correctly assess reactors based on AFCEN's codes. For example, the EPR is a pressurized water reactor based on a European design that is strongly supported by AFCEN's codes. The workshop allows partners who are not yet using AFCEN's codes to improve their knowledge of the codes and prepare to use them during a future implementation if applicable.

Organisation

As shown in the figure below, the Secretariat for Phase 4 of the workshop is shared between AFNOR (General Secretariat and PG2) and BNEN (PG1, PG3 and PG4). A Prospective Group (PG) has been set up to address the four technical subject areas, each of which is covered by an AFCEN code. PGs are responsible for suggesting changes to the codes and issuing pre-normative R&D proposals.

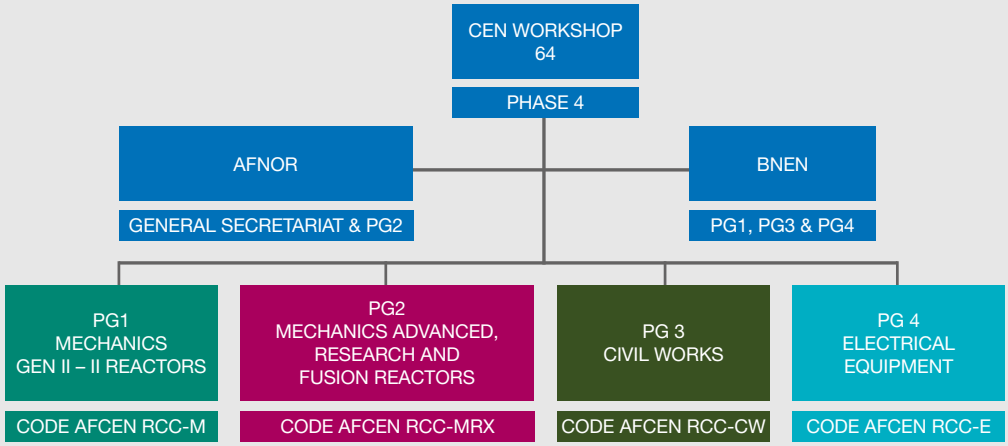


ILLUSTRATION OF AFCEN'S PARTICIPATION IN CEN

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

1.2.2.2 Participation in the HARMONISE Euratom Project

AFCEN is participating as a partner in the HORIZON-EURATOM HARMONISE project.

The consortium features 15 members, most of whom come from the ETSON network of European TSOs.

AFCEN's proposal proved to be successful, and the three-year project officially began in June 2022. The aim is to initially identify innovative concepts, systems, components and manufacturing processes for future fission and fusion reactors, before proposing procedures for evaluating those reactors and finally determining how they can be harmonized on a European scale.

In addition to taking part in the work package on communicating and disseminating information, AFCEN is mainly lending its expertise to the work package entitled "Codes and standards and digital twins of innovative nuclear power plants". The idea is to map the innovations that are already covered by existing codes and use that map to identify areas where there is a lack of coverage. There are plans to take a closer look at practices in other sectors of industry and ascertain how codes and standards are developed to address these new technologies, as well as the possibility of transferring the approval procedures (which have been successfully created to incorporate new technologies) to the nuclear sector. The objective is to weigh up the different approval options and determine which options hold the greatest promise for accelerating the speed and reliability of the procedures for authorizing and qualifying innovative nuclear reactors through codes and standards. Consortium members will subsequently propose a road map for improving and harmonizing codes and standards. In 2023, coding requirements were collected from innovative reactor projects.

1.2.3 China

Background

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

1.2 AFCEN'S ACTIVITIES IN FRANCE AND AROUND THE WORLD RELATIONSHIPS WITH PROJECTS

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

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

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

Chinese experts have strengthened their relationship with their French counterparts since 2015 by holding several technical sessions (Chinese Specialized Users Groups or CSUGs) to discuss the contents and interpretation of the codes. There are currently eight CSUGs covering all of AFCEN's technical fields. By December 2023, 68 CSUG meetings had been held in China, during which experts presented and discussed over 600 technical topics.

In 2017, AFCEN and NEA signed a long-term memorandum of understanding relating to nuclear standards and codes, which took AFCEN's codes one step closer to mainstream use in China. The agreement gives Chinese standardization bodies official permission to use AFCEN codes as reference for drafting the country's future nuclear standards (NB standards), while allowing for their translation into Chinese. The agreement also encourages regular technical discussions between China and France with a view to working together in enhancing the nuclear codes and standards by incorporating the highly dynamic feedback from the nuclear industries in both countries. Over the last three years, CGN and CNNC have completed the first round of translating AFCEN's codes. The Chinese versions of the seven codes, i.e. RCC-M, RSE-M, RCC-E, RCC-MRx, RCC-F, RCC-C and RCC-CW, have been published. A ceremony was held to mark this achievement during the CUG session in November 2023.

As part of the agreement with NEA, a new form of collaboration began in 2019, known as PGs or Project Groups. These groups are managed and incorporated into the CSUGs. They are aimed at providing a platform for French and Chinese experts to discuss a more specific range of joint topics concerning French and Chinese interests in greater technical detail. The first two PGs produced benchmarks for the different methods used in non-linearity and fatigue calculations. Work was finalized in 2022, following which modification requests will be issued, based on the results of the groups' efforts.

Activities in 2023

The series of events during "AFCEN China Week" from November 6 to 14 in China undoubtedly stand as one of the highlights of AFCEN's activities in China in 2023.

2023 also heralded the 40th anniversary of nuclear cooperation between China and France. To celebrate the date and move cooperation forward, AFCEN organized an event with its Chinese partners CGN, CNNC and CNEA.

"AFCEN China Week" was mainly divided into three parts:

1. CUG & CSUG: Meetings of the Chinese Users Group and Specialized Users Group
2. Third Franco-Chinese seminar on nuclear energy organized by AFCEN and CNEA
3. On-site visits in Zhangzhou and Sanmen

To coincide with the event, AFCEN's President and his delegation held a number of productive discussions with China's National Energy Administration (NEA), China Nuclear Industry Association (CNEA), China National Nuclear Corporation (CNNC) and China General Nuclear Power Corporation (CGN) to further cooperation on nuclear standards.

Meeting of the Steering Committee for the AFCEN Chinese Users Group (CUG)

On the morning of November 7, the Steering Committee for the AFCEN Chinese Users Group (CUG) held a meeting in Beijing, during which AFCEN's President Laurent Thieffry gave a welcome speech. The meeting was also attended by the French Embassy's Counselor for Nuclear Energy, the representative from the National Energy Administration (NEA), the representative from the Chinese Nuclear Safety Authority (NNSA), representatives from the nuclear industry and the chairs of the AFCEN Subcommittees and Chinese Specialized Users Group (CSUG). Participants reviewed cooperative ties between AFCEN and the CUG over the past five years, while discussing prospects and addressing several topics of joint interest relating to the nuclear industry and the standardization sector.

CUG GROUP

CEREMONY TO MARK THE RELEASE OF THE CHINESE VERSIONS OF AFCEN'S CODES

A ceremony was also held during the meeting to mark the publication of the Chinese versions of AFCEN's codes. These translated codes make it easier for Chinese users to apply and understand AFCEN's codes.

Finally, Mr. Zhou Jianping, Vice-Chairman of China General Nuclear Power Group (CGN), was elected as the new chair of the CUG.

On the afternoon of November 7 and 8, the AFCEN Chinese Specialized Users Group (CSUG) held its meetings in Beijing, with seven simultaneous sessions covering the different codes. The Chinese chairs or correspondents of the RCC-M, RSE-M, RCC-F, RCC-C, RCC-E, RCC-CW and RCC-MRx Subcommittees as well as the corresponding CSUG chairs led their respective meetings.

The AFCEN Subcommittee chairs and experts gave participants an overview of the updates to the various AFCEN codes and answered questions raised by Chinese users. In addition, experts from both parties presented a range of technical topics in their respective fields with the aim of improving mutual understanding of the technical issues.

1.2 AFCEN'S ACTIVITIES IN FRANCE AND AROUND THE WORLD RELATIONSHIPS WITH PROJECTS

7 CSUG

Third Franco-Chinese seminar on nuclear energy organized by AFCEN and CNEA

The third Franco-Chinese seminar on nuclear energy, which was organized jointly by AFCEN and the China Nuclear Industry Association (CNEA), took place in Beijing on November 9 and 10. Over 60 French representatives from EDF, Framatome and the Franco-Chinese Electricity Association (PFCE) attended the seminar alongside over 100 Chinese participants, especially from CNNC, CGN and SPIC.

During the seminar, AFCEN and CNEA renewed their memorandum of understanding to develop cooperation, while emphasizing their determination to pursue collaboration and discussions on nuclear activities.

AFCEN-CNEA SIGNING THE MOU

The seminar covered two key themes, namely nuclear standardization and advanced construction technologies. The first day focused on nuclear standardization, with representatives from nuclear equipment manufacturers, operators and national standardization organizations from both countries (especially BNEN and ISNI) to present the development of their own nuclear standards, share their feedback and offer suggestions to promote international cooperation on standardization. The day gave both parties a clearer insight into the directions of their respective standardization development strategies and served as a valuable experience for the future.

The second day took a closer look at welding and advanced construction technologies. To support the significant levels of growth in China's nuclear industry in recent years, Chinese nuclear companies are actively building new nuclear reactors and have accumulated a wealth of experience. At the same time, France has also announced plans to build new nuclear units. As such, both parties share the same goals when it comes to advanced construction technologies and welding. Experts from both parties presented their respective experiences in this particular field and held a series of in-depth discussions to strengthen mutual understanding of the latest technological advances and the results achieved on both sides.

On-site visits in Zhangzhou and Sanmen

The French delegation visited the construction sites of the Zhangzhou and Sanmen nuclear power plants from November 11 to 14 respectively and enjoyed productive technical talks with the experts on site.

SANMEN SITE VISIT

1.2 AFCEN'S ACTIVITIES IN FRANCE AND AROUND THE WORLD RELATIONSHIPS WITH PROJECTS

In addition to the "AFCEN China Week" event, AFCEN organized the following events in China in 2023:

CSUG RCC-M

The first meeting of the RCC-M 2023 Specialized Users Group (CSUG) was successfully held in Yinchuan on May 25, 2023. The meeting attracted over 50 members from various units across China, and French experts participated by means of a videoconference. The event led to in-depth discussions on over 30 technical topics, covering the code's chapters on design, materials, manufacturing, and so on.

RCC-M training

A new RCC-M training session was organized in Chongqing in September 2023. This session was subject to an agreement between CNEA and AFCEN. The session in question was the Chinese-language RCC-M course, which was formally certified by AFCEN in 2016. The course was attended by 49 trainees from 28 entities, including nuclear power plants, engineering firms, research & design consultancies, and manufacturers.

AFCEN takes part in China's nuclear trade fairs

AFCEN took part in China's nuclear trade fairs, namely CIENPI in Beijing in April and CINIE in Shenzhen in November.

AFCEN on WeChat

As part of the aim to improve communication with users and the general public, AFCEN has set up a public WeChat account in China (WeChat is the leading application used daily by over a billion Chinese people). The account has attracted 230 subscribers since it was created one year ago. A total of 35 articles have been posted, including AFCEN's latest news, interpretation forms for the standards and other types of content shared with subscribers.

The Chinese delegation attends the AFCEN Congress

Despite the lingering impact of pandemic restrictions, a 13-strong Chinese delegation, including experts from the RCC-M, RCC-F, RCC-MRx and RCC-CW CSUGs, took part in the seventh AFCEN International Conference in Paris on March 29 and 30, 2023.

Outlook for AFCEN in China in 2024

In 2024, AFCEN will work on simplifying the workflow for jointly drafting standards and/or codes in China. This specifically means that China and France will work closely together on drafting and preparing the corresponding texts for subjects of interest to both sides, such as a new process, a new method or an innovative material. AFCEN has forged a robust partnership with NEA in China and is already familiar with CNNC's and CGN's experts, which will form a solid foundation for its future endeavors. The exact operational details have yet to be worked out.

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

- As part of the MoU with NEA, continue supporting the official translation of the revised RCC codes in Chinese and form Project Groups (PGs) to pursue a new type of technical interaction.
- Through the CSUGs, trial a few mirror drafting groups in China with the hope that this new organization will build even stronger cooperative ties between French and Chinese experts on the RCC standards, with the prospect that the best practices of the Chinese nuclear industry could be transferred to AFCEN.
- Organize new meetings of the Chinese Specialized Users Groups to promote dialog on the use of AFCEN's codes in China, while encouraging technical discussions with particular emphasis on clarifying and interpreting specific aspects of the codes.
- Continue organizing a new series of training courses.

1.2.4 United Kingdom

AFCEN's activities in the UK are tied to the EPR reactor projects, which are drawing strength from AFCEN's codes for their design, construction and in-service inspection:

- Hinkley Point C (HPC): two units (construction phase),
- Sizewell C (SZC): two units (development phase - same design as HPC).

AFCEN is lending its support to the future operator (NNB: Nuclear New Build) and other parties involved in the UK's EPR projects in the following areas:

- Creation of AFCEN code Users Groups,
- Contribution to the working group on adapting the RSE-M code,
- Support with analyzing changes to the AFCEN codes following certification of the EPR model.

The AFCEN code Users Groups (UK Users Groups), which are supervised by an NNB-led Steering Committee, have the following missions:

- Facilitate uptake of AFCEN codes among industry and partners by minimizing discrepancies caused by poor interpretation of the codes,
- Collect users' requests and proposals (interpreting and modifying codes, drafting guides or local appendices), building on industrial practices and making AFCEN codes even more robust,
- Determine training needs and offer relevant solutions,
- Establish effective communication channels with AFCEN's Subcommittees.

The RCC-M Users Group is currently waiting to be reactivated.

The Users Group for the civil engineering code (ETC-C / RCC-CW) held a meeting at the HPC site in June 2023 and is busy preparing its next session for the spring of 2024. The RCC-E Users Group held a work session in January 2023 and is planning a further session in 2024 following a change in NNB group leader during 2023. A sit-rep on the progress achieved in adapting the RSE-M code to EPR reactors in the UK was presented mid-2023, and the RSE-M Subcommittee will keep a regular eye on the situation with a view to wrapping up the process by 2025.

HPC – LIFTING THE DOME ONTO UNIT 1

1.2.5 India

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

AFCEN has continued its policy of developing cooperative ties with India, especially in terms of training on the RCC-M code.

1.3 RELATIONSHIPS WITH STAKEHOLDERS

These initiatives are aimed at reinforcing collaborative ties between France and India as part of the JNPP project (Jaitapur Nuclear Power Project), which is entering the final round of discussions.

In 2024, AFCEN will continue supporting the proposal for six EPR units as part of the Jaitapur project.

STYLIZED VIEW OF THE JAITAPUR SITE

1.3.1 Relationship with ASN

AFCEN has been holding monthly meetings with ASN's Nuclear Pressure Components Division since 2015. This relationship of trust between both organizations was instrumental in the success of the three-year ESPN programme, which is covered by the 2018 editions of the RCC-M and RSE-M codes followed by the four-year roadmap whose products were introduced into the 2020 and 2022 editions of the RCC-M and RSE-M codes. AFCEN will pursue its efforts as part of an ESPN portfolio, which is aimed at seeing ASN continue to endorse the solutions proposed by the RCC-M code as being capable of satisfying the regulation's requirements for mechanical components.

1.3.2 Cooperation between organizations developing standards and harmonizing codes

As a major player in developing nuclear codes worldwide, AFCEN is naturally involved in cooperation and harmonization programs between codes and standards development organizations on an international scale. AFCEN's various initiatives bear testament to the association's ambition to promote the requirements and rules of its codes, integrate the local regulations and industry practices of its code users, and ensure that its codes benefit from best international practices.

Consequently, AFCEN actively contributes to the international group of organizations developing mechanical codes for the nuclear industry (SDO Convergence Board), which also includes ASME (US), JSME (Japan), KEPIC (South Korea), CSA (Canada), NIKIET (Russia), NTD (Czech Republic), ISNI (China) and R5/R6 (UK). Since 2010, this group has held four meetings a year. In March 2023, AFCEN hosted the SDO Convergence Board session in addition to its international conference. AFCEN voices its development objectives and contributes to convergence opportunities on the topics examined by the SDO Convergence Board, such as the use of ultrasonic testing for manufacturing inspections as an alternative to radiographic examinations.

AFCEN also interacts both directly and indirectly with the dedicated working groups for codes and standards in WNA/CORDEL, OECD/NEA and IAEA. Thus, AFCEN expresses its opinion on the WNA/CORDEL/MCSTF (Mechanical Codes & Standards Task Force) reports comparing mechanical codes and providing recommended pathways for better harmonizing practices. Furthermore, during an aging management seminar organized by OECD/NEA/CSNI/WGIAGE in June 2023, AFCEN presented how the RCC-M code integrates the effects of ageing into the design of mechanical components to guarantee their integrity over time. Lastly, AFCEN's codes are part of the wide range of standards that the IAEA examines in line with its Nuclear Harmonization and Standardization Initiative (NHSI), which aims to identify the harmonization strategies that can be harnessed to facilitate SMR development and deployment, particularly for mechanical components (RCC-M).

1.4 USE OF AFCEN CODES AROUND THE WORLD BACKGROUND

AFCEN codes are used as a reference for nuclear components and structures in over 100 power plants currently in operation (106), under construction (18) or in planning stages (26) around the world.

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

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

Project	Country	States of the reactors			Number of reactors	Number of reactors that are using or have used AFCEN codes		Series of codes used						
		P	C	E		for design and/ or construction	before commissioning and/ or for operation	RCC-M	RSE-M	RCC-E	RCC-CW	RCC-C	RCC-F	RCC-MRx
Nuclear power plants	France			56	56	16	56	X	X	X	X	X		
CP1	South Africa			2	2	2		X			X			
	South Korea			2	2	2		X			X			
M310	China			4	4	4	4	X	X	X	X			
CPR 1000 & ACPR1000	China			28	28	28	28	X	X	X	X			
CPR 600	China			6	6	6	6	X	X	X	X			
EPR	Finland			1	1	1		X						
	France		1		1	1	1	X	X	X	X	X	X	
	China			2	2	2	2	X	X	X	X	X	X	
	UK	2	2		4	4	4	X	X	X	X	X	X	
	India	6			6	6		X	X	X	X	X	X	
HPR1000	China	10	11	3	24	24	24	X	X	X		X	X	
	UK			2	2	2	2	X	X	X		X	X	
ACP 100	China		1		1	1	1	X						
EPR2	France	6			6	6	6	X	X	X	X	X	X	
PFBR	India		1		1	1								X
RJH	France		1		1	1								X
ITER	France		1		1	1								X
MYRRHA	Belgium	1			1	1								X
ASTRID	France	1			1	1								X
		26	18	106	150	110	134							

SUMMARY OF THE USE OF AFCEN CODES AROUND THE WORLD

1.4 USE OF AFCEN CODES AROUND THE WORLD BACKGROUND

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

Examples include :

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

1.4.1 France

Nuclear power plants

AFCEN codes have gradually been used by France's nuclear industry with 1,300 MWe reactors: Cattenom 2 (first vessel manufactured with RCC-M) and Flamanville 2 (first steam generator and first pressurizer manufactured with RCC-M).

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

EPR

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

EPR2

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

- RCC- M edition 2018,
- RCC-E edition 2019,
- RCC-CW edition 2018,
- RCC-F edition 2017,
- RCC-C (not yet defined),
- RSE-M (not yet defined).

Subsequent changes to the codes are occasionally monitored and analyzed by the EPR2 project.

ASTRID

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

This project is currently on standby.

RJH

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

- mechanical equipment with a sealing, partitioning, securing or supporting role,
- mechanical equipment that may contain or allow the circulation of fluids (vessels, tanks, pumps, exchangers, etc.) and their supporting structures.

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

FACTORY ASSEMBLY OF THE RJH REFLECTOR

ITER

ITER used the 2007 version of the RCC-MR code as a reference for its vacuum vessel. This code was chosen for the vacuum vessel on both technical grounds (the equipment and technology are covered by the code) and regulatory grounds (the code is adapted to French regulations). RCC-MRx (2012, 2015 and 2018 editions) has also been used for other components, such as the test blanket modules (China and Europe) and diagnostic systems (vertical neutron camera, and divertor neutron flux monitors)...

ITER VACUUM VESSEL

1.4 USE OF AFCEN CODES AROUND THE WORLD BACKGROUND

OTHER USES OF AFCEN CODES

Nuclear marine propulsion in France:
The construction of nuclear marine propulsion equipment (generally concerning the key equipment for the main primary and secondary systems) is based on a technical reference system known as the PN Compendium.
It is structured identically to the RCC-M code, since Naval Group's internal rules are technically very close to those of the RCC-M.

This particular organization is related to the history of nuclear propulsion: the skills of this industry were quickly codified into instructions and procedures that were progressively enriched by feedback and external normalization. In particular, since the publication of the code RCC-M, Naval Group has ensured the consistency of its rules with those of the code, and the overall consistency of design / manufacturing while maintaining the specific features of marine propulsion equipment (dimensions, accessibility and dismantling difficulties, stress resistance requirements for equipment in military-type applications, radiation protection requirements due to the crew's constant proximity, etc.). In order to improve the clarity of these rules, it became logical to adopt the editorial structure of the RCC-M.

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

In 2022, an expert from the RCC-M Subcommittee was appointed to take part in establishing the technical reference system known as the PN Compendium and evaluate the relevance of the chosen modifications for the PN Compendium, which could potentially be used by AFCEN.

In 2023, the complete PN Compendium was published. Work is continuing to update the PN Compendium with support from an AFCEN expert to reflect feedback and the latest developments in the external standardization sector.

1.4.2 China

AFCEN codes are widely used in China for the design, construction, in-service inspection of Chinese Generation II+ nuclear power plants (based on developments of the M310 technology introduced from France, called CPR-1000 and ACPR-1000) and Generation III reactors (especially EPR units and Hualong HPR-1000 units).

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

By the end of 2023, 54 of the 80 units in operation or under construction in China were using AFCEN codes, with 43 in operation and 11 under construction.

These units correspond to the M310, CPR-1000, ACPR-1000, HPR-1000, ACP-100, CPR-600 and EPR projects in blue font in the table below.

During 2023:

. The first concrete was poured in 2023 for Lufeng 2, a new HPR-1000 unit whose design has been modeled on AFCEN's codes.

. The first HPR-1000 unit of CGN, Fanchenggang Unit 3 was commissioned.

Type of reactor	Units in operation (no.)	Units under construction (no.)	Total number
300 MWe	Qinshan I (1)		1
M310	**Daya Bay (2) Ling'Ao (2)**		**4**
CPR-1000 & ACPR-1000	**Ling'Ao (2) Hongyanhe (6) Ningde (4) Yangjiang (6) Fangchenggang (2) Fuqing (4) Fangjiashan (2) Tianwan phase III (2)**		**28**
HPR-1000	**Fuqing (2) Fangchenggang (1)**	**Fangchenggang (1) Zhangzhou (2) Taipingling (2) SanAo (2) Changjiang (2) Lufeng (2)**	**14**
CPR-600	**Qinshan II (4) Changjiang (2)**		**6**
CANDU 6	Qinshan III (2)		2
AP1000	Sanmen (2) Haiyang (2)		4
CAP-1000		Sanmen (2) Haiyang (2) Xudapu (1) Lianjiang (1)	6
EPR	**Taishan (2)**		**2**
VVER-1000/428 (AES-91)	Tianwan (4)		4
VVER-1200 (AES-2006)		Tianwan IV (2) Xudapu (2)	4
HTR-PM	Shidaowan (1)		1
CFR-600		Xiapu (2)	2
CAP1400		Shidaowan (2)	2
ACP100		Changjiang (1)	1
Total number	**55**	**26**	**81**

LIST OF REACTORS CURRENTLY UNDER CONSTRUCTION OR IN OPERATION IN CHINA AS OF LATE 2023
(REACTORS HIGHLIGHTED IN BLUE ARE THOSE USING AFCEN CODES)

1.4.3 India

PFBR and FBR

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

1.4.4 United Kingdom

EPR projects

AFCEN's ambitions for the United Kingdom are tied to the development of EPR projects:

- Two reactors under construction at the Hinkley Point C site (HPC),
- Two other reactors in the planning stages at Sizewell C (SZC).

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

- RCC-M 2017 edition 2007 (+ 2008-2009-2010 addenda) for mechanical components,
- RCC-E 2012 edition for electrical components,
- ETC-C 2010 edition for civil engineering works,
- The project's fire protection rules are based on EDF's proprietary specifications and the EPR's specific design requirements (UK version of ETC-F Revision G of 2007), which were subsequently included in AFCEN's collections (ETC-F, 2010 edition), including a specific appendix to incorporate British fire protection regulations.

1.4 USE OF AFCEN CODES AROUND THE WORLD BACKGROUND

AFCEN codes were evaluated by the British Safety Authority (ONR – Office for Nuclear Regulation) as part of the GDA (Generic Design Assessment), which culminated in design acceptance confirmation for the EPR design in the United Kingdom in December 2012. The project sets out the terms for applying the codes through a number of project-specific requirements.

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

In addition, a group of independent experts endorsed the methods for analyzing the impacts of defects detected during operation in RSE-M (Appendix 5.4), which are used in design justification studies, against current practices in the United Kingdom (R6 Rules).

In a bid to offer support and assistance to the parties involved in the UK's EPR projects in using AFCEN's codes, three UK Users Groups have been set up: the first on the RCC-M code (created in 2013), the second on the ETC-C / RCC-CW civil engineering code (created in 2016) and the third on the RCC-E code (created in 2021).

Work on the HPC project has been ongoing since the final investment decision was taken in September 2016. Major progress was achieved in 2023 on the buildings (containment dome lifted onto unit 1) and the marine structures (water intakes), and work began on assembling the electromechanical systems.

In 2022, the UK Government gave the green light for the development of the EDF-led project to build two EPRs at the Sizewell site, while taking the decision to invest in the SZC project, which paves the way for a likely final investment decision from EDF in 2023. Work is also forging ahead on preparing the SZC project with the aim of achieving the final investment decision in 2022, based on a replication of the HPC design and the use of the same codes.

HPR-1000 project

The UK version of the HPR-1000 reactor featuring Chinese technology (UK Hualong) has been granted Design Acceptance Confirmation by the British Safety Authority after successfully completing the GDA. The design for this reactor is mainly based on a reactor that is currently being built in China (Fangchenggang 3). The design is primarily inspired by AFCEN's codes, thereby taking advantage of the lessons learned from the EPR project (incorporated in the codes). However, there are no longer any plans to build this reactor on UK soil.

1.4.5 Finlande

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

1.4.6 South Africa and South Korea

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

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

1.4.7 Participation in WNE 2023

The 2023 edition of the World Nuclear Exhibition proved to be a tremendous success. AFCEN welcomed a number of visitors to its stand (users, clients and interested parties), which provided the association with the ideal opportunity to spread the word about its codes. The event also gave AFCEN chance to organize a workshop to present the editorial program for its codes and technical documents.

WNE 2023

afcen

Shaping the rules for a sustainable nuclear technology

EDITORIAL ACTIVITY

REVIEW

2.1 CODES AND OTHER EDITORIAL PRODUCTS

AFCEN's published materials include design and construction codes, and technical publications (PTAN).

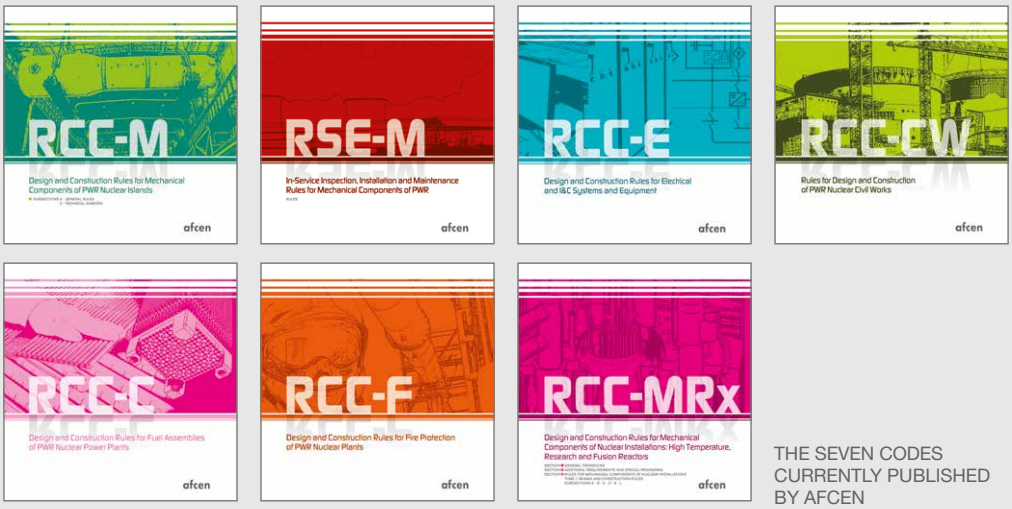
AFCEN's editorial activities involve:

- Producing and monitoring the work programme for the codes and technical publications,
- Authoring and investigating proposed changes to the codes and technical publications,
- Approving the release of changes to the codes and technical publications.

Editorial activities are performed by the Subcommittees in charge of the codes, and by the Editorial Committee in case of cross-functional topics. The Editorial Committee is also responsible for giving work the final seal of approval.

2.1.1 AFCEN codes

AFCEN currently publishes seven codes.



THE SEVEN CODES CURRENTLY PUBLISHED BY AFCEN

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

Two codes were revised in 2023, namely RCC-CW and RCC-C. The RCC-F code was originally due for release in 2023, but its publication has been pushed back to 2024.

The following table lists the codes available from AFCEN codes distributors.

CODE		EDITIONS AVAILABLE
RCC-M	Design and construction rules for mechanical components of PWR nuclear islands	. 2000 and 2007 editions, with addenda . 2012 edition, with addenda in 2013, 2014, 2015 . 2016, 2017 and 2018 editions . 2020 and 2022 editions
RSE-M	In-Service inspection, installation and maintenance rules for mechanical components of PWR	. 2010 edition, with addenda in 2012, 2013, 2014, 2015 . 2016, 2017 and 2018 editions . 2020 and 2022 editions

CODE		EDITIONS AVAILABLE
RCC-C	Design and construction rules for fuel assemblies of PWR nuclear power plants	. 2005 edition, with addenda in 2011 . 2015 edition . 2017, 2018, 2019, 2020 editions . 2022, 2023 editions
RCC-F	Design and construction rules for fire protection of PWR nuclear plants	. 2010 and 2013 ETC-F editions . 2017 and 2020 RCC-F editions . Next edition: 2024

LIST OF AFCEN CODES EDITIONS AVAILABLE

CODE		EDITIONS AVAILABLE
RCC-E	Design and construction rules for electrical and I&C systems and equipment	. 2012 edition . 2016 edition . 2019 edition . 2022 edition
RCC-CW	Rules for design and construction of PWR nuclear civil works	. 2010 and 2012 ETC-C editions . Annual RCC-CW since 2015, then RCC-CW editions every two years, starting in 2021 . 2023 edition

CODE		EDITIONS AVAILABLE
RCC-MRx	Design and construction rules for mechanical components of nuclear installations: high-temperature, research and fusion reactors	. 2012 edition, with addenda in 2013 . 2015 edition . 2018 edition . 2022 edition

LIST OF AFCEN CODES EDITIONS AVAILABLE

There are several reasons for updating AFCEN codes:

- Users' needs,
- Feedback,
- Developments prompted by scientific and technical breakthroughs,
- Changes to legislation and standards,
- Editorial improvements.

These changes bear testament to AFCEN's ambition of ensuring that its codes reflect the latest and highest level of technical knowledge in order to guarantee safe nuclear facilities, while making sure that they are continually relevant to industry (implementation capacities, effectiveness and optimization) and satisfy regulatory requirements. These changes may lead to an extension in the codes' scope of application. Some changes are introduced into the codes as probationary phase rules (RPP). Users are under no obligation to apply the RPP rules. The decision to apply the rules is at the user's discretion and should help gather the necessary feedback before imposing the rules in the codes. The main changes to the codes are described in the specific sections of this annual report for each Subcommittee.

AFCEN is reinforcing how the different changes are characterized (type and impact) so that people using earlier versions of the code can easily assess the impact of the modifications and determine whether there is any need to update their codes and standards according to the context and challenges specific to their projects. The RCC-M and RSE-M codes are prime examples, for which the following modification form (MF) classifications were published in 2023: AFCEN-PTAN-07001-2023 (Classification of RCC-M code modification forms - 2020 and 2022), AFCEN-PTAN-09001-2023 (Classification of RCC-M modification forms up to and including the 2018 edition), and AFCEN-PTAN-09002-2023 (Classification of RSE-M modification forms from the 2022 edition onwards). Similarly, the changes between two successive editions of the RCC-E and RCC-F codes are characterized in gap analysis documents.

Concerning the deployment of the Requirements Engineering (RE) strategy in AFCEN's codes:

- The RSE-M code has completely overhauled the structure and wording for the rules in its 2022 edition,
- The RCC-CW code has transformed the wording for Chapters G (General) and AM (Aging Management) in its 2023 edition (the other chapters are currently being revised),
- The RCC-F code has prepared its entire text in RE format ahead of its 2024 edition,
- The RCC-E code has trialed a dedicated tool (POLARION) to support requirements management,
- The RCC-C code also began this process in 2022 and will continue in 2024.

2.1 CODES AND OTHER EDITORIAL PRODUCTS

The following work began in 2023 for all the mechanical codes (RCC-M, RSE-M and RCC-MRx):

- French/English glossary of terms and definitions,
- Mechanical fast fracture analysis methods : the aim is to compile all the methods that can be used for the mechanical analysis of fast fracture resistance in a cross-cutting document that can be applied regardless of the code used, for the purpose of harmonizing and streamlining the process and ensuring greater consistency,
- Two new features are now available on the AFCEN website (www.afcen.com):

  . A tool for viewing the Interpretation Requests (currently for the RCC-M and RSE-M codes),

  . Errata (for all the codes).

2.1.2 AFCEN's technical publications (PTAN)

AFCEN's technical publications (PTAN) comprise the following types of documentation:

- Studies to complement and develop certain topics within the codes,
- Criteria that expand on the reasons for the rules in the codes,
- Guides to accompany the use of the codes.

Studies

AFCEN carries out a host of studies to explore topics relating to the fields covered by the codes (review of industry best practices, R&D dvelopments, etc.). They are not directly related to the use of the codes.

Examples include:

- RCC-CW: a guide on French experience and practice of seismically isolated nuclear facilities; a study report on seismic dissipative devices.

Criteria

AFCEN is focused on its objective of publishing documents called criteria, which provide background information on the rules in its codes. The criteria provide useful and educational insight into the codes.

Examples include :

- The RCC-M code criteria,
- The criteria on Appendices 5.4 and 5.5 of RSE-M (methods and criteria for analyzing the impacts of defects), and the criteria for taking account of the warm pre-stressing (WPS) phenomenon in the vessel's fast fracture resistance.

Guides

The guides are designed to help interested parties use the codes by offering recommendations, solutions or alternatives for meeting the requirements in the codes. They tend to be referenced by the codes or complement their use.

Examples include :

- RCC-E: a guide identifying the requirements needed to provide Class III qualification for systems using equipment families certified according to IEC 61508; a guidebook for defining the project data associated with the code,
- RCC-F: an analysis of the code's conformity with WENRA reference safety levels,
- RCC-MRx: a guide containing a series of recommendations for the seismic design rules for components; a guide to obtain the characteristic data of a new material needed for the application of the design rules,
- RCC-M, RSE-M: a complete set of guides that explain how to fulfil the essential safety requirements of the ESPN regulation,

- RSE-M : a guide for qualifying ultrasonic NDT (Non-Destructive Testing) processes,
- RCC-C: a guide specifying the measures that need to be taken to demonstrate qualification of the scientific computing tools for fuel core studies in response to Guide 28 issued by the French Nuclear Authority,
- A guide explaining the methodological procedure for addressing nonconformities when manufacturing new N1 level equipment.

In 2023, in addition to updating or translating a number of PTAN publications into English, two new guides joined the RCC-M collection in 2023:

- AFCEN-PTAN-07002-2023 : defines the requirements that laboratories must meet when carrying out drop-weight tests according to ASTM E208-75 (single-pass weld bead),
- AFCEN-PTAN-07006-2023 : defines the rules for designing and manufacturing low-risk pressure piping (“Category 0”), QC piping or Class 3 piping, as an alternative to volumes D or E in RCC-M.

Since 2022, AFCEN has also published guides for assessing and self-assessing the level of proficiency in the codes (currently available for RCC-M and RCC-E).

The technical publications available are listed in Appendix B.

2.1.3 ESPN programme

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

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

AFCEN / GSEN joint vision of the ESPN conformity assessment process

“Stakeholders confidently engaged in a stable, predictable and organised conformity assessment process with manufacturers, who ensure that nuclear pressure equipment conforms to requirements, and with Inspection Bodies, who verify compliance, so that compliant equipment can be provided to operators on time.”

Building on the work for the 2018 edition and in keeping with this vision, AFCEN launched a “four-year roadmap” (2019 – 2022) in 2019 to sustain the momentum and allow manufacturers and operators to integrate the regulation into their industrial processes with greater reliability.

Since 2023, work has been ongoing as part of the “ESPN portfolio”, which is focused on the same objectives as the four-year roadmap:

- Maintain the endorsement received from ASN and GSEN following the three-year programme,
- Incorporate changes in technologies and practices into the codes, following feedback from industry professionals, AFCEN, GSEN and ASN,
- Work alongside ASN and GSEN in examining the impacts of changes in regulations,
- Give a more industrial nature of the code, especially by aiming to ensure consistency between AFCEN’s methodological guides and the assessment standards produced by GSEN/AQUAP or ASN.

2.1 CODES AND OTHER EDITORIAL PRODUCTS

Unlike the four-year roadmap, the goal is to move away from the overarching programmatic vision that was adopted for the work at the beginning of the period (i.e. four-year roadmap) and instead embrace an active and prioritized vision shared between AFCEN, ASN and GSEN ("ESPN portfolio" of subjects that AFCEN / ASN / GSEN will work on together). In 2023, AFCEN consolidated the principles for managing this portfolio.

In 2023, AFCEN achieved major progress with its work on the ESPN portfolio as follows:

- AFCEN continued work on welding feedback, and modifications are planned for RCC-M 2024,
- AFCEN lent its support to ASN in updating guide 8,
- AFCEN assisted GSEN in assessing the code's ability to ensure compliance with Essential Safety Requirement 2.2.3 a) (safety and uncertainty factors) for N1 level equipment,
- AFCEN has revised the PTAN publication covering the technical qualification process for parts (AFCEN PTAN 07005-2023),
- AFCEN has revised the PTAN publication covering the retention of material resulting from the manufacture of parts of N1 level nuclear pressure equipment (AFCEN PTAN 07004-2023),
- AFCEN has revised the radiation protection guide (AFCEN PTAN 07003-2023),
- AFCEN has produced an e-learning module entitled "Methodology for addressing nonconformities" to support the implementation of the AFCEN-PTAN-01001-2022 guide. This module has been uploaded to the AFCEN and GIFEN websites,
- A commissioned study has been launched into the topic of data integrity in anticipation of preparing a best practice guide (not directly linked to the ESPN portfolio, but monitored during the ESPN Steering Committee meetings with ASN),
- A study has been commissioned to take account of the latest feedback on local heat treatment.

At the same time, AFCEN is working alongside ASN and GSEN to set up an organization, especially with the AFCEN notice entitled "Measures relating to the RCC-M code for ESPN conformity assessments", to help ensure that the 2018 edition of the RCC-M code is endorsed as "appropriate for providing provisions and methods allowing manufacturers to ensure that their N1 nuclear pressure equipment conforms to the essential safety requirements of the ESPN Regulation and allowing authorized organizations to verify compliance", subject to a finite list of conditions.

AFCEN is also continuing to take part in the deployment of the « ESPN Digital » tool, which went into sustainable mode at the end of June 2023 and which aims to standardize and enhance conformity assessments based on the work led by AFCEN and GSEN. AFCEN is checking that its technical publications are correctly incorporated in the ESPN Digital process. For further information about ESPN Digital, visit the LinkedIn page for the ESPN Digital project *(https://www.linkedin.com/groups/13885206).*

2.2 MECHANICAL FIELD FOR PRESSURIZED WATER REACTORS RCC-M

THE RCC-M CODE

2.2.1 Purpose and scope

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

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

RCC-M covers the following technical subjects:

- sizing and behavior analysis,
- choice of materials and procurement,
- fabrication and control, including:
  - associated qualification requirements (procedures, welders and operators, etc.),
  - control methods to be implemented,
  - acceptance criteria for detected imperfections,
- documentation associated with the different activities covered, and quality assurance.

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

2.2.2 Use and background

Use

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

2.2 MECHANICAL FIELD FOR PRESSURIZED WATER REACTORS RCC-M

- France's last 16 nuclear units (P'4 and N4),
- 4 CP1 reactors in South Africa (2) and South Korea (2),
- 54 M310 (4), CPR-1000 (28), CPR-600 (6), HPR-1000 (14) and EPR (2) reactors in service or undergoing construction in China,
- 4 EPR reactors in Europe: Finland (1), France (1) and UK (2).

Background

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

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

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

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

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

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

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

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

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

The 2020 edition integrates 90 modification forms, some of which relate to the commissioned studies into the ESPN Regulation; some modifications concern Appendices ZY and ZZ, while others are improvements resulting from the work on the three-year ESPN programme (2015-2018). ASN is currently analyzing whether the 2020 edition of the code conforms to the requirements of the ESPN Regulation. AFCEN provided GSEN with the modification forms relating to appendices ZY and ZZ of the 2020 edition of the code. After examining the forms, GSEN concluded that the code continued to conform to the requirements of the ESPN Regulation.

2.2.3 Edition available in 2023

The latest available edition is the 2022 edition. It integrates 136 modification forms to reflect users' needs, the latest developments in technology, feedback and changes in regulations and standards.

The changes implemented in the 2022 edition relate to the following provisions :

- Incorporation of the improvements that were identified when testing the code for conformity with the essential requirements of French regulations (Annex I of Directive 2014/68/EU and Appendices I to IV of the French Nuclear Pressure Equipment Regulation of December 30, 2015, as amended by the "ESPN" Regulation of September 3, 2018), or during their evaluation, with design-related changes,
- Additional requirements in Appendix ZY relating to compliance with specific requirements of the Regulation of December 30, 2015 as amended, i.e. Article 8-1, Article 8-2 and Article 8-4,
- An overhaul of the rules in A 5000 on the requirements for establishing and implementing a quality management system,
- An overhaul of RPP no. 1, which is now based on the quality management systems standard ISO 19443, which specifies requirements for the nuclear energy sector,
- The introduction of a new STR (M 3209) concerning the supply of bars for manufacturing latch housings of control rod mechanisms,
- The introduction of additional requirements for carrying out drop-weight tests with reference to an AFCEN technical publication (PTAN),
- An overhaul of Appendix Z G,
- The introduction of RPP no. 7 and RPP no. 8, which propose alternative methods for analyzing fatigue,
- The introduction of RPP no. 9 on the behavioral analysis of the multi-perforated medium for tube sheets,
- The introduction of RPP no. 10, which proposes alternative rules for designing bolted circular flanged connections,
- The introduction of the measures that need to be taken for TOFD and PA ultrasonic testing, and the acceptance criteria for full penetration butt welds with level 3 ferritic steel,
- A complete overhaul of the measures that need to be taken for magnetic particle testing,
- Changes in welding requirements based on feedback,
- Incorporation of the requirements specified in the 2017 version of ISO 15614-1 on the welding procedure test,
- The addition of a requirement for preventing adverse thermal gradients during the local heat treatment of circumferential welds on cylindrical bodies,
- A complete revision of the paragraphs in RPP no. 4 covering the seismic qualification of valves, and the addition of procedures for qualifying safety valves under normal and accidental conditions, and the introduction of rules for pump testing

The 2022 edition has been available in English since the end of 2023.

CONTENTS OF THE 2022 EDITION OF THE RCC-M CODE

SECTION I - NUCLEAR ISLAND COMPONENTS
. SUBSECTION "A": GENERAL RULES
. SUBSECTION "B": CLASS 1 COMPONENTS
. SUBSECTION "C": CLASS 2 COMPONENTS
. SUBSECTION "D": CLASS 3 COMPONENTS
. SUBSECTION "E": SMALL COMPONENTS
. SUBSECTION "G": CORE SUPPORT STRUCTURES
. SUBSECTION "H": SUPPORTS
. SUBSECTION "J": LOW PRESSURE OR ATMOSPHERIC STORAGE TANKS
. SUBSECTION "P": CONTAINMENT PENETRATION
. SUBSECTION "Z": TECHNICAL APPENDICES
SECTION II - MATERIALS
SECTION III - EXAMINATION METHODS
SECTION IV - WELDING
SECTION V - FABRICATION
SECTION VI - PROBATIONARY PHASE RULES

2.2 MECHANICAL FIELD FOR PRESSURIZED WATER REACTORS RCC-M

2.2.4 Next edition

In accordance with its sales model, AFCEN is now planning to publish editions every two years instead of addenda. The next edition is scheduled for 2024.

In addition to pursuing its activities relating to the ESPN Regulation, AFCEN has produced an editorial program for the RCC-M Subcommittee to cover the 2023-2026 period and define the key improvements that need to be made to the RCC-M code to reflect project requirements and industrial practices. The main changes planned for the 2024 edition are as follows:

- Continue integrating modifications to take account of welding feedback (main secondary system of the FA3 EPR),
- Continue updating Appendix Z G on the risk of fast fracture,
- Ensure coverage for the non-alloy P355 steel used for the lines in the main secondary system,
- Incorporate feedback on the use of inspection methods using advanced ultrasonic (TOFD and UT-PA) and digital radiographic techniques,
- Take account of feedback on local stress-relieving heat treatment.

2.2.5 RCC-M technical publications

Publication of interpretation requests

A tool for viewing interpretation requests (IRs) is available directly in the RCC-M section of the www.afcen.com website. IRs can be looked up by their number or by the section in the code. A filter is also available: by drafting group and/or edition and addendum and/or section.

RCC-M criteria

The RCC-M code criteria were published late 2014. This 550-page document, produced in both English and French, takes a look back at the code's background since the decision was taken for its creation. The technical origins of the code and the changes made to the recommendations until publication of the 2007 edition are explained from the point of view of an engineer who was required to draft a design specification in alignment with the RCC-M code.

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

Guides

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

In addition, new PTANs were published in 2023:

- AFCEN-PTAN-07001-2023: "Classification of RCC-M modification forms - 2020 and 2022 editions". This publication classifies the modification forms introduced into the 2020 and 2022 editions of the RCC-M code according to their impact on the user,
- AFCEN-PTAN-07002-2023: "Guide for conducting drop-weight tests according to standard ASTM E208-75"; this PTAN is mandatory under RCC-M 2022,
- AFCEN-PTAN-07003-2023: "Radiation protection guide for the design of nuclear pressure components in PWR plants in France". This is a revision of the AFCEN-RM 13-067-B PTAN,
- AFCEN-PTAN-07004-2023: "Retention of material resulting from the manufacture of parts of N1 level nuclear pressure equipment". This is a revision of the AFCEN-RM-18-056-A PTAN.

- AFCEN-PTAN-07005-2023: “ESPN technical qualification”. This is a revision of the RM 19-327-A PTAN,
- AFCEN-PTAN-07006-2023: “Rules for the design and construction of low-risk pressure piping.”

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

The ESPN programme is described in Section 2.1.3 of this annual report. An initial three-year programme (2015-2018) was launched. With the aim of maintaining ASN’s and GSEN’s endorsement of the RCC-M code following the three-year programme, AFCEN released a four-year road map in 2019 (2019-2022). The rules for organizing the follow-up to the programme are being changed to adopt an active and prioritized vision shared between AFCEN, ASN and GSEN of the subjects that they will work on together (“ESPN portfolio”).

2.2.7 2023-2026 editorial programme

In addition to the topics relating to the ESPN Regulation, the RCC-M Subcommittee has defined its editorial roadmap, which identifies the different technical topics that it wishes to develop over the 2023-2026 period with assistance from its members, with the focus on the 2024 and 2026 editions.

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

- respond to the requirements expressed by our users and projects,
- incorporate feedback from users and projects,
- integrate developments prompted by technical and scientific progress,
- incorporate changes in industry practices and standards,
- include changes in safety regulations and standards,
- assist with harmonizing practices in the different codes,
- extend the code’s scope of application.

As part of these activities, some working groups are actively looking to propose changes to the code on the following topics (some of which are part of the ESPN portfolio):

- Continued work on integrating welding feedback,
- Integration of advanced UT methods (TOFD and Phased Array), digital radiography and eddy current methods for inspecting pipe welds,
- Continued work on modifying Appendix Z G on fast fracture resistance with the aim of introducing new exemption criteria and supplementing the material data,
- The development of rules for temperature control during local heat treatment,
- Continued work on the design by analysis rules for tube support plates (RPP no. 9) to cover fatigue damage,
- Update to Volume S 8000 on hard coatings,
- Update to Volume H on supporting roles,
- Integration of “environmental fatigue” RPPs into the code.

A number of topics identified in this program should also be relaunched in 2024, including:

- Coverage of progressive deformation in Appendix Z C on non-linear finite element analyses,
- Continued work on the rules for calculating flanged joints, and characterizing and accepting joints,
- Resumption of work on drafting an appendix to cover seismic design for piping.

2.2 MECHANICAL FIELD FOR PRESSURIZED WATER REACTORS RCC-M

2.2.8 International challenges

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

In terms of the events in 2023, a half-day session was organized in May 2023 for the CSUG (Chinese Specialized Users Group) with five experts from the RCC-M Subcommittee. This meeting was conducted as a videoconference. The robust logistics measures taken during the Covid-19 pandemic were instrumental in enabling the session to go ahead. This meeting attracted around 50 Chinese members from various local companies and allowed the experts to answer several dozens of questions which, where applicable, resulted in code interpretation or modification requests. The RCC-M editorial program for 2023-2026 was presented, and the AFCEN China team gave an overview of the 2023 outlook for AFCEN's activities in China. During the AFCEN Week event held in China in November 2023, a two-day CSUG meeting was held in Beijing and included two experts from the Subcommittee. Approximately 30 technical topics were covered.

In 2023, the RCC-M Subcommittee also took part in several international working groups and participated in the associated events:

- RCC-M experts play an active role in the Convergence Board of Mechanical Standards Development Organizations (SDO Convergence Board). The Board usually meets during ASME Code Week, but decided to hold a meeting at the AFCEN International Congress in Paris in March 2023 and again at JSME (June 2023) and KEPIC (September 2023). Members are currently taking an in-depth look at several topics for harmonization. The way in which the RCC-M code considers aging phenomena was presented during the June 2023 meeting.
- At the European level, Phase 3 (launched in 2019) of the GEN II/III Prospective Group (PG1) of CEN/WS64 was finalized (refer to the dedicated paragraph in Section 1.2.2), and Phase 4 was given the green light in July 2023.

In 2024, there are plans to maintain international initiatives:

- Focusing on international comparisons, with the SDO Convergence Board in line with the expectations of the other SDOs,
- Furthering the aims of OECD/NEA/CNRA, by continuing relevant work on equivalent codes and regulations alongside the Safety Authorities in the WGCS,
- By leading AFCEN's Chinese Users Groups, and the corresponding international training courses,
- At the European level as part of the CEN/WS64 workshop.

To know more about RCC-M code

2.3 MECHANICAL FIELD FOR PRESSURIZED WATER REACTORS (OPERATION) RSE-M

THE RSE-M CODE

2.3.1 Purpose and scope

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

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

2.3.2 Use and background

Use

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

To date:

- the 56 units of France nuclear fleet enforce the in-service inspection rules of the RSE-M code,
- the operation of 43 commissioned units in China's nuclear infrastructure, corresponding to the M310, CPR-1000, ACPR-1000, CPR-600 and EPR reactors, is based on the RSE-M code (since 2007, use of AFCEN codes has been required by NNSA for Generation II+ reactors).

Background

AFCEN drafted and published the first edition in July 1990.

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

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

2.3 MECHANICAL FIELD FOR PRESSURIZED WATER REACTORS (OPERATION) RSE-M

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

The 2016 edition is in keeping with the work that has been pursued since the 2010 edition by continuing to update the existing version and incorporating EPR aspects (FA3).

The 2017, 2018 and 2020 editions supplement the technological, legislative (especially ESPN) and international developments that occurred in 2016.

2.3.3 Edition available in 2023

The latest published edition is the 2022 edition. This new version of the code heralds a major change. In addition to switching over to the Requirements Engineering format, which has led to a thorough overhaul of the code's architecture, this new edition clarifies and considers the most recent practices to ensure that the RSE-M code retains its benchmark status.

This in-depth change required a major commitment and collaboration by all the process owners, contributors and users involved in drafting the code, with the constant concern of ensuring relevance, consistency and simplicity for the code's users.

In practice, volumes A, B, C and D of the previous RSE-M editions have been reformulated in the Requirements Engineering format for this 2022 edition, and RSE-M has also been restructured. The general rules are still identified by the letter A in the requirements engineering system, and special rules are designated by the letters B, C and D, depending on the classification of the equipment covered.

AFCEN adopted the following principles when it came to reformulating and restructuring the RSE-M code:

- RSE-M is intended to serve as a contractual tool between the operator and its contractors. Therefore, it includes requirements for the Operator to help ensure that contracts are established correctly, and requirements for its contractors for performing in-service inspection and maintenance operations.
- RSE-M is heavily influenced by EDF's practices and feedback, but is not intended to copy EDF's operational documents. It is designed to define the prior or general requirements and thereby prevent them from being duplicated in the Operator's various specifications.
- Since RSE-M also draws significantly on French regulations, the specific aspects of French legislation are identified and covered wherever possible by referring to the regulations.
- The appendices have not been converted to the requirements engineering format, especially since they contain tables, figures and formulas. Consequently, the sections in the code that almost exclusively contain tables (e.g. B 8500 in the 2020 edition) or figures (A 1235 in the 2020 edition) have been moved to the appendices in the 2022 edition.
- The appendices that are visibly unused (no user feedback, modification requests (MRs), interpretation requests (IRs) or recent updates), that are not up-to-date with practices, that fall outside the scope of the RSE-M code as defined, or that are redundant with the elements covered in the RSE-M rules, have been removed.
- In light of the fully revamped 2022 edition of the RSE-M code, the amendments made to the general and special rules (previously volumes A, B, C and D) by the modification forms (MFs) are not identified by bars in the margin. Since the appendices have not been converted to the requirements engineering format and fully overhauled, the amendments made to the appendices by the MFs are identified by bars in the margin.

Requirements engineering is based on the following principles:

- Requirements engineering involves clearly identifying the person responsible for the requirement.
- Every requirement is unique. Redundancies between chapters are eliminated.
- Each requirement deals with a unique subject.

The RSE-M code on in-service inspection and maintenance is divided into three sections:

- General rules covering:
  - Use of the code,
  - General inspection and maintenance requirements.
- In-service inspection rules,
- Maintenance rules.

The following table shows the breakdown that has been chosen for the 2022 edition, with the last column showing the corresponding chapters or appendices in the 2020 edition.

RSE-M (a)			Ed 2022	Ed.2020
Règles communes	**Règles d'utilisation du RSE-M**		**1000**	
		Règles d'utilisation du RSE-M	1100	A 1000
		Domaine d'application du RSE-M	1200	A 1000
		Qualité	1300	A 1400
		Liste des codes, publications techniques et normes applicables	Annexe 1.1	Annexe 1.3
		Figures pour le classement en catégories	Annexe 1.2	A 1235
		Règles relatives à la réalisation d'un essai hydraulique ou d'une épreuve hydraulique (b)	Annexe 1.3	A 2500
	Propreté (c)		**2000**	
		Limitation des espèces polluantes	2100	A 1640
		Mise en propreté et contrôle de la propreté	2200	A 1650 et A 1660
		Conservation à l'arrêt	2300	A 1700
		Règles de mise en propreté et de contrôle de la propreté	Annexe 2.1	A 1600
Surveillance en exploitation	**Inspections et requalifications périodiques (d)**		**3000**	
		Inspections périodiques (programme, point zéro/*VCI* et réalisation)	3100	§ 3000
		Requalifications périodiques	3200	§ 2000
	Examen Non Destructifs et autres méthodes d'examen (e)		**4000**	**§ 4000**
		Certification, qualification et habilitation du personnel	4100	A 4700
		Description des méthodes END et autres méthodes d'examen	4200	A 4200 et A 4600
		Qualification d'un END	4300	§ 4300
		Mise en œuvre des END et autres méthodes	4400	A 4800 et A 4900
		Aménagement des profils et états de surface	Annexe 4.1	Annexe 4.1
		Documentation relative aux END	Annexe 4.2	Annexe 1.6 (IV et V)
		Exemples de qualification d'application END	Annexe 4.3	Annexe 4.3 (partiel)
		Méthodes END, surveillance, contrôle	Annexe 4.4	Annexe 4.4 et B 4400
	Traitement des Indications (TI) (f)		**5000**	**§ 5100**
		Détection	5100	§ 5200
		Discrimination	5200	§ 5200
		Traitement d'Ecart (DTE)	5300	§ 5300
		Choix et mise en œuvre d'une solution de traitement	5400	§ 5400 et § 5500
		Méthodes d'analyse de nocivité des défauts	Annexe 5.0	Annexe 5.0
		Géométrie des défauts	Annexe 5.1	Annexe 5.1
		Table d'acceptabilité des défauts	Annexe 5.2	Annexe 5.2
		Méthodes d'analyse de fatigue et d'instabilité plastique	Annexe 5.3	Annexe 5.3
		Méthodes analytiques de calcul des facteurs d'intensité de contrainte et de l'intégrale J	Annexe 5.4	Annexe 5.4
		Etude spécifique d'un défaut plan, critères d'acceptabilité mécanique	Annexe 5.5	Annexe 5.5
		Caractéristiques des matériaux	Annexe 5.6	Annexe 5.6
		Etude spécifique d'un défaut volumique	Annexe 5.7	Annexe 5.7
		Principes généraux sur l'utilisation de coefficients partiels de sécurité	Annexe 5.8	Annexe 5.8
		Dossier de Traitement d'Ecart (DTE)	Annexe 5.9	Nouvelle annexe
		Dossier de cohérence	Annexe 5.10	Annexe 1.5
		Analyse mécanique pour la tenue en service des cuves REP	RPP 2	RPP 2
		Méthode alternative d'interactions de défauts plans multiples	RPP 3	Nouvelle RPP
	Surveillance en fonctionnement (g)		**6000**	**§ 6000**
		Surveillance de l'étanchéité	6100	§ 6100
		Surveillance et comptabilisation des situations	6200	§ 6200
		Surveillance des effets de l'irradiation	6300	§ 6300
		Quantification des débits de fuite vapeur	Annexe 6.1	Annexe 4.4 (IV.1)
		Détection des corps migrants dans le CPP	Annexe 6.2	Annexe 4.4 (III.1)
Maintenance B 9000 B 9000	**Mise en œuvre d'une Opération de Maintenance (OM) (h)**		**8000**	
		Conception d'une opération de maintenance	8100	§8100 et 8500 (classement)
		Pièces de rechange	8200	§ 8200
		Qualification d'une opération de maintenance	8300	§ 8300
		Réalisation d'une opération de maintenance	8400	§ 8400
		Méthodes d'intervention de maintenance	Annexe 8.1	Annexe 8.1
		Dispositions applicables pour répondre aux exigences de la règlementation française des *équipements sous pression* (ESP/ESPN)	Annexe 8.2	Annexe 1.8
		Modalités d'application du RCC-M pour les opérations de maintenance	Annexe 8.4	Annexe 1.4
		Classement des interventions sur CPP-CSP	Annexe 8.5	B 8500
		Contenu du Dossier d'Opération de maintenance (DOM)	Annexe 8.6	Annexe 1.6 (I et II)
Glossaire	Publication Technique		**AFCEN-RS-20-001-A (i)**	A 1300 et Annexe 1.1

2.3 MECHANICAL FIELD FOR PRESSURIZED WATER REACTORS (OPERATION) RSE-M

ULTRASONIC EXAMINATION OF WELDS

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

As part of its involvement in France's ESPN Regulation, the RSE-M Subcommittee has commissioned studies with the aim of producing professional guides, which have been published since 2016 as modification files for the code and PTAN. The following diagram shows how the PTAN are arranged as Repair / Modification / Installation according to the equipment level as of late 2023.

INSTALLATION OF NPE (Nuclear Pressure Equipment)

NPE subject to appendix V, points 1 to 4

AFCEN-RS-18-003-A
Permanent joining
(30/12/2015 order, appendix V § 4.1.a 1st bullet of 1s § & 2nd §)
- Applicable requirements from 2014/68/UE directive + 30/12/2015 order
- Expected documentation
- Adapted modules: Fi

AFCEN-RS-18-004-C
Protection against exceeding the allowable limits
(30/12/2015 order, appendix V § 4.1.a 2nd bullet of 1st § & 2nd §)
- Method
- Adapted modules: Ap, Bp, Fp
- Applicable requirements for NPE built according to 1926 or 1943 decree

NPE subject to appendix V, point 5

AFCEN-RS-18-005-A
(30/12/2015 order, appendix V §5)
- Permanent joining
- Protection against exceeding the allowable limits

PIPING REQUALIFICATION

AFCEN-RS-16-007-E
(30/12/2015 order appendix V § 3.4)

N2 OR N3 NPE REPAIR OR MODIFICATION

AFCEN-RS-18-006-A
Requirements
(30/12/2015 order, appendix V §4.2.a)
Applicable requirements from PED + 30/12/2015 order

AFCEN-RS-16-009-B
Classification
(30/12/2015 order, appendix V § 4.2.a)
- Classification
- Adapted modules: (A_R, B_M, B_R, B_{PSI}, F_{PS}, F_{RM}, G_{RM}, F_{CDS}, G_{BOU})
- Expected documentation

AFCEN-RS-16-010-E
Documentation
(30/12/2015 order, appendix V § 4.2.a)
- Expected documentation
- Methods :
  . Hazards and risks analysis (& template)
  . Nuclear material appraisal (& template)
  . Material qualification
  . Unacceptable defects
  . Sizes : determination and control to prove essential safety requirements respect
  . Means of examination (& template)
  . Operating instructions (& template)

N1 NPE OF PWR MPS (Main Primary System) OR MSS (Main Secondary System)
AFCEN-RS-18-022-B
MPP (Main Pressure Part) procurement
(10/11/1999 order, art. 10.IV.b)
- Requirements
- Expected documentation
  . For modified MPP
  . For identical MPP
- Methods
  . Hazards and risks analysis (& template)
  . Nuclear material appraisal (& template)
  . Material qualification
  . Unacceptable defects specification
  . Sizes: determinalion and control to prove essential safety requirements respect
  . Means of examination
  . Operating Instructions
- Identical material
- Adapted modules (B_{ppp}, F_{ppp}, G_{ppp})

AFCEN-RS-18-007-A
Maintenance Operation
(10/11/1999 order, art.10)
- on MPP
- on MPS or MSS with MPP
- on MPS or MSS without MPP
- Assessment of welds between MPS or MSS and NPE subject to appendix V of 30/12/2015 order
- Assessment of maintenance operation on a safety device protecting an NPE subject to appendix V of 30/12/2015 order against exceeding allowable limits

Guides approved by ASN: AFCEN-RS-16-009-B, AFCEN-RS-17-022-B, AFCEN-RS-18-003-A, AFCEN-RS-18-004-C, AFCEN-RS-18-006-A
Guides recognised as relevant by ASN: AFCEN-RS-16-007-E, AFCEN-RS-16-010-E, AFCEN-RS-18-007-A

CONTENTS OF THE 2020 EDITION OF THE RSE-M CODE

VOLUME I - RULES
SECTION A - GENERAL RULES
SECTION B - SPECIFIC RULES FOR CLASS 1 COMPONENTS
SECTION C - SPECIFIC RULES FOR CLASS 2 OR 3 COMPONENTS
SECTION D - SPECIFIC RULES FOR NC COMPONENTS
VOLUME II - APPENDICES 1 TO 8
APPENDICES 1.0 TO 1.8: SUPPORTING APPENDICES FOR THE GENERAL REQUIREMENTS
APPENDIX 2.1: APPENDIX ASSOCIATED WITH § B2000 REQUALIFICATIONS AND HYDRAULIC TESTS
APPENDICES 4.1 TO 4.4: APPENDICES ASSOCIATED WITH § 4000 EXAMINATION TECHNIQUES
APPENDICES 5.0 TO 5.8 AND RPP2: APPENDICES ASSOCIATED WITH § 5000 INDICATION PROCESSING
APPENDIX 7.1: APPENDIX ASSOCIATED WITH INSTALLATION, INTEGRATION AND IMPLEMENTATION OPERATIONS FOR CONSTITUTING A NEW BASIC NUCLEAR FACILITY
APPENDICES 8.1 AND 8.3: APPENDICES ASSOCIATED WITH § 8000 MAINTENANCE OPERATIONS
VOLUME III - APPENDIX 3
APPENDIX 3.1 - VISIT TABLES
APPENDIX 3.2 - INSPECTION PLANS FOR COMPONENTS NOT ASSIGNED TO ANY PARTICULAR RSE-M CLASS

2.3.4 Outlook and next edition

In keeping with its 2023-2026 programme, the RSE-M Subcommittee is planning to direct its efforts towards the following topics:

- 2024 edition: introduction of advanced inspection technologies, clarification of the procedure for qualifying NDT tests (not including MPS/MSS), and additional methods and data for mechanical analyses.
- 2026 edition: introduction of advanced inspection technologies (continued), additional methods and data for mechanical analyses (continued), and clarification of the procedure for qualifying maintenance operations.

2.3 MECHANICAL FIELD FOR PRESSURIZED WATER REACTORS (OPERATION) RSE-M

2.3.5 Other RSE-M technical publications

PTAN AFCEN-RS-16-018-A "WPS" criteria (relating to Probationary Phase Rule 2 of RSE-M)

The purpose of the 2016 publication is to describe the loading history effect on the resistance to the cleavage brittle fracture of RPV steel by taking account of the warm pre-stressing phenomenon as well as the associated criteria that were proposed and which are currently being defined within a probationary phase rule (RPP2) in RSE-M.

PTAN AFCEN-RS-17-019-A Criteria "Appendix 5.4"

These criteria were published in 2017.

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

PTAN AFCEN-RS-18-026-A Criteria "Appendix 5.5"

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

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

PTAN AFCEN-RS-19-013-A "Guide for qualifying ultrasonic NDT processes - Definition of performance"

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

PTAN AFCEN-RS-20-001-A "Glossary"

This glossary contains definitions that apply to the use of both the RSE-M code and the PTANs issued by the RSE-M Subcommittee.

AFCEN-PTAN-09001-2023 "Classification of RCC-M modification forms up to and including the 2018 edition"

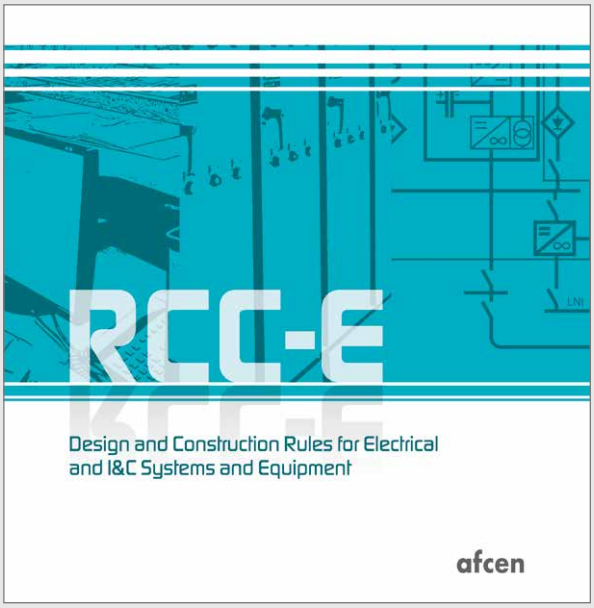
This PTAN contains the classification of the RCC-M modification forms previously included in the appendix to RSE-M.

AFCEN-PTAN-09002-2023 "Classification of RSE-M modification forms from the 2022 edition onwards"

This PTAN presents the classification assigned to each RSE-M modification form from the 2022 edition onwards in relation to its type, its impact on the user and its impact on French regulations.

What is the purpose of the RSE-M code and why Requirements Engineering for the 2022 edition?

2.4 ELECTRICAL AND I&C SYSTEMS
RCC-E



THE RCC-E CODE

2.4.1 Purpose and scope

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

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

The code's scope covers:

- electrical and I&C architectures and the associated systems,
- materials engineering and the qualification procedure for normal and accidental environmental conditions, including consideration for internal and external hazards,
- facility engineering and management of common cause failures (electrical and I&C) and electromagnetic interference,
- testing and inspecting electrical characteristics,
- quality assurance requirements supplementing ISO 9001 and activity monitoring.

2.4.2 Use and background

Use

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

- France's last 12 nuclear units (1,300 MWe (8) and 1,450 MWe (4)),
- 2 CP1 reactors in South Korea (2),
- 54 M310 (4), CPR-1000 (28), CPR-600 (6), HPR-1000 (14) and EPR (2) reactors in service or undergoing construction in China,
- 1 EPR reactor in France and 2 reactors in the UK (Hinkley Point C),
- The RCC-E code is used for maintenance operations in French power plants (56 units) and 32 Chinese M310 and CPR-1000 power plants.

2.4 ELECTRICAL AND I&C SYSTEMS RCC-E

Users include:

- equipment suppliers,
- engineering firms responsible for designing, building and installing equipment and systems,
- control and inspection organizations,
- Nuclear Safety Authorities.

Background

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

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

The 2005, 2012, 2016 and 2019 editions concern Generation II and III reactors. As from the 2005 edition, project specifications must be written to supplement and implement the rules in the RCC-E code and allow the code to be used in the project. With the 2019 revision, AFCEN has created a PTAN that provides users with guidelines on how to produce project specifications.

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

The 2005 and 2016 editions were translated into Chinese and published under CGN's authority.

2.4.3 Edition available in 2023

The RCC-E 2022 edition is the most recent version. It is available in French and English.

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

- Feedback from facilities under construction and in operation,
- The Nuclear Safety Authorities' investigation process,
- User inquiries,
- Changes in the standards used and IAEA's requirements,
- Changes in industry's maturity.

The 2022 edition:

- Is an update of the previous edition,
- Addresses Generation II, III and IV reactors, research reactors and naval reactors,
- Organizes requirements into four key areas for easier identification and greater clarity : monitoring, systems, equipment, and component and systems installation. Each key area covers all lifecycle activities,
- Takes account of IAEA requirements as applicable to the scope of the code,
- Clearly defines the supplements to the requirements in the chosen IEC standards for I&C systems.

This revised edition introduces a new set of topics including:

- Analysis and, if necessary, incorporation of the specific requirements for the NUWARD SMR project,
- Incorporation of operational feedback to improve the requirements, especially managing modifications to mass-produced equipment before qualification testing,
- Changes in the electrical architecture for integrating interfaces between mobile emergency power sources and internal power sources, total loss of electrical power sources, resistance of electrical and I&C systems to electrical or electromagnetic disturbances and hazards,
- Clarification of the interfaces between the electrical architecture and the I&C architecture, especially for the power distribution from the I&C cabinets, as well as consideration of voltage drop constraints,
- Incorporation of new standards, including IEC 63046, IEC 62003 and IEC 60079-0, update in the code to reflect the application of IEC 61508 for Class III equipment, and IEC 62808 for the design of isolation devices,

- Incorporation of requirements based on ISO 19443:2018 in addition to ISO 9001, particularly counterfeit, fraudulent and suspect items,
- Introduction to the strategies required to bring cybersecurity risks under control,
- Incorporation of fire hazards inside cabinets or cableways.

Reasons for updating the code include:

- A clearer insight into safety approaches (defense-in-depth examinations, design standard, events and deterministic approach, failure-oriented principle to encourage protective action, consistency of hazards with the French Regulation on basic nuclear facilities, etc.),
- Changes to IEC standards relating to the SC 45 Technical Committee and IEC industry standards.

Requirements are:

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

CONTENTS OF THE 2019 EDITION OF THE RCC-E CODE

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

A 2025 revision is currently being prepared in English and French.

2.4.4 Technical publications of the RCC-E Subcommittee

Edition gap analysis

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

For the 2022 edition, this document “RCC-E 2022 Gap Analysis” compares the 2019 and 2022 editions, and ties into the former chapters of RCC-E 2012.

Since 2012, such documents have always been produced to accompany each new edition.

For future code editions, this comparison will include a high-level impact assessment of the changes introduced with the aim of helping project owners take informed decisions.

In addition, a “Guide to preparing project specifications associated with RCC-E 2022” is provided with RCC-E 2022. This guide aims to simplify the process of identifying the requirements stipulated for the RCC-E 2022 code and help users when producing project specifications. Users can click on the link in this document to download an electronic template of the document to be completed.

Since 2019, such guides for preparing project specifications have consistently been produced for each new edition.

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

This PTAN, which supplements Volume 3 of RCC-E 2019, has been fully incorporated into the 2022 revision of RCC-E.

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

2.4 ELECTRICAL AND I&C SYSTEMS RCC-E

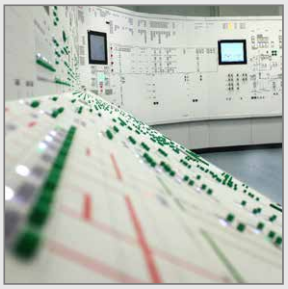
This approach has been introduced in addition to the standard qualification method according to the requirements of RCC-E for Class III I&C systems. It can only be used for Class III systems when a number of prerequisites have been satisfied, especially relating to compatibility between the planned safety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

It is available in French and English.

PTAN "Requirements for the consideration of cybersecurity in the design of I&C systems" (AFCEN-PTAN-05001-2022)

After five years of work, the collection of RCC-E publications has been enriched with a guide on the requirements for taking cybersecurity into account in the design of I&C systems, released at the end of 2022.






RCC-E knowledge test guide (AFCEN-PTAN-02001-2023)

The RCC-E Subcommittee has provided a guide for users to self-assess their degree of knowledge in the field of electrical and I&C systems. The aim is not to provide a certificate of aptitude, but instead allow users to identify the areas where they can improve their skills. At the same time, an audit guide has been produced to help the supply chain assess suppliers' overall skills in the field covered by the RCC-E code, excluding "Installation" and "Electrical systems".

External communication tool

The RCC-E Subcommittee has developed a six-minute communication video to raise greater awareness of the code's use. There are plans to continue producing such tools for each area covered by the code.

2.4.5 Outlook

New prospects are already in the pipeline for the 2025 revision. The work topics will include:

- new specific requirements for the NUWARD SMR project,
- investigation into the opportunity of integrating the IEEE requirements not covered by the code,
- rules for using commercial off-the-shelf components (Commercial Grade Dedication/Commercial Grade Items),
- impact of solar storms and the induced geomagnetic currents,
- greater harmonization between the RCC-F and RCC-E codes,
- in-depth implementation of requirements engineering,
- new applicable standards,
- feedback from the use of RCC-E 2019 and 2022.

2.4.6 International activities

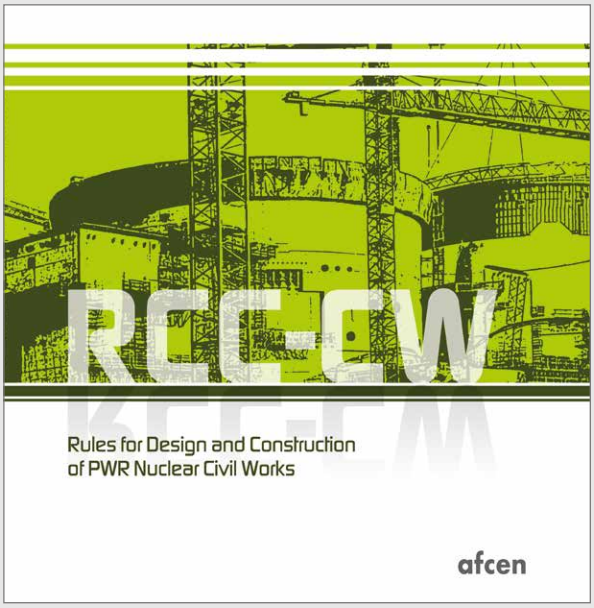
The RCC-E Subcommittee took part in meetings with the CSUG (Chinese Specialized Users Group). The Chinese working group comprises approximately 30 members. Every year, a meeting is organized in China to improve interaction and help address the interpretation and/or modification requests issued by the CSUG.

The CSUG seminar was held in Beijing in November 2023. Note that Chinese participants in the CSUG were keenly interested in the changes relating to their work on developing new designs, with particular enthusiasm for developing digital tools to support operators.

The Users Group in the United Kingdom got off to a promising start with a number of questions about how to take account of the specific situation in the UK. In light of the current projects in the United Kingdom (Hinkley Point and Sizewell), these seminars serve as the ideal opportunity to strengthen support for users and illustrate how the codes can be implemented.

To know more about RCC-E code

2.5 CIVIL WORKS RCC-CW



THE RCC-CW CODE

2.5.1 Purpose and scope

The RCC-CW code describes the rules for design, construction and ageing management of civil engineering structures in PWR reactors.

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

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

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

- load cases and combinations,
- geotechnical aspects,
- reinforced concrete structures and galleries,
- prestressed containments with metal liners,
- metal containment and pool liners,
- metal frames,
- anchors,
- concrete cylinder pipes,
- joints, paints, coatings and geomembranes,
- containment leak tests.

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

2.5.2 Use and background of RCC-CW

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

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

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

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

- initially, the publication of two specific editions for EPR projects: a 2010 edition followed by a 2012 edition,
- subsequently, the publication of a generic civil engineering code that is not specific to any given project: successive annual editions of RCC-CW have been published since 2015.

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

In 2015, AFCEN prepared and published the first edition of a generic civil engineering code that does not relate to any specific project. The RCC-CW code no longer adheres to the EPR project and can be used for PWR reactors featuring a prestressed containment with a metal liner. This code is being used for the EPR2 project in France.

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

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

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

- bonded prestressing has been supplemented with unbonded prestressing,
- the code covers the design and development of seismic isolation devices,
- the section on external hazards has been updated to include tornadoes,
- the design approach has been expanded to provide greater focus on design extension situations.

The 2016 to 2021 editions of the RCC-CW code have featured a large number of changes, including extensions to the field covered by the code, the addition of methods and technologies, the incorporation of changes to the standards referenced in the code, and clarifications following feedback from current projects. The following changes deserve a mention :

- new chapters have been created : CCOAT for paints and coatings, CGEOM for geomembranes, and CCONT for containment construction,
- thorough revision of the DANCH chapter on anchors, inclusion of the latest changes to EN 1992-4, and integration of several technologies (anchor channels, active anchors, post installed anchors, T-head bolts and shear connectors),
- modifications to the actions or combinations of actions to be considered for the Design Basis Domain or Design Extension Domain,

2.5 CIVIL WORKS RCC-CW

- change to the seismic appendix (DA) and new rules for seismic soil column calculations,
- improved requirements related to the minimum reinforcement rate,
- change to the contents for certain chapters in the construction part in alignment with EN 13670,
- change in leak detection requirements for pools and tanks (DPLIN & CPLIN),
- introduction of industrial feedback for containment testing and monitoring (MCONT),
- addition of requirements relating to deep foundations or soil liquefaction risks,
- improved requirements for the minimum reinforcement rate: scale effect for containments (DCONC),
- general revision of prestress requirements (CPTSS, CC, CCONC, DCONC),
- creation of a new AM part (Aging Management) incorporating the following chapters:
  - AMGENR: General requirements,
  - AMCONT: Containment aging management,
  - AMCONC: Aging management for reinforced concrete structures,
  - AMGEOT: Aging management for geotechnical structures.
- change in requirements for lamellar tearing (DSTLW),
- improvement of the code requirements for concrete shrinkage (DB),
- changes to the welding for anchor systems (CANCH),
- changes to the requirements for construction joints (CCONC).

Release	Description	Key applications
1988	AFCEN document including French PWR fleet experience (RCC-G 1988)	French 1300, 1450 Mwe
2006	Draft for further AFCEN releases (EDF document)	Flamanville 3, Taishan 1&2
2010 - 2012	Prepared for UK GDA process in 2010. Revised in 2012	HPC, SZC
2015 - 2016 2017 - 2018 2019 - 2020 2021	Renewed edition: . post-Fukushima level & methods . improvements & updates . extensions of scope	Updated editions to be used as reference for New Build Projects

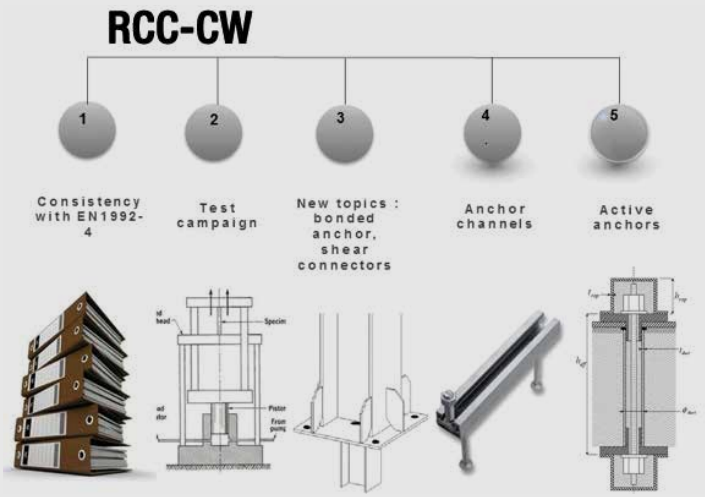
SUCCESSIVE VERSIONS OF RCC-CW

2.5.3 Edition available in 2023

The 2023 edition of the AFCEN RCC-CW code includes the following improvements:

- requirements engineering for part G (GTABL, GREFD, GDEFN, GGENP and GA),
- new section on climate change (DGENR),
- modification to the action covering pool water temperature variations in the event of a severe accident (DGENR),
- change to the displacement approach (DGEOT),
- addition of the in-service temperature of concrete in RCC-CW (DCONC),
- modification of the strain criteria for liners with shape defects (DCLIN, CCLIN),
- impact of the new EN 1090-2 standard (DSTLW, CSTLW, CCLIN, CPLIN),
- extended chapters on bonded anchors (DANCH, CANCH),
- introduction of EAD 330008-03-0601 (DANCH, CANCH),
- change concerning uncertainty management and non-linear SSI (DA),
- clarification of Appendix DE (new sketches and tables),

- addition of the notion of a third-party organization for welding procedure qualifications and welder qualifications (CCLIN, CPLIN),
- requirements engineering for part AM (AMGENR, AMGEOT, AMCONC, AMCONT),
- aMANCH: aging management for anchoring systems (new chapter).



THE RCC-CW CODE COVERS ANCHOR-RELATED TOPICS

CONTENTS OF THE 2023 EDITION OF THE RCC-CW CODE

PART G - GENERAL
GUSER - NOTE TO THE USER
GTABL - ORGANIZATION OF RCC-CW
GREFD - STANDARDS AND DOCUMENTS MENTIONED IN RCC-CW
GDEFN - DEFINITIONS, NOTATIONS AND ABBREVIATIONS
GGENP - GENERAL PROVISIONS
GA - APPENDICES
PART D - DESIGN
DGENR - GENERAL DESIGN REQUIREMENTS
DGEOT - GENERAL RULES FOR GEOTECHNICAL ENGINEERING
DCONC - GENERAL RULES FOR CONCRETE STRUCTURES
DCLIN - LEAK-TIGHT METAL PARTS ON CONTAINMENTS
DPLIN - METAL PARTS INVOLVED IN THE WATERTIGHTNESS OF THE POOLS AND TANKS
DSLTW - GENERAL RULES FOR STRUCTURAL STEELWORK
DANCH - DESIGN REQUIREMENTS FOR ANCHORING SYSTEMS EMBEDDED IN CONCRETE
DA to DN - APPENDICES

2.5 CIVIL WORKS RCC-CW

CONTINUED CONTENTS OF THE 2023 EDITION OF THE RCC-CW CODE

PART C - CONSTRUCTION
CGEOT - EARTHWORKS AND SOIL TREATMENT
CCONC - CONCRETE
CREIN - REINFORCEMENT FOR REINFORCED CONCRETE
CPTSS - POST-TENSIONING SYSTEM
CPREF - PREFABRICATED CONCRETE ELEMENTS AND REINFORCEMENT CAGES
CCLIN - LEAK-TIGHT METAL PARTS ON CONTAINMENTS
CPLIN - POOLS AND TANKS
CSTLW - STRUCTURAL STEELWORK
CANCH - DESIGN REQUIREMENTS FOR ANCHORING SYSTEMS EMBEDDED IN CONCRETE
CBURP - REINFORCED CONCRETE PIPELINES
CJOIN - JOINT SEALING
CCOAT - PAINTS AND COATINGS
CGEOM - GEOMEMBRANE LEAK-TIGHTNESS SYSTEM
CTOLR - SURVEY NETWORKS, TOLERANCES AND MONITORING SYSTEMS
CCONT - LEAK AND MECHANICAL TESTS AND INSPECTION OF THE CONTAINMENT
CA to CI - APPENDICES
PART AM - AGING MANAGEMENT
AMGENR - GENERAL REQUIREMENTS FOR AGING MANAGEMENT
AMGEOT - AGEING MANAGEMENT OF GEOTECHNICAL STRUCTURES AND STRUCTURES IN STRONG INTERACTION WITH THE SOIL
AMCONC - REINFORCED CONCRETE STRUCTURES
AMCONT - AGEING MANAGEMENT FOR CONTAINMENT

2.5.4 Outlook

The development of the civil engineering code is continuing in the following directions:

- integrate feedback from projects currently under development or construction,
- broaden the scope of robust technologies covered by the code,
- encourage application of the code in the European and international arena by offering greater coverage of the latest international standards and promote the code as a civil engineering benchmark for the Prospective Groups that CEN/WS64 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 AFCEN code users' countries.

The work programme includes the following core topics:

- composite steel and concrete structures,
- marine structures,
- incorporation of changes in the Eurocodes,
- improved reinforcement rates,
- evolution of design criteria for metal liners,
- aging management.

2.5.5 Technical publications on seismic isolation and dissipation

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

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

This publication enables European industry to:

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

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

2.5.6 International activities

CEN/WS64

The Subcommittee is involved in the activities of CEN Workshop 64 - Phase 3 and will also be active in Phase 4.

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

During the workshop’s activities, AFCEN examines all requests to update the code. As an example, work will begin in 2024 to improve the appendix covering the impact of projectiles.

Chinese Users Group (CSUG)

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

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

UK Users Group

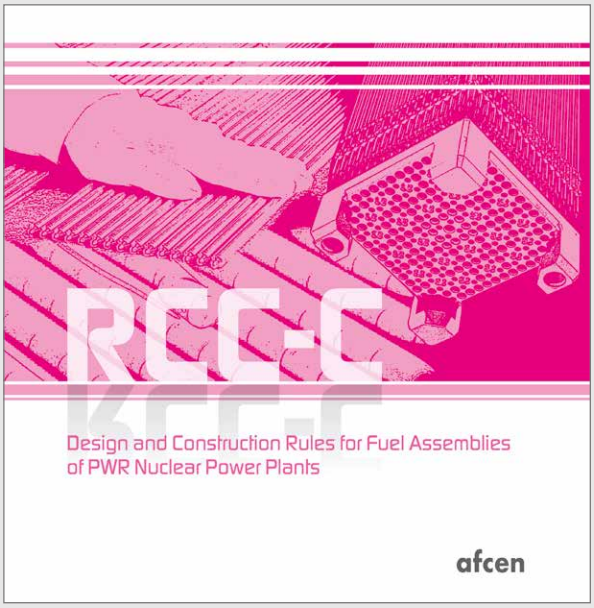
The UK Users Group on civil engineering codes includes the main companies involved in the Hinkley Point C project. The Users Group was officially launched during the AFCEN 2017 Congress. The group held two meetings in 2017 and one meeting in 2018, 2019, 2020 and 2023.

The next meeting is scheduled for 2024.

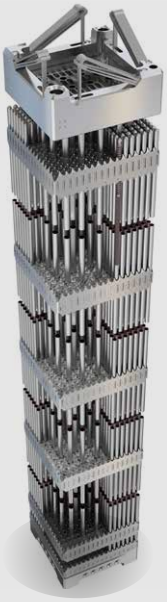
Do you have good knowledge of the RCC-CW code?

RCC-CW CODE DESCRIPTION VIDEO

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



THE RCC-C CODE



©WESTINGHOUSE
RFA900 PWR FUEL ASSEMBLY

2.6.1 Purpose and scope

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

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

The code's scope covers:

- fuel system design, especially for assemblies, fuel rods and associated elements (core components),
- the characteristics to be checked for products and parts,
- fabrication methods and inspection methods,
- safety-oriented integrated management systems for all activities concerned by the above-mentioned areas.

2.6.2 Use and background

Use

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

Fuel for EPR projects is manufactured according to the provisions of the RCC-C code.

The code is available in French, English and Chinese. The 2020 version of the code is the latest edition translated into Chinese.

Background

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

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

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

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

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

The 2022 edition was released early January 2023 with the following main changes:

- the heat treatment requirements were adjusted to clarify how they apply to factories,
- adjustment to the requirements governing material supplies and product manufacturing processes: intercrystalline corrosion of stainless steel materials, Mn content of structurally hardened austenitic stainless steel alloys, material requirements for the alloy 718 spring wires of AIC/B4C absorber rods, check of the hydrogen content in pellets, and visual inspection of the pellets.

2.6.3 Edition available in 2023

The 2023 edition of the code was published in January 2024. The main changes in this edition are as follows:

- inclusion of the quality requirements of IAEA GSR Part 2 instead of GSR-3,
- adjustment to the requirements relating to material supplies, product design and manufacturing through the following modification forms: recrystallization of nickel-based alloys, design criteria (follow-up for the Permanent Working Group on fuel performance criteria), qualification of sintering furnaces, contacting materials and pollutants, heat treatment report for stainless steels, material grade for bottom nozzle pin and thimble plug assemblies nut.

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

CONTENTS OF THE 2023 EDITION OF THE RCC-C CODE

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

Next edition

The next edition (in French and English) is scheduled for the end of 2024.

2.6.4 Outlook

Work on adapting the design requirements will continue focusing on incorporating the conclusions of the French 2017 Permanent Working Group on fuel performance criteria.

The ongoing work of clarifying the code's current requirements will continue, particularly through the modification forms submitted by the various stakeholders in the nuclear industry.

Manufacturing process requirements will be modified according to the proposals and feedback from Subcommittee members. Efforts are currently underway to clarify the requirements for introducing new products or processes in relation to the industry's current projects and should be completed in 2024.

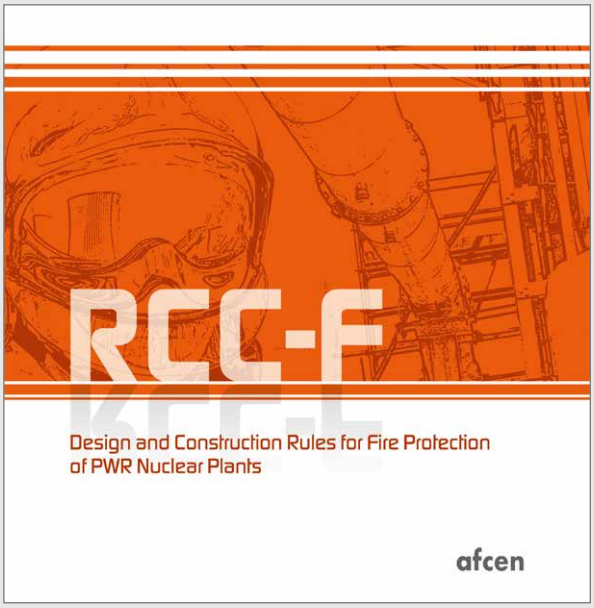
Chapter 5 (situations outside the nuclear steam supply system) is currently being revised to clarify the rules and scope of requirements. There is a potential overlap between the requirements for manufacturing, transportation and plant operations, since these different sectors of activity have their own specific requirements.

Finally, there are plans to update the chapters on special assemblies and core components with the aim of formally and explicitly implementing experimental products.

The process of applying the Requirements Engineering methodology to the RCC-C code was launched in 2022 and will continue in 2024, especially with a trial that will involve RCC-C.

To know more about RCC-C code

2.7 FIRE PROTECTION FOR PRESSURIZED WATER REACTORS RCC-F



THE RCC-F CODE

2.7.1 Purpose and scope

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

This code is therefore targetting:

- engineers in charge of the design, construction and installation of the buildings constituting a PWR,
- engineers responsible for analyzing fire hazards and establishing the safety demonstration from a fire hazard perspective,
- engineers responsible for designing the means to prevent and protect against fires and mitigate the effects of a fire outbreak,
- suppliers of fire protection equipment,
- laboratories carrying out qualification testing of fire protection equipment,
- Nuclear Safety Authorities responsible for approving the safety demonstration.

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

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

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

- the industrial risk (loss of assets and/or operation),
- personnel safety,
- the environment.

The code is divided into five main sections:

- generalities,
- design safety principles,
- fire protection design bases.

2.7 FIRE PROTECTION FOR PRESSURIZED WATER REACTORS RCC-F

- Construction provisions
- Rules for installing the fire protection components and equipment

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

2.7.2 Use and background

In response to the needs of the Flamanville 3 EPR project in France, EDF published a reference document called ETC-F (EPR Technical Code for Fire Protection) for the design of fire protection systems. This document harnesses the experience acquired through several decades of designing and operating France's nuclear power stations.

This document acted as a starting point for a fire protection code that AFCEN produced in 2009 as part of the RCC-F Subcommittee, which led to:

- initially, the publication of the 2010 edition of the ETC-F code similar to the EPR code,
- subsequently, the drafting of the 2013 edition, which gave less focus to the specifics of EPR projects but which still addresses the safety principles in alignment with existing EPR projects; UK regulations were incorporated into this version of the code,
- the publication of the RCC-F 2017 code, which is generally suited to light-water reactors, such as PWRs,
- finally, the publication of the RCC-F 2020 code, including various technical improvements.

The ETC-F and RCC-F codes are currently being applied to various projects that are either in operation or under examination, including FA3 EPR, Jaitapur EPR project, HPC and SZC EPRs, Taishan EPR, EPR2 project, NUWARD SMR project and EPR1200 project.

2.7.3 Edition available in 2023

The RCC-F 2020 edition is the most recent version. The English reference version of RCC-F 2020 was published late December 2020, while the French version was released in January 2022.

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

Technical improvements to the code

- development of an appendix on fire hazard analyses, presenting the different types of analyses and calculation methods to be implemented, while incorporating the previous appendices G (fire barrier justification) and H (functional criteria),
- creation of a section giving greater consideration to fire protection hazards (sprinklers, gas, etc.) and the management of protection system incidents (e.g., detection),
- clarification on how to factor in external fires within the basic nuclear facility and the site,
- clarifications and additional information on combined hazards,
- creation of a paragraph on Beyond Design Basis events and feedback on the Fukushima Daiichi accident,
- migration to ISO 9001:2005,
- minor modifications for the purpose of improving compatibility with WENRA Safety Levels 2014,
- improvements to the fire resistance of ventilation ducts,
- clarification on sizing fire pumps*,
- additional information about cable arrangements*,
- deletion of Appendix F on EDF proprietary documents and dissemination of practical information and relevant requirements in the body of the text,
- various editorial or minor improvements, translations*, organization of certain sections.

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

Update to the appendices on regulations and standards

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

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

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

CONTENTS OF THE 2020 EDITION OF THE RCC-F CODE

2.7 FIRE PROTECTION FOR PRESSURIZED WATER REACTORS RCC-F

Other publications of the RCC-F Subcommittee

The analysis of the RCC-F 2020 code's conformity with WENRA 2014 safety levels (PTAN) was published in 2021.

The gap analysis between the 2017 and 2020 editions was published in 2021 as a PTAN associated with the RCC-F 2020 edition.

A comparison with US NFPA standards was finalized in 2022.

2.7.4 International activities

The Chinese working group (Chinese Specialized User Group) comprises 19 permanent members and was created in March 2015 (Beijing). Every year, a meeting is organized in China to improve interaction and help address the interpretation and/ or modification requests issued by the CSUG.

In 2023, activities with the CSUG were resumed after being stood down during the pandemic. A Chinese delegation attended the AFCEN Congress in March 2023 and the RCC-F Subcommittee open meeting (March 28, 2023). The annual seminar was held in Beijing (November 7-8, 2023), following which new requests were submitted to the Subcommittee.

As part of the AFCEN/NEA memorandum of understanding, a Chinese-language version of RCC-F 2017 was published in 2021. Les nouvelles versions doivent également faire l'objet de traduction.

As for the UK, EDF Energy is a member of the Subcommittee, but there is no mirror committee.

RCC-F was present at the World Nuclear Exhibition (WNE) in November 2023.

2.7.5 Outlook and preparation of the RCC-F 2024 edition

Outlook

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

- integrate state of the art and feedback from projects currently under development or construction,
- drive the code's application on a European and international level by including international standards and regulations. Depending on the needs, this may prompt AFCEN to develop appendices and addenda specifically addressing how the code can be adapted to local regulations (refer to the exercise already carried out for the United Kingdom).

Requirements engineering

There are plans to align the RCC-F code with AFCEN's "Requirements engineering" process. Therefore, the 2024 version of RCC-F will be presented in the Requirements Engineering format, which will be refined in successive versions of the code.

RCC-F 2024 edition

The next edition of RCC-F is scheduled for 2024. The general ambition with this version is to include the initial "Requirements Engineering" format and pursue efforts on incorporating the improvements identified in the editorial program.

Improvements were identified when examining the RCC-F code as part of the EPR2 project (answers to the questionnaires issued by IRSN). Those improvements are currently being included in the new version.

Some modifications came in response to requests from the CSUG.

The Subcommittee's technical work was organized into "macro-topics" while also incorporating the various observations and proposals made by the experts as part of normal activity:

- fire containment: especially relating to radiological containment,
- regulatory aspects: particularly relating to compartmentalization,
- detection: update to the installation qualification requirements in liaison with RCC-E and in response to EPR2 expectations,
- evacuation: various improvements in line with regulatory aspects,
- nuclear safety: improvements relating to combined hazards and the application of aggravating events,
- fire hazard analysis: including additional provisions concerning fuel storage,
- ventilation: the subject of iodine traps has been revised to clarify the objectives,
- other codes: align several topics with WENRA 2020 requirements,
- fire fighting/extinguishing,
- fire resistance,
- earthquake,
- installation.

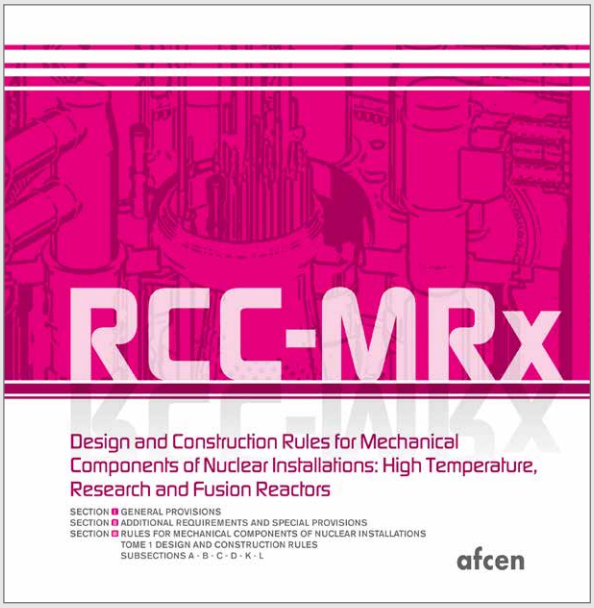
The appendix on UK regulations will be updated with support from EDF Energy.

ISO 19443 will be introduced into the code in the form of additional requirements to ISO 9001, thereby ensuring that application of the code is easily compatible with the standard for nuclear safety quality assurance.

Do you have good knowledge of the RCC-F code?

RCC-F CODE DESCRIPTION VIDEO

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



THE RCC-MRX CODE

2.8.1 Purpose and scope

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

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

2.8.2 Background and use

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

The RCC-MR code, drafted by AFCEN's RCC-MR Subcommittee together with the Tripartite Committee formed on March 16, 1978 by the Commissariat à l'Energie Atomique, Electricité de France and Novatome (now Framatome), to establish the applicable rules for designing components working at high temperatures. AFCEN published four editions of RCC-MR in 1985, 1993, 2002 and 2007. The RCC-MR code was used to design and build the prototype Fast Breeder Reactor (PFBR) developed by IGCAR in India and the ITER Vacuum Vessel.

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

An unpublished preliminary version of RCC-MRx created in 2010 by AFCEN was chosen as the baseline for the CEN CWA European Workshop (entitled “CEN-WS-MRx, Design and Construction Code for mechanical equipment of innovative nuclear installations”), which was intended to familiarize European partners with the RCC-MRx 2010 code and propose modifications to satisfy the needs of their projects. The results of the workshop were incorporated into the 2012 edition of RCC-MRx published by AFCEN. Three new editions of RCC-MRx have since been published (in 2015, 2018 and 2022).

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

2.8.3 2022 Edition

CONTENT OF THE 2022 EDITION OF THE RCC-MRX CODE

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

The 2022 edition is the most recent version.

The 2022 edition of the code incorporates feedback from the use of the 2018 edition of the code (or its earlier editions). Feedback from the (ongoing) construction of the Jules Horowitz reactor has proven to be especially valuable for updating this edition of the RCC-MRx code, for example:

- Material supplies: creation of an STR covering 6061-T6 aluminum alloy flanges obtained by ring forging for the RJH core vessel or an STR for supplying beryllium billets.
- Manufacturing operations:
  - Authorization for polymer quenching (as an alternative to oil quenching),
  - Reinforcement of the requirements for qualifying nitriding treatments and introduction of ionic processes,
  - Introduction of specific shearing and forming rules for the exchange plates in plate and gasket exchangers.

The following major changes have also been added:

- Creation of a set of characteristics including the data for nitrogen alloyed X2CrNi19-10 steel [“304L(N)”] in RPP no. 18.
- Introduction of the CuCrZr grade (one STR and Appendix A3) in RPP no. 23.
- Improved rules for taking account of creep-fatigue.

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

- Creation of volume G focusing on core internals.
- Complete reorganization of Volume II to ensure easier use by creating a single place within the code to address supplies based on product standards.

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 and regulations (e.g., updated versions of France's nuclear regulations). Therefore, all the work involved in demonstrating the RCC-M code's compliance with the ESPN Regulation has been included and incorporated into the 2022 edition (Chapter REC 3000).

As part of the aim to open the code to international needs, the 2022 edition features the initial results of the CSUGs and AFCEN's collaboration with NEA. In terms of the code's application in China, REC 2300 defines the potential approaches for using Chinese standards in alignment with the requirements of the code. Only standards published by a recognized body in the Chinese standardization system may be offered as alternatives. In all cases, evidence must be provided that they are equivalent to the code's requirements.

The 2022 edition has also factored in feedback from CEN Workshop 64 - Phase 3 by incorporating the following changes:

- Inclusion of a probationary phase rule (RPP no. 20) to introduce small punch tests as an addition to the code-based procedures for characterizing materials, whether at the time of procurement or when characterizing the material's in-service behavior.
- Introduction of additional requirements and special measures in REC 4000 to take account of NQA-1, when NQA-1 is required for compliance with regulations (e.g., installations built in Belgium).
- Addition of a probationary phase rule (RPP no. 19) to introduce an alternative method for preventing creep-fatigue damage to steels subject to cyclic softening.
- Addition of a 19Cr12Ni2Mo welding consumable datasheet for the TIG process in Volume IV and Appendix A9.

2.8.4 Outlook

Between 2023 and 2025, efforts will be dedicated at preparing the next edition of the code, which is due to be published in 2025. Building on the previous editions, the aims for the new edition of RCC-MRx are to improve the code's modularity and clarity, so that it can be adapted to the many projects that are likely to use it as a reference. The new edition will also incorporate the requests submitted by European partners through CEN/WS64 (latest modifications from Phase 3 and new modifications from Phase 4). An initial modification that has already been endorsed will effectively ratify the decision to change the code's name to "Design and construction rules for mechanical components of nuclear installations: advanced, research and fusion reactors", illustrating how the code has been extended to encompass AMRs (Advanced Modular Reactors).

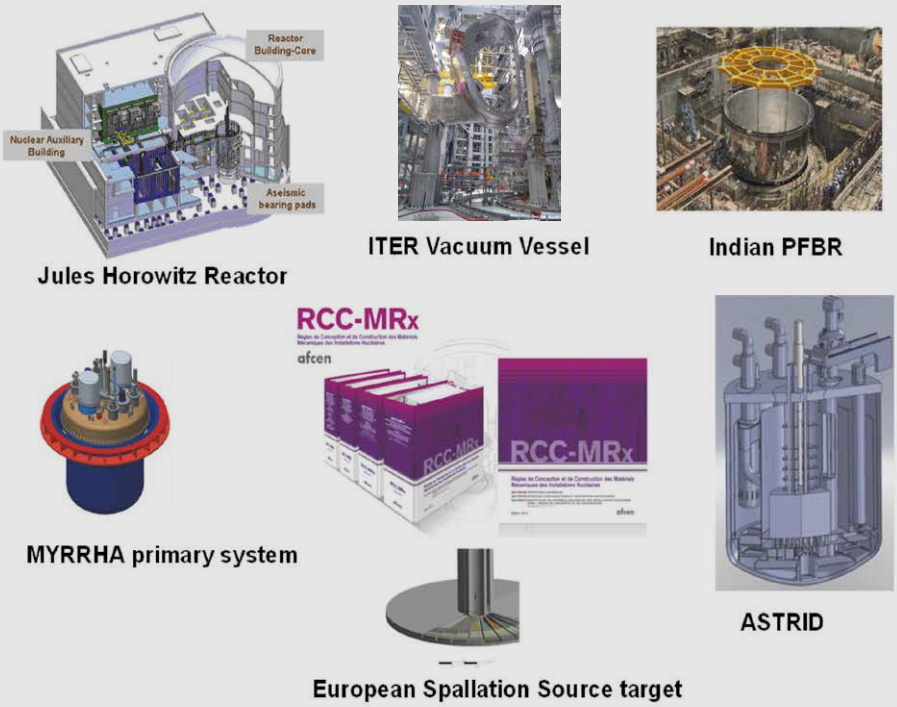
2.8.5 Technical studies

In 2016, work was finalized on the commissioned study entitled "Terms for introducing a new material into RCC-MRx". This study led to the publication of a methodological guide ("Guide for introducing a new material in RCC-MRx"), which explains, when introducing a non-codified material into RCC-MRx, the methods for obtaining the characteristics in Appendix A3 (expected / authorised tests, meaning of the data). This document will be updated in 2024 to include the precautions relating to intergranular corrosion and welded joint design data.

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

- Fast fracture analysis: this commissioned study also involves the RCC-M code. The aim is to standardize practices between the RCC-M and RCC-MRx codes and clarify the approach for identifying areas where fast fracture analyses must be performed. This commissioned study was completed in 2019 and identifies opportunities for improving the code accordingly.
- Update of RCC-MRx – Section II – Part REC 3000 (Special instructions for equipment subject to regulations): the purpose of this commissioned study is to update the sections on French regulations in line with the work carried out for RCC-M. This commissioned study was completed in 2020 and resulted in a major modification to the code that was incorporated into the 2022 edition.
- Preparation of a document describing the sources and key reasons underlying Appendix A1 (guide for the seismic analysis of equipment): the aim of this commissioned study is to publish the criteria for Appendix A1 in a PTAN. This commissioned study was finalized in 2018, following which these criteria were published.

In addition, the Subcommittee is involved in AFCEN's commissioned studies on producing a document compiling the tools for analyzing fast fracture resistance, as well as a commissioned study for producing a standard glossary for the three mechanical codes.



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

afcen

Shaping the rules for a sustainable nuclear technology

SUPPORT
FOR THE INDUSTRY

3.1 TRAINING

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

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

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

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

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

Partnership agreements

As of 2023, the 11 organizations that have signed a partnership agreement with AFCEN to deliver technical training are as follows: APAVE, BUREAU VERITAS, EFECTIS, Framatome, INSTN, PONTS FORMATION CONSEIL, SICA NUCLEAIRE, SNPI (CGN Group), UFPI (EDF Group), VINCOTTE Academy and SOCOTEC.

PARTNERSHIP AGREEMENTS SIGNED BY AFCEN AND TRAINING ORGANIZATIONS BY THE END OF 2023

3.1.1 Certified training

In 2021, AFCEN set up a certification scheme for remote learning courses and proposed the scheme to its training partners. Three partners have now obtained certification for their remote courses: Framatome, SOCOTEC and BUREAU VERITAS.

In 2023, the Committee had 39 certified courses in the catalog. 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.

Code	Title of training	Duration	Language	Partner
RCC-M	Introduction & further study of the code	2 to 5 days	FR / EN / CH	7 partners
	Structure and application of the code	3 days	FR	2 partners
	Procurement of materials according to the code	1 day	FR	1 partner
	Quality assurance	1 day	FR	1 partner
	Examination methods	2 days	FR	1 partner
	Design and sizing	2 to 4 days	FR / EN	2 partners
	Manufacturing - Welding	2 days	FR	1 partner
	Valve	3 days	FR	1 partner
	Elastic analysis according to the code - Primary stresses and fatigue	2 days	FR/EN	1 partner
RSE-M	Introduction to the code	2 days	FR	1 partner
	Use of the RSE-M code and its requirements	5 days	FR	1 partner
RCC-E	Introduction to the code	1 day	FR/EN	1 partner
	Comprehensive code training 2012 / 2016 / 2019	2 to 4 days	FR/EN	1 partner
	Qualification and long-term fabrication of mechanical components qualified under accidental conditions (2012 & 2016 & 2019 editions)	2 to 3 days	FR/EN	1 partner
	RCC-E code 2012 edition - "Inspection" Specialization	1 day	FR	1 partner
	Gap 2012 – 2016 - 2019	1 day	FR/EN	1 partner

Code	Title of training	Duration	Language	Partner
RCC-CW	General introduction	1 day	FR/EN	1 partner
	Construction	2 days	FR/EN	1 partner
	Design	3 days	FR/EN	1 partner
RCC-C	Introduction and use of the RCC-C code	2 days	FR	1 partner
RCC-F	Comprehensive code training	4 days	FR/EN	1 partner
RCC-MRx	Introduction to the code	2 to 3 days	FR/EN	3 partners

AFCEN TRAINING CATALOG AS OF LATE 2023 (DETAILS IN APPENDIX C)


afcen

CERTIFICATE OF TRAINING

Logo Training Partner

Of the following course

« TRAINING TITLE »

Code name

Awarded to : M. /Mrs First Name FAMILY NAME

From : Company

Date of attendance : from dd to dd mmm 20xx at place – (duration time XX hours)

Technical fields covered by the course : Training Content & covered fields

Place,dd mmm 20xx

On behalf of AFCEN
Training Manager of the CODE
First name, FAMILY NAME

On behalf of the training Partner
Manager of the Training
First name, FAMILY NAME

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www.site organisme

AFCEN CERTIFICATE OF ATTENDANCE

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

3.1.2 Training courses delivered in 2023

In 2020, AFCEN and its partners finished developing courses focusing on the ESPN documentation (guides, changes to the RCC-M code). The first sessions were available early 2021, and BUREAU VERITAS carried out a training session in 2023 (12 trainees) with Italy.

In 2023, 76 training sessions were held and covered all codes, representing 646 trainees and 1867 days of training. The training quality was assessed per code and organization, with specific attention to ensure that all associated messages related to nuclear safety were effectively delivered. Training managers took part in the in-class evaluation of three courses.

At the end of 2023, the certified training catalog featured several distance learning courses and the possibility for trainees to access electronic versions of the codes during their course. The catalog has been expanded to include a course on valves as part of the RCC-M code.

By the end of 2023, the certified training catalog comprised 39 courses covering all the AFCEN codes.

3.1 TRAINING

3.1.3 International training

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

In 2023, courses were delivered in China and in India.

A partnership agreement was renewed for China with SNPI (CGN group) in 2021. The RCC-M training course provided by this organization was certified in 2016. 49 trainees completed the RCC-M course in 2023.

In India, a partnership was set up by AFCEN, EDF, BUREAU VERITAS and LARSEN & TOUBRO to facilitate the provision of certified training in the country and thereby accompany projects currently being spearheaded by the French nuclear industry. In 2021, 46 trainees completed the online RCC-M course. A webinar providing an introduction to the RCC-E code was attended by 35 participants from approximately 20 companies (including five from NPCIL). No training courses were delivered in 2022 and 2023.

3.2 PRESENTATIONS OF THE CODES IN HIGHER EDUCATION

As part of the key development area identified when preparing the strategic plan, efforts are currently being made to present AFCEN's codes in certain undergraduate courses in nuclear engineering. It is effective for students on the following programmes:

- Masters of Nuclear Energy (MNE), for the speciality Nuclear Plant Design (RCC-M, RCC-E and RCC-CW),
- Engineering degree with honors in nuclear engineering offered by CNAM (RCC-M, RCC-F and RCC-CW).

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

3.3 AFCEN'S "FRANCE RELANCE" - CERTIFIED PROJECT - IMPROVING THE SECTOR'S EXPERTISE IN THE CODES

3.3.1 Project objectives launched in June 2021

AFCEN codes form an essential part of the technical standards used by France's nuclear industry. For example, they were used as a benchmark by at least 25% of the engineering, equipment and systems contracts awarded for the Flamanville 3 project (those contracts accounted for two thirds of the external expenditure committed to the project). There is every likelihood that these ratios are even higher for the EPR2 project, where approximately 60% of contracts should be aligned with AFCEN's codes. As such, it is vitally important for France's nuclear industry to be proficient in using the codes.

The aim of AFCEN's "France Relance"-certified project is to quickly provide the industry with two major types of tools:

- Tools for assessing a supplier's expertise in the codes
- Tools for improving the effectiveness of training courses on AFCEN's codes

Rolling out and using assessment tools for all the companies in the industry will help raise the level of technical expertise in AFCEN's codes through training or investments if knowledge gaps or discrepancies are observed, by identifying the suppliers offering the greatest maturity in the codes, and by encouraging suppliers to invest in training on the codes.

The tools for reinforcing training effectiveness are focused on improving the quality of the distance learning courses (an easier way of making the codes available during training), as well as building on the courses that AFCEN provides for universities and other institutes of higher education.

3.3.2 - Progress achieved in 2023: end of the project

The AFCEN project has now been completed. The tools have been developed and will be deployed in 2024. The results are presented below.

3.3.2.1 Tools for self-assessing and assessing suppliers' expertise in the RCC-M and RCC-E codes

In 2022, AFCEN provided the nuclear industry with a set of **tools allowing clients** to assess the level of experience in the RCC-M code by means of three guides:

- Guide 0 RCC-M (AFCEN-CF-22-002-A): assess the experience of providers (manufacturers, suppliers and subcontractors) in applying the technical requirements of the RCC-M code (Level 2 and 3).
- Guide 1 RCC-M (AFCEN-CF-22-014-A): allow manufacturers to effectively assess a supplier's or subcontractor's level of technical experience in the RCC-M code (Class 2 & 3 equipment).
- Guide 2 RCC-M (AFCEN-CF-22-015-A): allow clients to effectively assess a manufacturer's level of technical experience in the RCC-M code (Class 2 & 3 equipment).

In 2022, AFCEN also provided clients in the nuclear industry with a solution for assessing the level of expertise in the RCC-E code by means of a guide:

- Guide RCC-E (AFCEN-PTAN-02001-2022) : allow clients to effectively assess a manufacturer's level of technical experience in the RCC-E code.

In 2023, AFCEN also finalized its aim of **providing suppliers with tools to self-assess their proficiency** in the RCC-M code (mechanical components for pressurized water reactors), guide AFCEN-PTAN-02003-2024, and in the RCC-E code (electricity and I&C systems), guide AFCEN-PTAN-02002-2023.

The self-assessment tools are being developed in electronic format to increase their appeal (anonymous correction system, questions picked at random, and so on).

3.3.2.2. Tools for improving the effectiveness of training courses on AFCEN's codes

In 2022, AFCEN, in collaboration with AFNOR, has developed a specific secure tool for the temporary availability of AFCEN codes during the training period, in digital and read-only format.

This tool uses AFNOR's distribution platform (CObaz). Not only is this platform secure, but it also has the necessary features for providing this particular service. This tool is available to all AFCEN training partners.

3.3 AFCEN'S "FRANCE RELANCE" - CERTIFIED PROJECT - IMPROVING THE SECTOR'S EXPERTISE IN THE CODES

In 2022, AFCEN worked alongside the Framatome training academy and SICA Nucléaire in developing the PERF 1 and PERF 2 modules for the RCC-M and RCC-E codes.

In 2023, AFCEN and SICA Nucléaire worked together in upgrading the three-hour GENERAL module presenting all the AFCEN codes.

These modules are available for integration into university programmes.

Presentation of AFCEN in higher education (engineering degrees)

Three levels of proposals for engineering undergraduates majoring in nuclear engineering.

1/ GENERAL: a foundation module that introduces AFCEN's codes and provides an overview of how AFCEN's codes contribute to the safety demonstration of a basic nuclear facility. The module ties together such aspects as safety requirements, the level of quality and robustness required for nuclear components and equipment, the safety functions and the stakeholders of a nuclear project. It shows first-year undergraduates (on nuclear engineering or general engineering syllabuses) that the codes exist and provides a clearer insight into their value for the nuclear industry. This module can also highlight the interactions between the different codes, since the process of installing equipment and components may involve mechanical engineering, civil engineering, electrical engineering and fire protection.
Duration: three hours
Final assessment: yes, with questions that emphasize the role that the codes play in ensuring safety
Module developed and already in use

2/ PERF 1: a bespoke programme containing an introductory module on AFCEN's codes [GENERAL] as well as an introduction to the content and use of AFCEN's different codes. The university can choose the code, based on the top major subjects among its students: mechanical engineering (three codes = RCC-M – design and construction rules for mechanical components, RSE-M – in-service inspection rules for mechanical components, RCC-MRx – design and construction rules for mechanical components of nuclear installations: high-temperature, research and fusion reactors), electrical engineering (one code = RCC-E), civil engineering (one code = RCC-CW), fuel assemblies (one code = RCC-C), and fire protection (one code = RCC-F). Note that the process of installing equipment and components may involve civil engineering, electrical engineering and fire protection.
Duration: three hours (GENERAL) + three hours for each code chosen
Final assessment: yes
Modules developed and already in use

3/ PERF 2: a programme that builds on the previous programme by adding a "practical case study" module that is tailored to the students' major subject. A specific part of the code is presented in detail (three hours). Students work on an industrial project (outside of class time), which is subsequently commented on and corrected in class (three hours). Industrial project examples include designing a building's concrete walls, verifying the concrete design studies, calculating the thickness of the main sections of a vessel with a hemispherical base, sizing the sections for reinforcing openings, developing a fire containment system for a building, identifying the test sequence for electrical equipment, and installing electrical equipment in a room.
This programme offers students a hands-on approach to the codes and introduces them to the engineering tools that are widely used by nuclear equipment manufacturers and clients. It shows the wealth of technical demonstrations required to prove a reactor's safety. Allowing students to explore the code for their chosen major subject improves their understanding of the industrial aspects surrounding the nuclear industry. Taking part in an industrial project that addresses the code for their area of specialization gives them a closer look at the real challenges facing nuclear equipment manufacturers and consultancies designing nuclear power plants.
Module duration: three hours for the common core syllabus [GENERAL] + three-hour general presentation of the code [PERF 1] + six hours (detailed presentation followed by corrections of the industrial project) + time spent working on the industrial project outside of class
Final assessment: yes, with corrections to the industrial project
Modules developed for RCC-M and RCC-E

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Shaping the rules for a sustainable nuclear technology

AFCEN
RESOURCES

4.1 GOVERNING MEMBERS

AFCEN is an international association which was founded by EDF and Framatome in 1980 and brings together all 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 is managed by a Board of Directors, which reports to members on its activities during the General Meeting according to the terms defined in its articles of association.

AFCEN's founder members (EDF and Framatome), and CEA sit on AFCEN's Board of Directors. AFCEN's Board of Directors manages and administers the association, defines the strategic objectives and provisional budget. EDF serves as AFCEN's President, while Framatome acts as Vice-President.

The Board designates an Executive Committee, which is tasked with achieving its work programme. The Executive Committee is assisted by a General Secretariat, which is responsible for the general coordination of the association's activities, a Training Committee, an Editorial Committee and seven Subcommittees (one for each code). The General Secretariat oversees AFCEN's operation, proposes strategic directions to the Board of Directors and implements the actions chosen by the Board.

AFCEN does not have any regular employees. Board members designate the association's General Secretary and his Deputy, the Chairs of the Editorial and Training Committees, and the Chairs of the seven Subcommittees responsible for developing the codes.

4.2 MEMBERS AND THEIR INVOLVEMENT IN THE SUBCOMMITTEES

AFCEN is aiming to increase membership levels among companies providing key experts who can draw on their expertise to move codes development forward. By the end of 2023, AFCEN had 79 members, all involved in the nuclear industry both in France and at the international level. As part of the membership process, each company prepares an application that explains its reasons to join the association, as well as the Subcommittees in which it wishes to participate and send its experts to help develop codes. Board members approve applications after examining the company's reasons for wishing to join the association, and following feedback from the Chairs of the Editorial Committee and the relevant Subcommittees.

Every member joining a Subcommittee takes part in that Subcommittee's meetings and designates which experts would like to participate in the working groups. Each Subcommittee Chair approves the member's involvement in the working groups after verifying its skills and/or expertise in the chosen field. In some Subcommittees, leadership of the working groups may be entrusted to an expert from an industrial company if the following three conditions are met:

1. The expert possesses the required level of expertise in the relevant field
2. The expert is chosen by the Subcommittee Board
3. The expert's company grants the necessary time for the expert to lead the drafting group's activities

As such, AFCEN is striving to ramp up the proportion of industry experts in each Subcommittee's working groups.

By the end of 2023, AFCEN members are:

Membership renewed in 2023 **New member for 2023**

1	ALPHATEST	FR	28	FUSION FOR ENERGY	ES	55	SICA NUCLEAIRE	FR
2	ALTRAD ENDEL	FR	29	GE STEAM POWER SYSTEMS	FR	56	SIGEDI	FR
3	APAVE	FR	30	GEODYNAMIQUE ET STRUCTURE	FR	57	SITES	FR
4	AUBERT ET DUVAL	FR	31	GISMIC	FR	58	SNCT Publications	FR
5	BASLER & HOFMANN AG	CH	32	HDI	FR	59	SULZER	FR
6	BERNARD CONTROLS	FR	33	HILTI France	FR	60	TECHNICATOME	FR
7	BOUYGUES TP	FR	34	INSTITUT LAUE LANGEVIN (ILL)	FR	61	TERRASOL	FR
8	BUREAU VERITAS	FR	35	INTERCONTROLE	FR	62	TRACTEBEL ENGINEERING	FR
9	CEA	FR	36	ITER	FR	63	TRILLIUM FLOW TECHNOLOGIES France	FR
10	CETIM	FR	37	JACOBS	GB	64	TUV UK Ltd	GB
11	CGNPC	CN	38	JIULI (ZHEJIANG JIULI HI-TECH METALS CO LTD)	CN	65	VELAN SAS	FR
12	CLYDEUNION PUMPS SAS	FR	39	LEVIAT GMBH	DE	66	VINCI CONSTRUCTION	FR
13	CNNC	CN	40	LISEGA SAS	FR	67	VINCOTTE SA	BE
14	DAHER VALVES	FR	41	MANGIAROTTI SPA	IT	68	WESTINGHOUSE FR	FR
15	DEXTRA MANUFACTURING	TH	42	NAVAL GROUP SA	FR	69	WUERTH	DE
16	EDF	FR	43	NFM SYSTEMS	FR	70	LINXION THE ORIGINAL (ex-BARTEC GROUP)	FR
17	EDVANCE	FR	44	NNB	GB	71	MONTEIRO	FR
18	EFECTIS France	FR	45	NUVIA PROTECTION	FR	72	UGITECH	FR
19	EGIS INDUSTRIES	FR	46	OMEXOM (CEGELEC)	FR	73	NEWCLEO	FR
20	EIFFAGE GC	FR	47	ONET TECHNOLOGIES	FR	74	ALCO	FR
21	EMERSON AUTOMATION SOLUTIONS	FR	48	ORANO	FR	75	ACM	FR
22	ENSA (EQUIPOS NUCLEARES S.A, SME)	ES	49	ORTEC	FR	76	ERICO France	FR
23	EPM INC	US	50	PETERCEM	FR	77	ARTELIA SAS	FR
24	FIVES NORDON	FR	51	PONTICELLI	FR	78	PEIKKO GROUP CORPORATION	FI
25	FLOWSERVE POMPE SAS	FR	52	REEL SAS	FR	79	SBS FORGE	FR
26	FRAMATOME	FR	53	SCHNEIDER ELECTRIC	FR			
27	FRAMATOME GRENOBLE	FR	54	SCK CEN	BE			

4.2 MEMBERS AND THEIR INVOLVEMENT IN THE SUBCOMMITTEES

Member involvement in the Subcommittees

In 2023, AFCEN members were involved in the Subcommittees as described in the box below.

RCC-M (46 members)
ACM, ALCO, ALPHATEST, ALTRAD ENDEL, APAVE, AUBERT & DUVAL, BUREAU VERITAS EXPLOITATION, CEA, CETIM, CGNPC, CLYDEUNION PUMPS SAS, CNNC, DAHER VALVES, EDF, EDVANCE, EMERSON AUTOMATION SOLUTIONS, ENSA, FIVES NORDON, FLOWSERVE SAS, FRAMATOME, FUSION FOR ENERGY, GISMIC, HDI, INTERCONTROLE, JIULI, LISEGA SAS, MANGIAROTTI SPA, MONTEIRO, NAVAL GROUP SA, NNB, ONET TECHNOLOGIES, ORTEC, PONTICELLI, REEL SAS, SBS FORGE, SIGEDI, SNCT, SULZER, TECHNICATOME, TRACTEBEL ENGINEERING, TRILLIUM FLOW TECHNOLOGIES, TUV UK Ltd, UGITECH, VELAN SAS, VINCOTTE SA, WESTINGHOUSE FR.

RSE-M (18 members)
ALTRAD ENDEL, APAVE, BUREAU VERITAS EXPLOITATION, CEA, CGNPC, CNNC, EDF, EDVANCE, FRAMATOME, INTERCONTROLE, ITER, NNB, OMEXOM, ONET TECHNOLOGIES, ORANO, ORTEC, TRILLIUM FLOW, WESTINGHOUSE FR.

RCC-E (20 members)
APAVE, BERNARD CONTROLS, CEA, CGNPC, CNNC, EDF, EDVANCE, FRAMATOME, FRAMATOME GRENOBLE, GE STEAM POWER SYSTEMS, JACOBS, NNB, PETERCEM, REEL SAS, SCHNEIDER ELECTRIC, SICA NUCLEAIRE, SIEMENS SAS, TECHNICATOME, TRACTEBEL ENGINEERING, WESTINGHOUSE FR.

RCC-CW (31 members)
APAVE, ARTELIA SAS, BASLER & HOFMANN AG, BOUYGUES TP, CEA, CGNPC, CNNC, DEXTRA MANUFACTURING, EDF, EDVANCE, EGIS INDUSTRIES, EIFFAGE GC, ERICO FRANCE ; FRAMATOME, FUSION FOR ENERGY, GEODYNAMIQUE ET STRUCTURE, HILTI FRANCE, JACOBS, LEVIAT GMBH, LINXION THE ORIGINAL, NFM SYSTEMS, NNB, ONET TECHNOLOGIES, ORANO, PEIKKO GROUP CORPORATION, SITES, TECHNICATOME, TERRASOL, TRACTEBEL ENGINEERING, VINCI CONSTRUCTION, WUERTH FRANCE.

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

RCC-F (12 members)
CEA, CGNPC, CNNC, EDF, EDVANCE, EFECTIS FRANCE, EPM INC, FRAMATOME, NNB, NUVIA PROTECTION, TECHNICATOME, TRACTEBEL ENGINEERING.

RCC-MRx (19 members)
APAVE, BUREAU VERITAS EXPLOITATION, CEA, CNNC, EDF, ENSA, FRAMATOME, FUSION FOR ENERGY, ILL, ITER, MANGIAROTTI SPA, NEWCLEO, NNB, ONET TECHNOLOGIES, ORANO, SCK CEN, TECHNICATOME, TRACTEBEL ENGINEERING, VINCOTTE SA.

AFCEN MEMBER INVOLVEMENT IN THE SUBCOMMITTEES IN 2023

4.3 EXPERTS

Each member company sends its experts to participate in the activities of the Subcommittees and working groups. Experts taking part in a working group provide their expertise and enhance the group's performance by comparing and contrasting their views with the opinions of the other experts. Involvement in AFCEN allows experts to broaden their area of expertise and help move the nuclear industry forward.

The number of experts made available by the members to take part in the activities of the Subcommittees is as follows for 2023 (not including the Users Groups):

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

4.4 NEW MEMBERS IN 2023

Ten new organizations became AFCEN members in 2023:

LINXION was founded in 1994 by a French group with the aim of developing and marketing the original patent for the "BARTEC" cold forged threaded mechanical splice. LINXION (formerly BARTEC) specializes in mechanical splicing devices for reinforced concrete and works in partnership with its rebar clients on major civil engineering and public works projects in France and abroad. The company has joined the RCC-CW Subcommittee.

Founded in 1999 to develop piping and welding activities in the nuclear industry, Monteiro designs, manufactures, modifies and repairs sheet metal equipment and nuclear piping. The company has joined the RCC-M Subcommittee.

Founded in 1948 with the aim of building pressure vessels in complex environments, ACM designs and manufactures SG internals and level 2 & 3 exchangers. The company has joined the RCC-M Subcommittee.

4.4 NEW MEMBERS IN 2023

ALCO Tubes & Fittings	Since 1979, ALCO has been distributing seamless tubes and fittings in stainless steel and nickel alloys of European origin for the petrochemical, industrial gases (including hydrogen), naval, military and nuclear markets. ALCO is an EDF-UTO and Framatome QN-100 qualified RCC-M stockholder. The company stores and distributes tubes, fittings, flanges, bars and bespoke parts according to EN-ASTM-CST standards, including RCC-M level 1, 2 and level 3 parts and RCC-MRx parts in stainless steel, alloy steels and carbon steels. The company has joined the RCC-M Subcommittee.
newcleo Futurable Energy	This startup was launched in September 2021 to develop the technology based on fast neutron modular reactor (LFR-SMR) concepts using liquid lead as the primary coolant. Newcleo is aiming to build a 30 MWe demonstrator followed by a 200 MWe reactor. The company has joined the RCC-MRx Subcommittee.
nVent ERICO	ERICO manufactures mechanical clamp and anchor systems for reinforced concrete rebar (or DRAAB according to AFCAB). Its activities also include electricity, such as lightning and power surge protection solutions, power supplies, attachment points and electrical cabinets. The company has joined the RCC-CW Subcommittee.
Ugitech	Ugitech produces and sells a wide range of long stainless steel products. Rebar, wire rods and drawn wire are the three main products in Ugitech's range. This company has joined the RCC-M Subcommittee.
ARTELIA	Artelia is an independent, multidisciplinary engineering consultancy specializing in construction engineering. The company has joined the RCC-CW Subcommittee.
peikko	Peikko supplies concrete and beam connections for precast and cast-in-situ solutions in a wide range of applications. The company has joined the RCC-CW Subcommittee.
SBS	SBS Forge manufactures forged components weighing up to five tons and operates in a number of sectors, including the nuclear industry. This company has joined the RCC-M Subcommittee.

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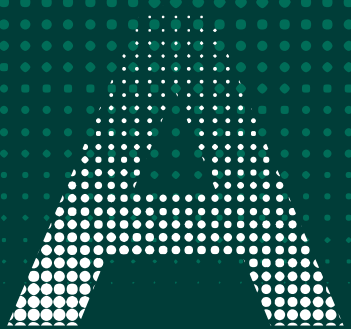
Shaping the rules for a sustainable nuclear technology

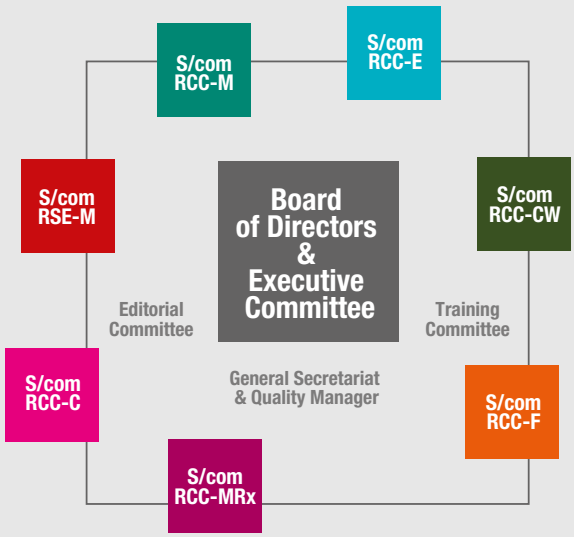


ORGANIZATION
AND OPERATION OF AFCEN

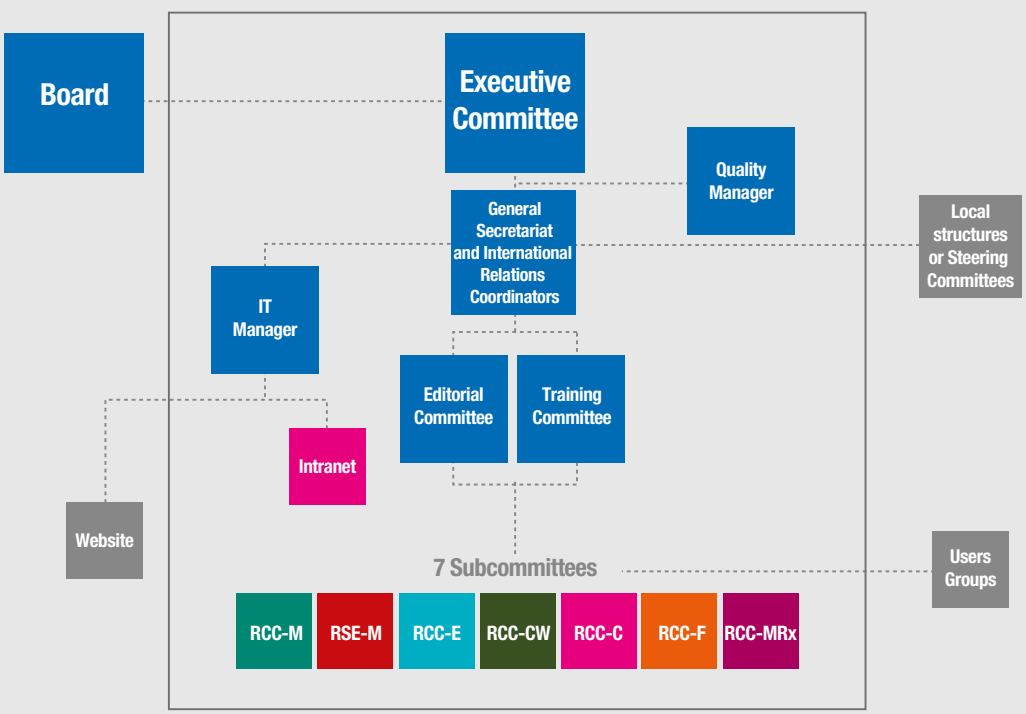
A.1 ORGANIZATION AND OPERATION

A.1.1 General organization

The general organization of AFCEN is detailed on the website **www.afcen.com** and represented in the diagram below.



AFCEN'S ORGANIZATIONAL STRUCTURE



GENERAL ORGANIZATION OF AFCEN

A.1.2 General Meeting and Board of Directors

The AFCEN's Board of Directors members.

LAURENT THIEFFRY
PRESIDENT, EDF ADMINISTRATOR

FRANÇOISE DE BOIS
VICE-PRESIDENT TREASURER,
FRAMATOME ADMINISTRATOR

PARTICIPATE IN BOARD MEETINGS

LUCIEN ALLAIS
CEA ADMINISTRATOR

PHILIPPE LAURENT
EDF ADMINISTRATOR

NICOLAS GILLET
FRAMATOME
ADMINISTRATOR

DIDIER HERVIEU
GENERAL SECRETARY

BRUNO MARQUIS
DEPUTY GENERAL
SECRETARY

AFCEN'S BOARD OF DIRECTORS

In 2023, AFCEN's Board of Directors held two meetings, and members organized their General Meeting on March 30, 2023. During the General Meeting, members validated the:

- financial results for 2022 and the 2023 budget,
- membership fees for 2024,
- general strategic directions prepared by the Board of Directors.

AFCEN GENERAL ORIENTATIONS IN 2023

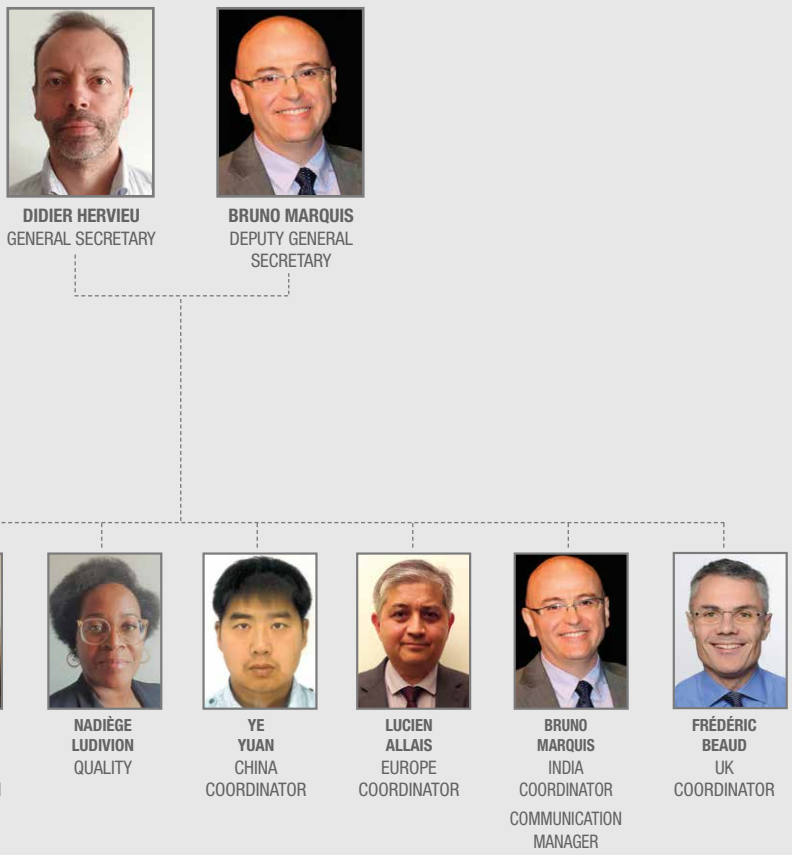
- In France, keep our commitments for conformity of mechanical construction code with French ESPN regulations and strengthen exchanges with the authorities
- Support EDF in preparation of PWR international nuclear offers and SMR
- Support the Major Order Givers in the implementation of the requirement to master AFCEN codes in the supplier qualification process
- Reinforce AFCEN international position to be reference in Europe
- Pursue the development of our open policy towards new members and reinforce their technical participation
- Strengthen and adapt to industrial demand the AFCEN certified training offer and code management tools
- Continue to implement digitalization within the Association
- Maintain AFCEN financial performance and organization efficiency

A.1 ORGANIZATION AND OPERATION

A.1.3 General Secretariat

The General Secretariat organizes the process of producing and distributing codes, and supports all AFCEN activities deployed by the Editorial and Training Committees. The General Secretariat interfaces with the association's members, clients and interested parties. It oversees AFCEN's communication and biennial international Congress, as well as the association's participation in international trade fairs, such as World Nuclear Exhibition (WNE).

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



AFCEN'S GENERAL SECRETARIAT

A.1.4 Editorial Committee

The Editorial committee Chair and the Deputy Chairs are appointed by the Board of Directors. In addition to the Chair and the Deputy Chair in charge of ESPN programme, the Editorial Committee is attended by the Chairs from the 7 Subcommittees. The General Secretary and the Deputy General Secretary, as well as the International Coordinators, Quality Manager and Information System Manager, are invited to attend Editorial Committee meetings. Depending on the order of business, working group leaders are also invited to report on the progress of specific works programmes commissioned by the Editorial Committee.

FRÉDÉRIC BEAUD
CHAIRMAN OF THE EDITORIAL COMMITTEE

MARIE LEMAIRE
DEPUTY

MANUELA TRIAY
CHAIRMAN
OF THE RCC-M
SUBCOMMITTEE

MATHIEU DOLL
CHAIRMAN
OF THE RSE-M
SUBCOMMITTEE

BENEDICT WILLEY
CHAIRMAN
OF THE RCC-E
SUBCOMMITTEE

GUILLAUME ZAMMOUT
CHAIRMAN
OF THE RCC-CW
SUBCOMMITTEE

KADER NIANG
CHAIRMAN
OF THE RCC-C
SUBCOMMITTEE

BERNARD GAUTIER
CHAIRMAN
OF THE RCC-F
SUBCOMMITTEE

CÉCILE PETESCH
CHAIRWOMAN
OF THE RCC-MRx
SUBCOMMITTEE

AFCEN'S EDITORIAL COMMITTEE

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

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

A.1 ORGANIZATION AND OPERATION

The Editorial Committee's editorial programme is aimed at responding to the needs of AFCEN's members. Standard practice is for members to express their needs by means of code Requests for Modification (RM) or Requests for Interpretation (RI). Such needs may also be voiced during AFCEN's general meetings or any events organized by the Association, as well as during meetings between AFCEN and its different stakeholders (major projects, nuclear safety authority, etc.). The various international schemes set up by AFCEN (Users Groups, CEN/WS64, etc.) are intended to ascertain potential requirements. These needs are addressed in the different Subcommittees or directly by the Editorial Committee where topics concern several Subcommittees.

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

General activity of the Editorial Committee in 2023:

The Editorial Committee held four meetings. The main items addressed during the meetings were as follows:
a. AFCEN's general information (events, meetings, organization, information system, etc.)
b. International news and projects
c. Operation of the Editorial Committee (organization, quality, etc.)
d. Oversight of the editorial programme (codes, overarching studies, ESPN programme, etc.) with subject presentations
e. Subcommittee reporting

In addition to amending the codes in the permanent working groups within each Subcommittee, dedicated working groups are regularly set up to examine specific technical subject areas at the request of the Subcommittees or Editorial Committee. As such, the ESPN programme led by the Editorial Committee coordinates a set of working groups focusing on the terms for applying the ESPN Regulation in relation to the RCC-M and RSE-M codes.

A.1.5 Training Committee

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

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

The Training Committee assesses the ability of prospective providers to implement AFCEN courses and approves the training aids that they consequently need to use. It establishes partnership agreements with training organizations and manages all the aspects specified in those agreements.

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

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

BRUNO MARQUIS
CHAIRMAN OF TRAINING COMMITTEE

DIDIER HERVIEU
DEPUTY

OLIVIER RECEVEUR
MANAGER FOR TRAININGS ON RCC-M

EMILIE SAMAIN
MANAGER FOR TRAININGS ON RSE-M

ISABELLE MORGADO ELLEBOODE
MANAGER FOR TRAININGS ON RCC-E

YOLAINE HERRERA
MANAGER FOR TRAININGS ON RCC-CW

LUDOVIC QUEMARD
MANAGER FOR TRAININGS ON RCC-C

MICKAËL CESBRON
MANAGER FOR TRAININGS ON RCC-F

THIERRY LEBARBE
MANAGER FOR TRAININGS ON RCC-MRx

JEREMY KERAVEN
MANAGER FOR CROSS-FUNCTIONAL TRAININGS

AFCEN'S TRAINING COMMITTEE

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

The Training Committee includes a representative from each Subcommittee, called a "Subcommittee Training Officer", and also a liaison for all training courses that are not specific to one or more codes, who is responsible for developing and maintaining those courses.

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

GENERAL ACTIVITY OF THE TRAINING COMMITTEE IN 2023

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

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

The Training Committee consolidated 39 training courses and issued 646 certificates of attendance for courses on AFCEN codes.
The Training Committee has continued developing videos to present AFCEN codes. Videos are currently produced for six codes, the video on the RCC-MRx code will be available in 2024.

A.1 ORGANIZATION AND OPERATION

A.1.6 Subcommittees

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

AFCEN SUBCOMMITTEES IN 2023

In 2023, seven Subcommittees were active:

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

The Subcommittees are responsible for:

- working as part of the Editorial Committee and drafting the rules corresponding to the field covered by the Subcommittee, and continuously updating those rules to reflect feedback from industry best practices and changes to international legislation,
- supporting the Training Committee with certifying training courses and selecting providers to deliver such courses,
- supporting and interfacing with international Users Groups.

Each Subcommittee comprises :

- a Subcommittee General Assembly,
- a Subcommittee Board,
- permanent working groups,
- dedicated working groups.

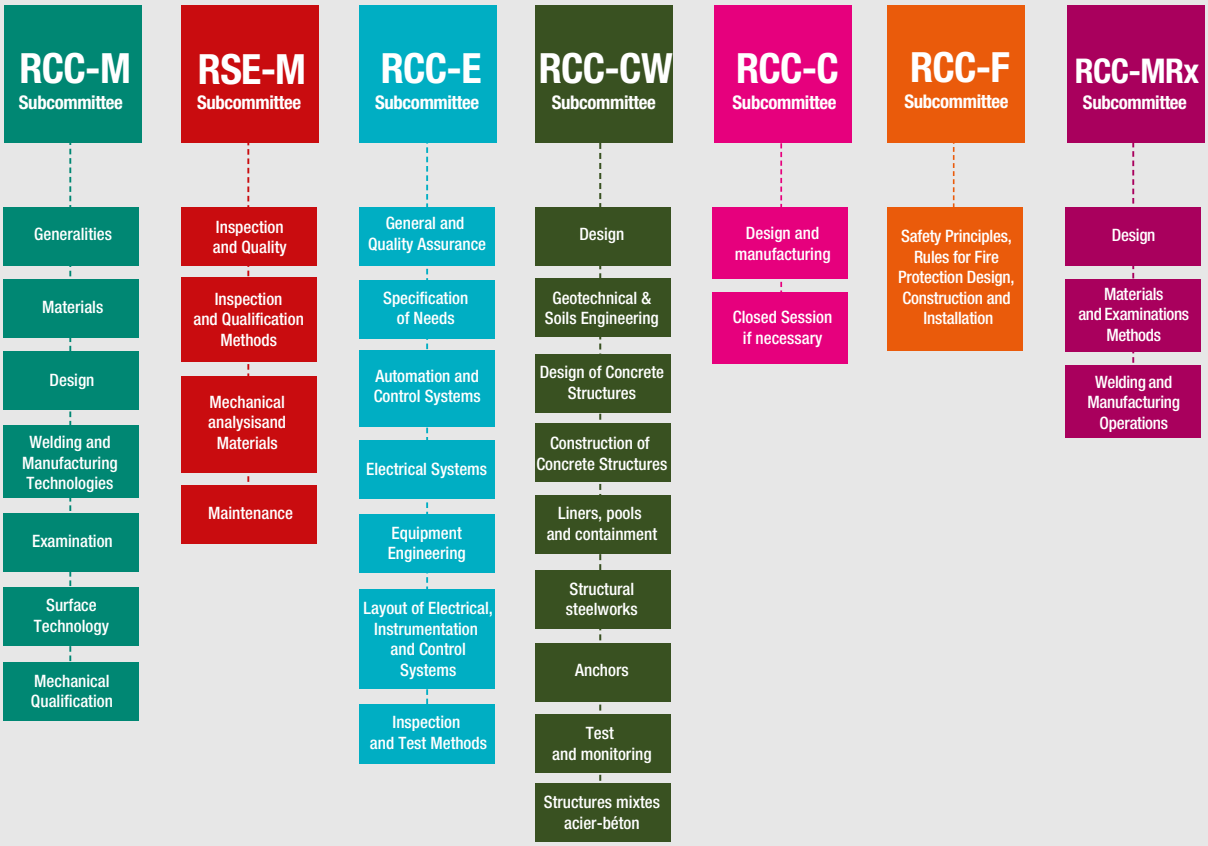
The Subcommittee Board represents the Subcommittee's decision-making and arbitration body, and features a chair and a restricted number of experts appointed by the Subcommittee chair based on their skills. The Subcommittee Chair designates the working group leaders from the experts in the Subcommittee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

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

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

- drafting and continually improving the parts of the code corresponding to the sub-field concerned,
- examining and responding to modification and interpretation requests.

Permanent working groups investigate modification requests, which are openly discussed during a Subcommittee meeting attended by all representatives appointed by AFCEN members. Decisions are taken by the Subcommittee Board. Texts approved by the Subcommittee Board are submitted to the Editorial Committee and Secretary-General by the Subcommittee Chair to obtain approval for publication.



AFCEN'S SUBCOMMITTEES AND PERMANENT WORKING GROUPS

A.1 ORGANIZATION AND OPERATION

A.1.7 Users Groups

Users Groups are local structures (for each country and Subcommittee) that are responsible for coordinating code activities at the international level in liaison with local industry. Their missions involve: pre-investigating modification and interpretation requests submitted by local AFCEN code users,

- informing users about the activities of AFCEN's Subcommittees and any changes to the corresponding codes,
- sharing feedback from the country's nuclear industry,
- facilitating adaptation of AFCEN codes to the local context (especially the country's regulations and industry best practices),
- helping to provide training for the AFCEN code users in their country,
- assisting with identifying communication needs (seminars, conferences, etc.) and their implementation in the country,
- helping ensure consistency in the various multi-lingual versions of the codes.

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

In 2023 in the UK :
Three Users Groups are in operation in the UK.
The RCC-M Users Group is currently waiting to be reactivated.
The Users Group for the civil engineering codes held a working session in June 2023.
The RCC-E Users Group held a working session in January 2023.

In 2023 in China:
The CSUG (Chinese Specialized Users Groups) resumed its activities after three difficult years of grappling with the Covid pandemic. In November 2023, the CUG steering committee meeting was successfully organized in Beijing. A new Chinese chair (Mr. Jianping Zhou), proposed by CGN, was elected. Seven CSUGs (one for each code) subsequently held productive meetings in Beijing and attracted over 150 French and Chinese experts. In addition, the RCC-M CSUG called an extra session in May 2023 in Yinchuan, in which the RCC-M Subcommittee participated by videoconference.
Note that the CSUG also host the working groups (PG) between AFCEN and NEA (National Energy Administration) based on collaborative projects with Chinese standards, including the translation of AFCEN's codes into Chinese.

GENERAL ACTIVITY OF THE AFCEN CODE USERS GROUPS IN 2023

A.2 AFCEN QUALITY MANAGEMENT

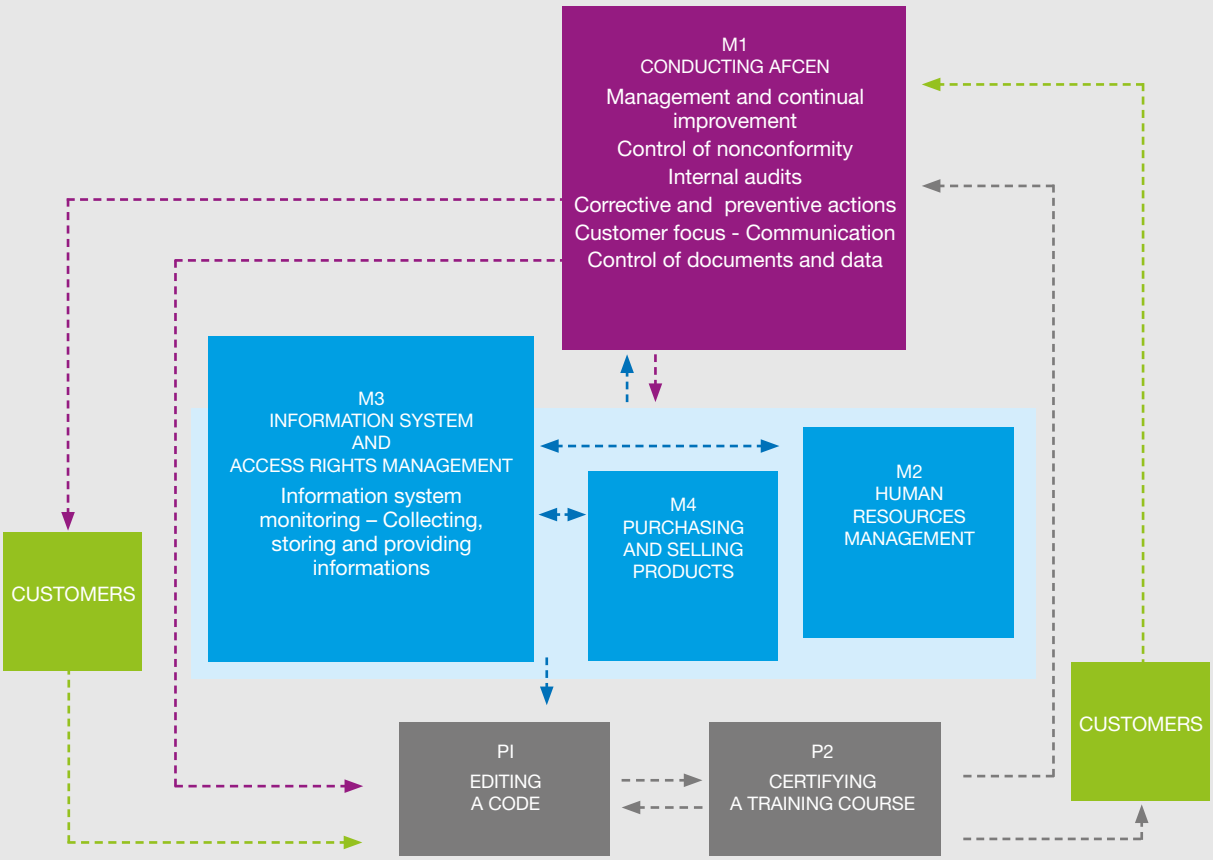
AFCEN has set up a process-based management system to perform its missions, namely produce and disseminate reference publications and codes for building, operating and using nuclear facilities.

This process-based organization enables AFCEN to:

- supervise AFCEN's operation from a cross-functional perspective,
- manage the interfaces and resources,
- clearly define the responsibilities.

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

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



PROCESS MAP

Management of AFCEN is described in process M1.

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

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

A.2 AFCEN QUALITY MANAGEMENT

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

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

AFCEN has been ISO 9001-certified since January 2014. In 2017, AFCEN migrated its quality management system to the 2015 version of ISO 9001. In 2022, the certification follow-up audit concluded that AFCEN's quality management system was sufficiently mature and effective.

AFCEN's general quality management activities in 2022 are summarized in the box below.

Three internal audits were carried out in 2023 into the processes for purchasing and selling products, managing skills and certifying training.

In response to the 2022 certification audit, AFCEN revised and clarified the individual elements within the processes and consequently reviewed the associated procedures.

Three process reviews were performed into M2 "managing skills", M1 "managing AFCEN" and P1 "developing a code». The AFCEN management review was held in February 8, 2023. It enabled the association to:

- identify key performance indicators
- check the actions taken to resolve any identified nonconformities and implement the association corrective actions,
- consider the interested parties and assess their expectations,
- decide what actions to implement to reduce risks and consider the opportunities of these processes
- analyse feedback from the WNE held in December 2021,
- check that the customer focus principle is correctly applied when dealing with requests from AFCEN members, and the French and English Safety Authorities.

An interim management review held on July 20, 2023, to:

- monitor the key performance indicators and decide on which actions should be taken,
- address any areas for concern identified during the internal audits.

The quality policy and strategy were communicated at every opportunity. In particular, the actions associated with the Strategic Plan were deployed, especially the resources component aimed at strengthening expertise in the drafting groups and developing experts' participation in AFCEN.

Certification follow-up audit:
On November 16, 2023, AFCEN passed the certification follow-up audit for its quality management system (ISO 9001: 2015) since no nonconformities were identified. The auditor identified four strengths, i.e. the process maturity analysis (M1), trainer validation through in-class evaluations (P2), monitoring of key profiles (M2), and the process for addressing interpretation requests (IRs) and modification requests (MRs) (P1).

AFCEN'S GENERAL QUALITY MANAGEMENT ACTIVITIES

A.3 INFORMATION AND SALES SYSTEM

A.3.1 AFCEN Core collaborative workspace

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

In 2023, AFCEN continued offering training sessions for its main users in the collaborative space available to its expert members. Over 1,000 users have registered. Each Subcommittee manages its space independently. In 2023, efforts focused on keeping shared information up-to-date by the technical secretaries, using tables for numbering chronological lists and saving information.

Sharing the tables ensures faster access to information. The shared calendar featuring the main events is now operational.

A.3.2 The AFCEN.com website

AFCEN.com presents AFCEN's organization, activities and latest news. The website acts as an interface with the public, interested parties and users. The afcen.com website was given a makeover in 2020 to improve clarity and enhance the navigation experience.

The afcen.com website allows users to:

- purchase AFCEN's publications with access via the online library, some publications are available free of charge,
- subscribe to the Association and sign up for AFCEN's events,
- view Interpretation Request, Modification Request and Feedback forms, as well as the collection of Interpretation Requests for the RCC-M and RSE-M codes, and the Modification Forms for the 2020 and 2022 editions of the RCC-M code,
- discover the training courses on AFCEN's codes by our partners.

AFCEN applies the provisions required by the General Data Protection Regulation (GDPR) for information exchanges. AFCEN's data privacy policy and its terms and conditions of sale are available on the www.afcen.com website to ensure complete transparency.

A.3.3 Sales model for AFCEN's publication

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

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

- prioritizing AFCEN's members by offering access to its publications at even more attractive prices,
- driving subscription renewals from one year to the next to give users unlimited access to the latest updates and publications.

A.3 INFORMATION AND SALES SYSTEM

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

- access to the digital versions of its publications,
- unlimited and anywhere access to its online library,
- access to the most recent versions of the codes upon publication,
- access to the technical publications and criteria associated with the codes,
- access to the code history and versions in the different languages published.

To provide industry players operating across several sites with easier access to the codes, AFCEN has implemented an “unlimited subscription” service with an attractive pricing policy for each code. When clients sign up for the three-year subscription plan, they receive a 60% discount for the first year of their subscription. The price per code is summarized in Appendix B of the price list.

A.3.4 Distribution agreement with AFNOR

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

In 2021, the SAGAWEB solution was replaced with CObaz, a platform that offers users a wider range of features. WEBPORT users were switched over to CObaz in 2023.

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

Visit www.afcen.com to find out more!

afcen

Shaping the rules for a sustainable nuclear technology

APPENDIX

CATALOG

OF AFCEN CODES AND DOCUMENTS AVAILABLE FOR SALE

B PUBLICATIONS PRICES

Codes and publications	Description	Available lang.	Paper book format (€ excl tax)	PDF single format (€ excl tax)	Subscription format* (€ HT)
RCC-M Subscription	Publications included in the subscription: RCC-M 2022 / RCC-M 2020 / RCC-M 2018 / RCC-M 2017 / RCC-M 2016 / RCC-M 2012 + addendum 2013, 2014, 2015 / RCC-M 2007 + addendum 2008, 2009, 2010 / RCC-M 2000 + addendum 2002 / Criteria 2014 RCC-M Prevention damage mechanical components / AFCEN-RM-13-067-A / AFCEN-RM-13-067-B / AFCEN-RM-14-309-A / AFCEN-RM-14-309-C / AFCEN-RM-15-001-A / AFCEN-RM-15-149-B / AFCEN-RM-15-149-C / AFCEN-RM-15-150-B / AFCEN-RM-15-166-A / AFCEN-RM-15-166-C / AFCEN-RM-16-218-C / AFCEN-RM-16-263-A / AFCEN-RM-16-264-A / AFCEN-RM-16-271-D / AFCEN-RM-16-274-D / AFCEN-RM-16-282-C / AFCEN-RM-16-455-B / AFCEN-RM-17-094-B / AFCEN-RM-17-110-B / AFCEN-RM-17-428-B / AFCEN-RM-17-461-B / AFCEN-RM-18-018-C / AFCEN-RM-18-019-C / AFCEN-RM-18-056-A / AFCEN-RM-18-198-B / AFCEN-RM-19-327-A / PTAN 2020 AIP conception fabrication / AFCEN-PTAN-01001-2022 / AFCEN-PTAN-07001-2023 / AFCEN-PTAN-07002-2023 / AFCEN-PTAN-07003-2023 / AFCEN-PTAN-07004-2023 / AFCEN-PTAN-07005-2023 / AFCEN-PTAN-07006-2023 / AFCEN-PTAN-09001-2023	•	/	/	2600
RCC-M 2022 AFCEN-PTAN-07001-2023	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands + PTAN Classement des fiches de modification du code RCC-M (English version will be available soon)	FR, EN	2 950	/	Cf. Subscription
RCC-M 2020 AFCEN-PTAN-07001-2023	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands + PTAN Classement des fiches de modification du code RCC-M (English version will be available soon)	FR, EN	2 950	/	
RCC-M 2018	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	2 950	/	
RCC-M 2017	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	2 950	/	
RCC-M 2016	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	2 950	/	
RCC-M 2012 + addendum 2013, 2014, 2015	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	2 820	/	
RCC-M 2007 + addendum 2008, 2009, 2010	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	/	1 620	
RCC-M 2000 + addendum 2002	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR	/	1 620	
Criteria 2014 RCC-M	Prevention of damages in mechanical components. Introduction to the design, analysis and construction rules of the RCC-M	FR, EN	1 590	1 540	
AFCEN-RM-13-067-A	Radiation protection guide for the design of Nuclear Pressure Equipment for PWR plants in France	FR, EN	/	30	
AFCEN-RM-13-067-B	Guide de radioprotection pour la conception des équipements sous pression nucléaires des centrales REP installées en France (rev B)	FR	/	30	
AFCEN-PTAN-07003-2023	Radiation Protection Guide for the design of Nuclear Pressure Equipment for PWR plants1 in France (rev C)	FR, EN	/	60	
AFCEN-RM-14-309-A	Guide Analyse de risques pour ESPN N1 (rev A)	FR	/	210	
AFCEN-RM-14-309-C	Guide Analyse de risques pour ESPN N1 (rev C)	FR	/	255	
AFCEN-RM-15-001-A	Justification de l'exemption d'essai de flexion par choc pour les composants de faible épaisseur en aciers inoxydables austénitiques et les alliages base nickel	FR	/	70	
AFCEN-RM-15-149-B	Guide de l'inspectabilité pour la conception des équipements sous pression nucléaires de niveau N1 des centrales REP installées en France (rev B)	FR	/	30	
AFCEN-RM-15-149-C	Inspectability guide for the design of N1 level nuclear pressure equipment of PWR plants installed in France (rev C)	FR, EN	/	40	
AFCEN-RM-15-150-B	Dimensional reference standard of N1 nuclear pressure equipments	FR, EN	/	85	
AFCEN-RM-15-166-A	Guide for the contents of the operating instructions for nuclear pressure equipment	FR, EN	/	85	
AFCEN-RM-15-166-C	Guide pour le contenu de la notice d'instructions d'un équipement sous pression nucléaire	FR	/	65	
AFCEN-RM-16-218-C	Methodological guide for preparing NPMAs for N2/N3 nuclear pressure equipment	FR, EN	/	80	
AFCEN-RM-16-263-A	Note support à la rédaction des EPMN pour équipements ESPN N1*, N2 et N3 Corrosion des aciers inoxydables austénitiques et austéno-ferritiques	FR	/	145	
AFCEN-RM-16-264-A	Note support à la rédaction des EPMN pour équipements ESPN N2 et N3 Vieillissement thermique des aciers inoxydables austénitiques et austéno-ferritiques	FR	/	135	
AFCEN-RM-16-271-D	Guide sur les modalités de réalisation de la Vérification Visuelle dans le cadre de l'Examen Final	FR	/	25	
AFCEN-RM-16-274-D	Guideline about the execution of manufacturing visual examinations requested by the hazard analysis	FR, EN	/	25	
AFCEN-RM-16-282-C	Identification of allowable limits of the MPS/MSS (Application of the Nuclear Pressure Equipment (ESPN) Order)	FR, EN	/	50	
AFCEN-RM-16-455-B	Dimensional reference standard for N1*, N2 or N3 nuclear pressure equipment	FR, EN	/	80	
AFCEN-RM-17-094-B	Analysis of the regulatory texts for the classification of the parts of a valve type pressure accessory and of a safety valve type safety accessory	FR, EN	/	60	
AFCEN-RM-17-110-B	Analyses de risques pour les équipements ESPN de niveau N2 fabriqués selon RCC-M	FR	/	325	
AFCEN-RM-17-428-B	Guide de conception des SRMCR installés sur les REP pour protéger les ESPN de niveau N2 ou N3	FR	/	95	
AFCEN-RM-17-461-B	Guide de l'inspectabilité pour la conception des équipements sous pression nucléaires de niveau N2 ou N3 des centrales REP installées en France	FR	/	30	
AFCEN-RM-18-018-C	Identification of allowable limits of nuclear pressure equipmentexcluding MPS/MSS (Application of the Nuclear Pressure Equipment (ESPN) Order)	FR, EN	/	45	
AFCEN-RM-18-019-C	Démarche d'identification des AIP et des exigences définies relatives à l'intégrité pour la conception et la fabrication des équipements sous pression nucléaires	FR	/	125	
AFCEN-RM-18-056-A	Retention of Material resulting from the Manufacture of parts of Level 1 Nuclear (rev A)	FR, EN	/	70	
AFCEN-PTAN-07004-2023	Retention of Material resulting from the Manufacture of parts of Level 1 Nuclear (rev B, French version only)	FR	/	65	
AFCEN-RM-18-198-B	Guide méthodologique pour la surveillance de la fabrication des composants non soumis à qualification technique spécifique	FR	/	70	
AFCEN-RM-19-327-A	Qualification technique ESPN (rev A)	FR	/	845	
AFCEN-PTAN-07005-2023	Qualification technique ESPN (rev B)	FR	/	875	
AFCEN-PTAN-01001-2022	Démarche méthodologique pour le traitement des non-conformités lors de la fabrication des équipements neufs N1 de catégorie de risque I à IV : principes, processus, difficultés et bonnes pratiques	FR	/	Free	
AFCEN-PTAN-07002-2023	Guide for conducting drop weight tests according to standard ASTM E208-75	FR, EN	/	50	
AFCEN-PTAN-07006-2023	Règles de conception et de construction des tuyauteries à faible risque pression	FR	/	140	
AFCEN-PTAN-09001-2023	Classement des fiches de modification du RCC-M jusqu'à l'édition 2018 incluse (will be available in English soon)	FR	/	Free	

Codes and publications	Description	Available lang.	Paper book format (excl tax)	PDF single format (excl tax)	Subscription format* (HT)
RSE-M Subscription	Publications included in the subscription: RSE-M 2022 / RSE-M 2020 / RSE-M 2018 / RSE-M 2017 / RSE-M 2016 / RSE-M 2010 + addendum 2012, 2013, 2014, 2015 / AFCEN-RS-16-007-D / AFCEN-RS-16-007-E / AFCEN-RS-16-009-A / AFCEN-RS-16-009-B / AFCEN-RS-16-010-B / AFCEN-RS-16-010-D / AFCEN-RS-16-010-E / AFCEN-RS-16-018-A / AFCEN-RS-17-019-A / AFCEN-RS-17-022-A / AFCEN-RS-17-022-B / AFCEN-RS-17-022-C / AFCEN-RS-18-003-A / AFCEN-RS-18-004-C / AFCEN-RS-18-005-A / AFCEN-RS-18-006-A / AFCEN-RS-18-007-A / AFCEN-RS-18-026-A / AFCEN-RS-19-013-A / AFCEN-RS-20-001-A / AFCEN-PTAN-09002-2023	•	/	/	1600
RSE-M 2022 AFCEN-PTAN-09002-2023	In-Service Inspection, Installation and Maintenance Rules for Mechanical Components of PWR + Classement des fiches de modification du RSE-M à compter de l'édition 2022 (will be available in English soon)	FR, EN	1 760	/	Cf. Subscription
RSE-M 2020	In-Service Inspection, Installation and Maintenance Rules for Mechanical Components of PWR	FR, EN	1 760	/	
RSE-M 2018	In-Service Inspection, Installation and Maintenance Rules for Mechanical Components of PWR	FR, EN	1 760	/	
RSE-M 2017	In-Service Inspection Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	1 760	/	
RSE-M 2016	In-Service Inspection Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	1 760	/	
RSE-M 2010 + addendum 2012, 2013, 2014, 2015	In-Service Inspection Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	1 760	/	
AFCEN-RS-16-007-D	Guide for Periodic Requalification of Class N2 or N3 ESPN piping (French version only)	FR	/	50	
AFCEN-RS-16-007-E	Guide for Periodic Requalification of Class N2 or N3 ESPN piping Guide recognized appropriate by ASN (CODEP-DEP-2019-011284)	FR, EN	/	45	
AFCEN-RS-16-009-A	Professional guide to repairs and modifications of nuclear pressure equipment subject to Points 1 to 4 of Appendix V of the amended Order of 12/30/2015 (French version only)	FR	/	Free	
AFCEN-RS-16-009-B	Professional guide to repairs and modifications of nuclear pressure equipment subject to Points 1 to 4 of Appendix V of the amended Order of 12/30/2015 - Guide accepted by ASN (CODEP-CLG-2019-003687)	FR, EN	/	Free	
AFCEN-RS-16-010-B	Professional guide to significant repairs/modifications of nuclear pressure equipment subject to Points 1 to 4 of Appendix V of the amended Order of 12/30/2015 (French version only)	FR	/	135	
AFCEN-RS-16-010-D	Professional guide to significant repairs/modifications of nuclear pressure equipment subject to Points 1 to 4 of Appendix V of the amended Order of 12/30/2015 (French version only)	FR	/	140	
AFCEN-RS-16-010-E	Professional guide to significant repairs/modifications of nuclear pressure equipment subject to Points 1 to 4 of Appendix V of the amended Order of 12/30/2015. This guide applies to revision E with PTAN AFCEN-RS-18-006-A and AFCEN-RS-16-009-B. Guide recognized appropriate by ASN (CODEP-DEP-2019-011284)	FR, EN	/	110	
AFCEN-RS-16-018-A	Principle and substantiation for taking Warm Pre-Stressing (WPS) into account in PWR vessel fact fracture resistance criterion	FR, EN	/	85	
AFCEN-RS-17-019-A	Appendix 5.4 of RSE-M: Principles of and background to the formulation of analytical methods for calculating stress intensity factors and the J integral for a planar defect.	FR, EN	/	210	
AFCEN-RS-17-022-A	Professional guide for the design and manufacture of main pressure parts (MPP) intended for nuclear pressure Equipment in the MPS-MSS	FR	/	Free	
AFCEN-RS-17-022-B	Professional guide for the design and manufacture of main pressure parts (MPP) intended for nuclear pressure Equipment in the MPS-MSS. Guide accepted by ASN (CODEP-CLG-2019-003685)	FR, EN	/	Free	
AFCEN-RS-17-022-C	Guide professionnel pour la conception et la fabrication des PPP destinées à des ESPN du CPP ou CSP	FR	/	Free	
AFCEN-RS-18-004-C	Guide méthodologique de la protection pour l'installation d'un ESPN Guide accepté par l'ASN (CODEP CLG-2019-003687)	FR	/	Free	
AFCEN-RS-18-005-A	Guide professionnel pour les dispositions d'installation d'un ESPN soumis au point 5 de l'annexe V de l'arrêté du 30/12/2015 modifié. Ce guide est en cours d'instruction par l'ASN en vue de son acceptation en application du point 5 de l'annexe V de l'arrêté du 30/12/2015 modifié	FR	/	Free	
AFCEN-RS-18-006-A	Professional guide to the requirements applicable to repairs and modifications of nuclear pressure equipment subject to Points 1 to 4 of Appendix V of the amended Order of 12/30/2015 and procurement of parts for this purpose This guide applies with PTAN AFCEN-RS-16-009-B and AFCEN-RS-16-010-E. Guide accepted by ASN (CODEP-CLG-2019-003687)	FR, EN	/	Free	
AFCEN-RS-18-007-A	Guide professionnel pour les intervention ssur des ESPN du CPP-CSP Guide reconnu approprié par l'ASN (CODEP-DEP-2019-011284)	FR	/	40	
AFCEN-RS-18-026-A	Principles of and background to the formulation of the criteria in Appendix 5.5 of the RSE-M code relating to the fast fracture strength of pressure equipment displaying a planar defect during operation	FR, EN	/	110	
AFCEN-RS-19-013-A	Guide to Qualification of NDT processes using ultrasound Establishing performance data	FR, EN	/	80	
AFCEN-RS-20-001-A	Glossaire du RSE-M et de ses publications	FR	/	Free	
RCC-E Subscription	Publications included in the subscription: RCC-E 2022 / RCC-E 2019 / RCC-E 2016 / RCC-E 2012 / Gap analysis RCC-E 2016 - 2019 / Gap analysis RCC-E 2005 - 2012 / Gap analysis RCC-E 2012 - 2016 / PTAN 2019 RCC-E Guidebook for defining RCC-E 2019 Book of Project DATA / PTAN 2019 RCC-E Qualification en classe 3 / AFCEN-PTAN-05001-2022 / AFCEN-PTAN-05002-2023 / AFCEN-PTAN-05003-2023	•	/	/	950
RCC-E 2022 AFCEN-PTAN-05002-2023 AFCEN-PTAN-05003-2023	Design and construction rules for electrical and I&C systems and equipment + PTAN Guidebook for defining RCC-E 2022 Book of Project Data + PTAN Nuclear Codes & Standards: RCC-E 2022 Gap analysis	FR, EN	1 000	/	Cf. Subscription
RCC-E 2019 Gap Analysis RCC-E 2016-2019	Design and construction rules for electrical and I&C systems and equipment + PTAN Guidebook for defining RCC-E 2019 Book of Project DATA	FR, EN	1 000	/	
RCC-E 2016 Gap analysis RCC-E 2012 - 2016	Design and construction rules for electrical and I&C systems and equipment	FR, EN	1 000	/	
RCC-E 2012 Gap analysis RCC-E 2005 - 2012	Design and construction rules for electrical equipment of nuclear islands	FR, EN	625	/	
PTAN 2019 RCC-E Qualification Classe 3	Class 3 design qualification of systems using equipment families certified according to IEC 61508	FR, EN	/	45	
AFCEN-PTAN-05001-2022	Prescriptions pour la prise en compte de la cybersécurité lors de la conception des systèmes de contrôle-commande	FR	/	110	

B PUBLICATIONS PRICES

Codes and publications	Description	Available lang.	Paper book format (€ excl tax)	PDF single format (€ excl tax)	Subscription format* (€ HT)
RCC-CW + ETC-C Subscription	Publications included in the subscription: RCC-CW 2023 / RCC-CW 2021 / RCC-CW 2020 / RCC-CW 2019 / RCC-CW 2018 / RCC-CW 2017 / RCC-CW 2016 / RCC-CW 2015 / ETC-C 2012 / ETC-C 2010 / PTAN 2015 RCC-CW seismic isolation / PTAN 2018 RCC-CW Seismic Dissipative Devices	•	/	/	1430
RCC-CW 2023	Rules for design and construction of PWR nuclear civil works	FR, EN	1 500	/	Cf. Subscription
RCC-CW 2021	Rules for design and construction of PWR nuclear civil works	FR, EN	1 500	/	
RCC-CW 2020	Rules for design and construction of PWR nuclear civil works	FR, EN	1 500	/	
RCC-CW 2019	Rules for design and construction of PWR nuclear civil works	FR, EN	1 500	/	
RCC-CW 2018	Rules for design and construction of PWR nuclear civil works	FR, EN	1 500	/	
RCC-CW 2017	Rules for design and construction of PWR nuclear civil works	FR, EN	1 500	/	
RCC-CW 2016	Rules for design and construction of PWR nuclear civil works	FR, EN	1 500	/	
RCC-CW 2015	Rules for design and construction of PWR nuclear civil works	FR, EN	1 500	/	
ETC-C 2012	EPR Technical Code for Civil Works	FR, EN	only English version 1 060	1 010	
ETC-C 2010	EPR Technical Code for Civil Works	FR, EN	820	780	
PTAN 2015 RCC-CW seismic isolation	French experience and practice of seismically isolated nuclear facilities	FR, EN	/	190	
PTAN 2018 RCC-CW seismic dissipative devices	Study report on seismic dissipative devices	EN	/	390	
RCC-C Subscription	Publications included in the subscription: RCC-C 2023 / RCC-C 2022 / RCC-C 2020 / RCC-C 2019 / RCC-C 2018 / RCC-C 2017 / RCC-C 2015 / RCC-C 2005 + addendum 2011 / PTAN 2019 RCC-C Qualification OCS	•	/	/	820
RCC-C 2023	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	Cf. Subscription
RCC-C 2022	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	
RCC-C 2020	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	
RCC-C 2019	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	
RCC-C 2018	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	
RCC-C 2017	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	
RCC-C 2015	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	
RCC-C 2005 + addendum 2011	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	725	/	
PTAN 2019 RCC-C Qualification OCS	Qualification of scientific computing tools used in the nuclear safety case – 1st barrier	FR, EN	/	50	
RCC-F Subscription	Publications included in the subscription: RCC-F 2020 / RCC-F 2017 / ETC-F 2013 / ETC-F 2010 / Gap Analysis RCC-F 2020 (only EN version) / PTAN RCC-F 2020 Compatibilty analysis with reference documents	•	/	/	380
RCC-F 2020 Gap Analysis RCC-F 2020	Design and Construction rules for fire protection of PWR nuclear plants	FR, EN	400	/	Cf. Subscription
RCC-F 2017	Design and Construction rules for fire protection of PWR nuclear plants	FR, EN	400	/	
ETC-F 2013	Design and Construction rules for fire protection of PWR nuclear plants	FR, EN	400	/	
ETC-F 2010	Design and Construction rules for fire protection of PWR nuclear plants	FR, EN	275	/	
PTAN RCC-F 2020 Compatibility analysis with reference documents	RCC-F 2020 Compatibility analysis with reference documents – WENRA SRL 2014	EN	/	65	
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RCC-MRx 2022	Design and Construction Rules for Mechanical Components of nuclear installations : high-temperature, research and fusion reactors	FR, EN	2 940	/	Cf. Subscription
RCC-MRx 2018	Design and Construction Rules for Mechanical Components of nuclear installations : high-temperature, research and fusion reactors	FR, EN	2 940	/	
RCC-MRx 2015	Design and Construction Rules for Mechanical Components of nuclear installations : high-temperature, research and fusion reactors	FR, EN	2 940	/	
RCC-MRx 2012 + addendum 2013	Design and construction rules for mechanical components of nuclear installations	FR, EN	2 880	/	
RCC-MR 2007	Design and construction rules for mechanical components of nuclear installations	FR, EN	/	2 140	
PTAN 2017 RCC-MRx new material	Guide for introducing a new material in the RCC-MRx: requirements and recommendations for obtaining the data necessary for preparing the Properties Groups for the materials in Appendix A3 of RCC-MRx	FR, EN	/	100	
PTAN 2018 RCC-MRx seismic analysis components	Guide for seismic analysis of components: recommendations for the seismic design of equipment according to Appendix A1 of RCC-MRx	FR, EN	/	65	
EVALUATION GUIDES					
AFCEN-CF-22-002-A	Guide 0 d'évaluation de l'expérience des fabricants et fournisseurs mettant en oeuvre le RCC-M	FR	/	Free	
AFCEN-CF-22-014-A	Guide n° 1 d'évaluation du niveau de maîtrise du RCC-M par les fournisseurs – Version allégée	FR	/	Free	
AFCEN-CF-22-015-A	Guide n° 1 d'évaluation du niveau de maîtrise du RCC-M par les fabricants – Version allégée	FR	/	Free	
AFCEN-PTAN-02001-2022	Guide d'évaluation au code RCC-E hors "installation" et "systèmes électriques"	FR	/	Free	
AFCEN-PTAN-02002-2023	Guide de test de connaissance au code RCC-E	FR	/	Free	
AFCEN-PTAN-02003-2024	Guide n°3 : aide à l'auto-évaluation d'un fabricant ou d'un fournisseur d'équipement ou de composant de niveaux 2 et 3 RCC-M	FR	/	Free	

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TRAINING
CATALOG

CATALOG OF TRAININGS CERTIFIED BY AFCEN
January 2024

Field	Reference	Code	Title of training	Duration	Language	Partner
Mechanics	M-001	RCC-M	Supply and materials according to RCC-M	1 d	French	APAVE
	M-002		Quality assurance according to the RCC-M code	1 d	French	APAVE
	M-003		Control methods according to the RCC-M code	1 d	French	APAVE
	M-006		Understanding the RCC-M code	2 d	French	APAVE
	M-007		RCC-M code introduction	2 d	French/English	BUREAU VERITAS
	M-008		Design - Sizing according to RCC-M code Materials Lev. 2 and 3	3 d	French, English	APAVE
	M-009		Fabrication - Welding - Monitoring according to the code RCC-M	2 d	French	APAVE
	M-010		RCC-M code design	2 d	French/English	BUREAU VERITAS
	M-012		Introduction to the use of the code RCC-M	3 d	French/English	BUREAU VERITAS
	M-013		RCC-M code training ed.2012 (+add. 2015)	4 d	English	BUREAU VERITAS
	M-014		Architecture and application of the code RCC-M	3 d	French	APAVE
	M-015		Nuclear pressure equipments - Discovery of the code RCC-M	3 d	French/English	VINCOTTE
	M-016		Discovering RCC-M code	4 d	French / English	FRAMATOME
	M-017		RCC-M code	5 d	Chinese	SNPI (GROUPE CGN)
	M-018		RCC-M 2020 - Design, manufacturing and controls	2 d	French	SICA
	M-019		Knowing and applying the code RCC-M	4 d	French/English	SOCOTEC
	M-020		Discovery of RCC-M code	1 d	French/English	SOCOTEC
	M-022		RCC-M code training (without design)	4 d	English	BUREAU VERITAS
	M-023		RCC-M code training (with design)	4 d	English	BUREAU VERITAS
	M-024		Valves in according with RCC-M	3 d	French	FRAMATOME
	M-025		Discovering the design according to the RCC-M code	1 d	French	FRAMATOME
	M-026		Elastic analyses according to RCC-M - Primary stresses and fatigue	2 d	French/English	FRAMATOME
	EM-001	RSE-M	Introduction to the use of the code RSE-M	3 d	French	BUREAU VERITAS
	EM-002		Use of the RSE-M code and its reference document	3 d	French	EDF UFPI
	MRx-001	RCC-MRx	Discovering the code RCC-MRx	3 d	French / English	FRAMATOME
	MRx-002		RCC-MRx - Experimental Reactor Specific Construction Code	3 d	French / English	BUREAU VERITAS
	MRx-004		Discovery of the code RCC-MRx	2 d	French / English	BUREAU VERITAS
	MRx-005		Understanding the RCC-MRx code	3 d	French	APAVE
Civil Engineering	CW-001	RCC-CW	Civil engineering for nuclear (ETC-C and RCC-W): Construction	2 d	French / English	ECOLE DES PONTS
	CW-002		Civil engineering for nuclar (ETC-C and RCC-CW): Design	3 d	French/English	ECOLE DES PONTS
	CW-003		Civil engineering for nuclear (ETC-C and RCC-CW): General introduction	1 d	French / English	ECOLE DES PONTS
I&C systems	E-002	RCC-E	RCC-E 2012 - Qualification and manufacturing of an electrical equipment	3 d	French/English	SICA
	E-005		RCC-E 2012 - Specialisation "Inspection"	1 d	French	SICA
	E-006		RCC-E 2012 - Qualification and manufacturing of an electrical equipment	2 d	French	SICA
	E-010		RCC-E 2019 - Qualification and manufacturing of an electrical equipment	3 d	French/English	SICA
	E-012		Upgrade RCC-E 2012 - 2016 - 2019	1 d	French	SICA
	E-013		RCC-E 2019 - Qualification and manufacturing of an electrical equipment	2 d	French/English	SICA
	E-013		RCC-E 2019 - Qualification and manufacturing of an electrical equipment	2 d	French / English	SICA
Fuel	C-001	RCC-C	Complete training on the Code	2 d	French	UFPI
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GLOSSARY

	FR	EN
AIEA/IAEA	AGENCE INTERNATIONALE DE L'ENERGIE ATOMIQUE	INTERNATIONAL ATOMIC ENERGY AGENCY
AMR		ADVANCED MODULAR REACTOR
ASN	AUTORITÉ DE SÛRETÉ NUCLÉAIRE	FRENCH SAFETY AUTHORITY
CEN	COMITÉ EUROPÉEN DE NORMALISATION	
CSUG		CHINESE SPECIALIZED USERS GROUPS
DI/ IR	DEMANDE D'INTERPRÉTATION	INTERPRETATION REQUEST
DM/MR	DEMANDE DE MODIFICATION	MODIFICATION REQUEST
ECCC		EUROPEAN CONSULTATIVE CREEP COMMITTEE
EERA	ALLIANCE EUROPÉENNE DE LA RECHERCHE ENERGÉTIQUE	EUROPEAN ENERGY RESEARCH ALLIANCE
EPMN	EVALUATION PARTICULIÈRE MATÉRIAUX NUCLÉAIRE	
ESNII		EUROPEAN SUSTAINABLE NUCLEAR INDUSTRIAL INITIATIVE
ETSON		EUROPEAN TECHNICAL SAFETY ORGANIZATION NETWORK
ESPN	EQUIPEMENT SOUS PRESSION NUCLÉAIRE	
FM/MS	FICHE DE MODIFICATION	MODIFICATION SHEET
GDA		GENERIC DESIGN ASSESMENT
GEMMA		GENERATION IV MATERIALS MATURITY (PROJET EUROPÉEN H2020)
GFR		GAS FAST REACTOR
GK	GRAND CARÉNAGE	
GMPP	GROUPE MOTORISÉ DES POMPES PRIMAIRES	
GR	GROUPE DE RÉDACTION	
GSEN	GROUPEMENT POUR LA SECURITÉ DES EQUIPEMENTS NUCLÉAIRES	
HTR		HIGH TEMPERATURE REACTOR
IE/RE	INGÉNIERIE DES EXIGENCES	REQUIREMENTS ENGINEERING
INNUMAT		INNOVATIVE STRUCTURAL MATERIALS FOR FISSION AND FUSION (PROJET EURATOM)
JPNM		JOINT PROGRAMME ON NUCLEAR MATERIALS
KTA		GERMAN NUCLEAR SAFETY STANDARDS COMMISSION (KERNTECHNISCHER AUSSCHUSS - KTA)
LFR		LEAD FAST REACTOR
MCG	MÉCANISME COMMANDE DE GRAPPE	
MNE		MASTER OF NUCLEAR ENERGY
MOFF/SWOT	MENACES OPPORTUNITÉS FORCES FAIBLESSES	STRENGTHS WEAKNESSES OPPORTUNITIES THREATS
MOU		MEMORANDUM OF UNDERSTANDING
NB	NORMES CHINOISES NATIONALES	
NEA		NUCLEAR ENERGY ADMINISTRATION (IN PRC)
NFPA		NUCLEAR FIRE PROTECTION ASSOCIATION
NUCOBAM		NUCLEAR COMPONENTS BASED ON ADDITIVE MANUFACTURING (PROJET EUROPÉEN H2020)
OCDE/OECD	ORGANISATION DE COOPÉRATION ET DE DÉVELOPPEMENT ÉCONOMIQUE	ORGANISATION FOR ECONOMIC COOPERATION AND DEVELOPMENT
ONR		OFFICE FOR NUCLEAR REGULATION
PG		PROSPECTIVE GROUP
PG		PROJECT GROUPS
PTAN	PUBLICATION TECHNIQUE DE L'AFCEN	
R&D	RECHERCHE ET DÉVELOPPEMENT	
RJH	RÉACTEUR JULES HOROWITZ	
RPP	RÈGLES EN PHASE PROBATOIRE	RULES IN PROBATIONARY PHASE
SDO		STANDARDS DEVELOPMENT ORGANIZATION
SG	SECRÉTARIAT GÉNÉRAL	GENERAL SECRETARY
SMR		SMALL MODULAR REACTOR
TBM		TEST BLANKET MODULE
TOFD		TIME OF FLIGHT DIFFRACTION
TS		TECHNICAL SECRETARY
TSO		TECHNICAL SUPPORT ORGANIZATION
UT		ULTRASONIC TEST
WS		WORKSHOP

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