afcen

Shaping the rules for a sustainable nuclear technology

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FOREWORD
BY AFCEN'S PRESIDENT

Laurent THIEFFRY,
President

In December 2020, I was appointed President of the association by AFCEN's Board of Directors. One of the overriding aims during my first year at the helm of the association was to define and implement a strategic plan to steer AFCEN down a clear and robust roadmap for the next four years. Throughout this 2021 - 2025 plan, we hope to fulfil our ambition to have our codes more and more used and recognized, for their ability to guarantee safety and raise the efficiency bar in industry.

I would like to see our association make a concerted effort to reinforce its ability to implement industrial practices at the right pace that our members need to roll out their expertise, while delivering support and guidance to ensure easier incorporation of any changes in standards into our members' projects.

In 2021, AFCEN continued to hold discussions with the French nuclear regulator (ASN), particularly on the implementation of the ESPN nuclear pressure equipment regulation. Based on the progress made, AFCEN is confident that ASN will continue to endorse the solutions proposed by the codes as being capable of complying with the ESPN regulation requirements on mechanical equipment.

As part of the French government's "France Relance" plan to get the country's economy back on track, AFCEN was awarded funds in 2021 to support investments in the nuclear sector and strengthen skills in the nuclear industry. This is the first time in its history that AFCEN has received public funding. We can be proud of the confidence and trust that the government has placed in our association, and we should continue working together in an effort to improve quality control practices across the nuclear industry. AFCEN will make great strides towards realizing this aim by reinforcing the section on welding in the RCC-M code, releasing a guide on self-assessing the level of expertise in the RCC-M and RCC-E codes and assessing suppliers' expertise in those codes, and spearheading many other initiatives.

In 2021, AFCEN also started work on preparing new editions for six of its seven codes, which will reinforce the knowledge capitalized by the nuclear industry while helping reflect and incorporate the industrial feedback that members need to lead their future projects. As the years go by, AFCEN's seven codes continue to represent an exceptional and unique asset that leverages the technical expertise and feedback that have been acquired over more than 40 years from designing, manufacturing and operating systems, structures and components in over 100 nuclear reactors around the world. They constitute an exceptional driving force for standardizing practices across the nuclear industry.

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

On behalf of all our members, it gives me great pleasure to present the 2021 AFCEN Annual Report. This report clearly illustrates the many achievements and events that our association has organized and supported over the previous year.

I look forward to seeing you at the next AFCEN Day event on May 12, 2022.

SIGNIFICANT EVENTS
2021

In 2021, AFCEN held its virtual congress

In 2021, AFCEN's very first virtual congress was attended by the main decision-makers and stakeholders from our association's members, who are firm believers in the importance of sharing their views about their expectations for the codes, the opportunities for development and the areas that need improving.

AFCEN DIGITAL CONGRESS ON MARCH 23, 2021

In 2021, AFCEN took part in the fourth edition of the WNE

The 2021 World Nuclear Exhibition proved to be a resounding success. AFCEN welcomed a number of visitors to its stand (users, clients and interested parties), which gave the association the ideal opportunity to spread the word about its codes. To coincide with its participation in the event, AFCEN's President provided members with an outline of the association's 2021-2025 strategic plan.

WORLD NUCLEAR EXHIBITION IN PARIS VILLEPINTE FROM NOVEMBER 30 TO DECEMBER 2, 2021

SIGNIFICANT EVENTS
2021

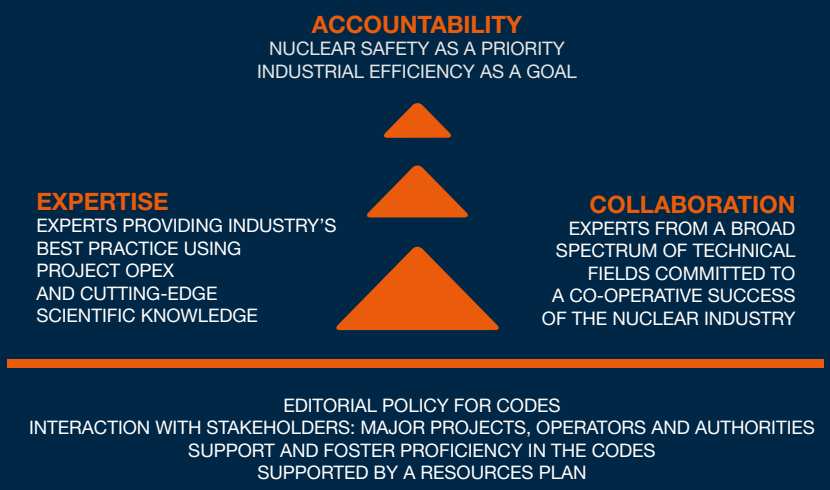
In 2021, AFCEN adopted its 2021-2025 strategic plan

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

Our Ambition: Reference nuclear codes in Europe, chosen around the world for their guarantee of safety and their effectiveness in standardizing industrial practices and building on feedback

Our core values: Expertise, Collaboration, Accountability

AFCEN's strategic plan



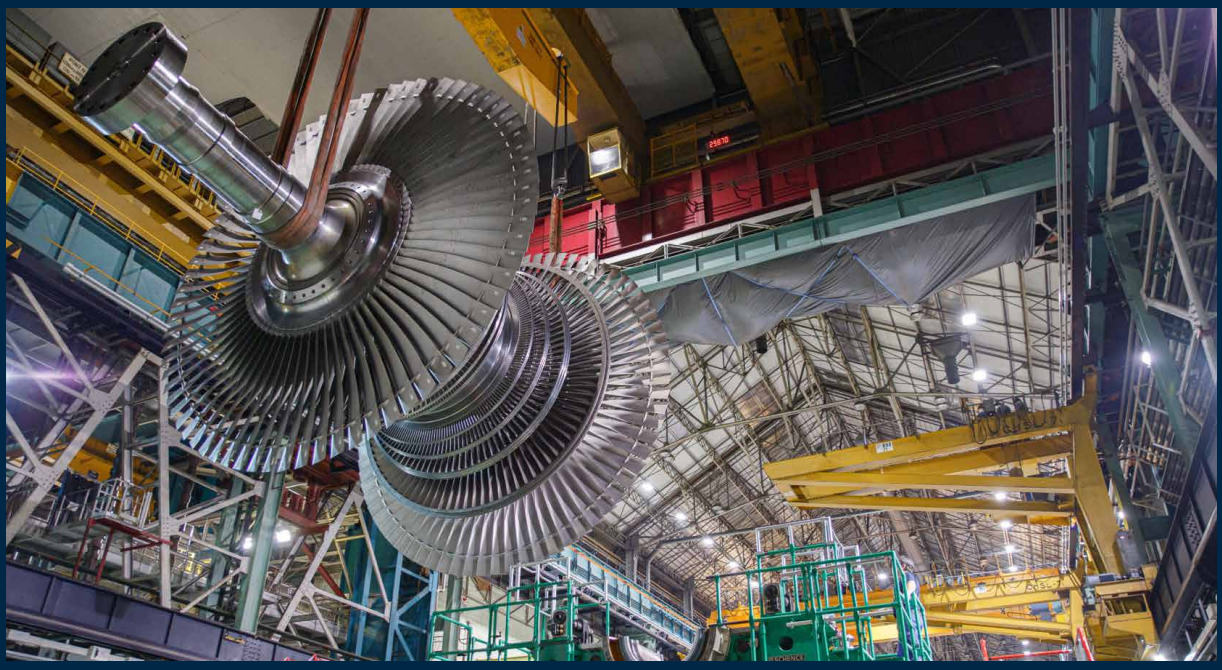
AFCEN was awarded funds in 2021 to support investments in the nuclear sector and strengthen skills in the nuclear industry

The project aims to provide the sector with tools for assessing the level of expertise in AFCEN's RCC-M and RCC-E codes, as well as tools for improving the effectiveness of the various code training programs. The assessment tools objectively identify the suppliers offering the greatest expertise in the codes. They are an invaluable aid for encouraging suppliers to enroll in training or empowering all other suppliers to raise their performance. The tools available are designed to improve the quality of all online training programs and dovetail with the courses taught at universities and institutes of higher education.

SIGNIFICANT EVENTS
2021

In 2021, AFCEN continued lending its support to nuclear reactor construction projects in the UK and China

In 2021, HPC celebrated its 5th anniversary since full construction started. The progress has been huge and in 2021 we passed a significant milestone with the formal permission for start of the mechanical, electrical and HVAC installation into the first rooms handed over from Civil Construction on the Nuclear Island Safeguard Building. Equipment manufacture has progressed significantly. HPC has taken delivery of the 1st 257 tonne LP Rotor, the Unit 1 EDG Generator Sets have been shipped from works and primary circuit component manufacture makes good progress. HPC looks forward to receiving the Unit 1 RPV later in 2022 with manufacture well advanced such as the nozzle shell and lower assembly already completed.



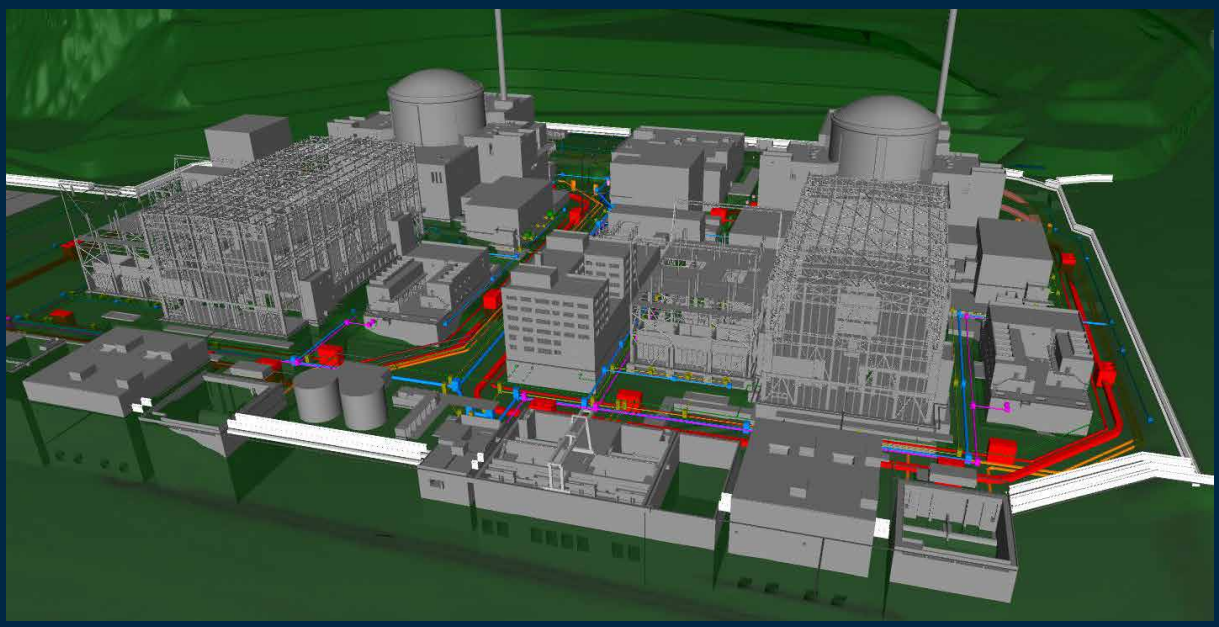
HPC PROJECT

In 2021, the Fuqing 6 units were commissioned, thereby reinforcing CCNC's Hualong 1 reactor, whose design is based on the RCC-M code.

HUALONG 1 PROJECT (FUQING 6)

SIGNIFICANT EVENTS
2021

In 2021, AFCEN continued its involvement in preparing the EPR2 and NUWARD™ projects



▲ EPR2 PROJECT

In 2021, AFCEN carried out a complete review of recent and future changes to the codes with the EPR2 project, and took into consideration the expectations of the project. AFCEN provided support in getting to grips with the changes introduced in the codes, in particular with the effort made by the RCC-M Subcommittee to produce a table listing and classifying the modifications, which offers a clearer inisight into the type and scope of the changes, thus facilitating the impact analysis by the project.

In 2021, AFCEN and NUWARD™ came to the discussion table with the aim of streamlining and strengthening AFCEN's potential support in defining the project's technical standards, covering both the prototype and the commercial standardized units, in France and for export markets.

▼ NUWARD™ REACTOR

SIGNIFICANT EVENTS
2021

In 2021, AFCEN actively pursued its collaborative efforts in China

Despite the health crisis, cooperation in China paved the way for three virtual work sessions of the Chinese Specialized Users Groups (CSUGs) in 2021 between France and China, thereby allowing French experts to ramp up their participation.

AFCEN pursued its policy of forging stronger ties with the Chinese operators using AFCEN's codes by signing several agreements in 2021, including continued leadership of the CSUGs by the CNNC Group and CGN Group, the publication and dissemination of the Chinese-language versions of the AFCEN codes, and the decision to extend certification for the RCC-M training course in Chinese/English.

In 2021, AFCEN welcomed four new members

Aubert & Duval designs and produces leading-edge metal solutions in the form of forged parts, closed die forged parts, long products, and metal powders made from high-performance steel, superalloys, titanium and aluminum.

Fives Nordon designs and manufactures piping and high-performance equipment for all types of industries.

REEL designs, manufactures, installs and maintains equipment for the nuclear industry (fuel handling systems, filtration solutions, polar cranes for reactor buildings for reactor buildings, and fuel storage systems).

Sulzer specializes in manufacturing pumps and servicing rotating machinery.

AUBERT&DUVAL

fives

SULZER

afcen

Shaping the rules for a sustainable nuclear technology

1

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.

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

AFCEN's strategic plan

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 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 (3 months currently, target one week) 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 focused on 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 SMR (NUWARD™)
- 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 WS 64, which contains leading players in Europe's nuclear industry looking to improve their expertise in AFCEN's codes.
- Continue developing working platforms for the 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,
- 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™ and 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. In 2021, major efforts focused on integrating feedback from the welding work on the main secondary system into future editions of the RCC-M code.

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 with the aim of taking account of feedback from the EPR units (in service or undergoing commissioning) and fulfilling the safety requirements for EPR2. In 2021, AFCEN carried out a complete review of recent and future changes to the codes with the EPR2 project, and took into consideration the expectations of the project. AFCEN provided support in getting to grips with the changes introduced in the codes, in particular with the effort made by the RCC-M Subcommittee to produce a table listing and classifying the modifications, which offers a clearer inisight into the type and scope of the changes, thus facilitating the impact analysis by the project.

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.

RJH activity

Feedback from the project continues to shape the RCC-MRx code through the modification requests submitted by Framatome and TechnicAtome. Some 50 modification requests were recorded in 2021.

NUWARD™ activity

AFCEN and NUWARD™ came to the discussion table with the aim of streamlining and strengthening AFCEN's potential support in defining the project's technical standards, covering both the prototype and the commercial standardized units, in France and for export markets. Both parties are currently preparing an agreement.

Activities relating to the existing fleet

In 2021, changes were introduced to the in-service units as part of the Grand Carénage (GK) programme, which involves the use of AFCEN's codes.

1.2.2 European Union

1.2.2.1 CEN Workshop 64

CEN Workshop 64 (CEN/WS64) represents one of AFCEN's main institutional activities on a European level. CEN/WS64 was created in 2010 on AFCEN's initiative and is currently in Phase 3.

Rationale for proposing Phase 3

AFCEN had many reasons for suggesting a third phase for the WS64 workshop. The first aim is to maintain and even ramp up Europe's dynamic presence in the nuclear codes sector. As a result, CEN/WS64 will extend its scope to encompass electrical aspects with the involvement of the RCC-E code. The work already started was supposed to be continued until the end of Phase 2, but several topics needed finalizing and other emerging topics needed addressing.

In addition, the Nuclear Illustrative Program (PINC) established by the EC's Directorate-General for Energy drew attention to the need to significantly increase nuclear power generation capacities by 2030 with the aim of attaining Europe's objectives to reduce greenhouse gas emissions. Consequently, there was growing pressure to take action and carry out the groundwork for expanding this particular market, bearing in mind that fragmented industry best practices and national regulations are one of the market's defining features. 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.

Objectives of phase 3

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

- Strengthen synergistic ties between European experts on nuclear codes, working in different countries on different projects, with the aim of minimizing fragmented best practices across the nuclear industry, while offering a platform for technical discussions and creating possibilities for coding practices across Europe.
- Allow future nuclear project leaders to raise awareness of their projects' constraints and suggest changes to the codes. The workshop also allows all participants to express the changes that they would like to make to the codes and lets them incorporate their industrial expertise or the lessons learned from their own practices.
- Engage nuclear power plant operators who are open to the prospect of suggesting and discussing code proposals to address the issues of aging facilities and the difficulties in sourcing spare parts. These proposals are aimed at delivering appropriate solutions to the challenge of downsizing the nuclear supply chain in Europe.

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

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

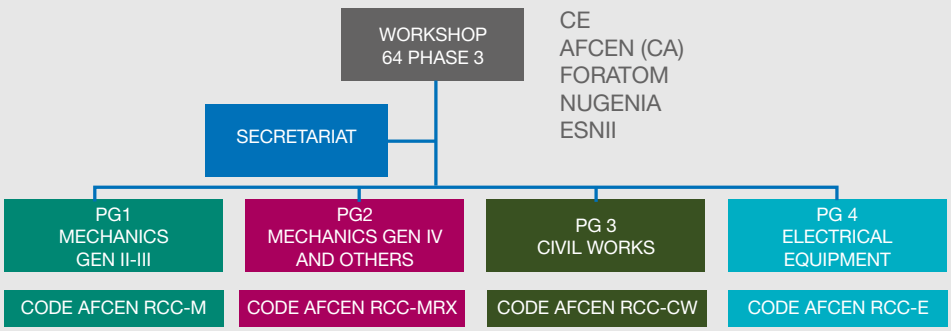


ILLUSTRATION DE LA PARTICIPATION DE L'AFCEN AU CEN

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 program.

The workshop currently features 20 members from 11 countries, representing operators, manufacturers, engineering consultancies, research centers, safety authorities and TSOs.

It should be noted that from 2022, NCBJ, which is expected to be the future Polish TSO, will join CEN/WS64.

Despite the Covid-19 crisis in 2021, CEN/WS64 members regularly pursued their activities in 2021 by organizing virtual meetings.

Activity review during the plenary meeting on September 28, 2021

PG1 (RCC-M) decided to submit two proposed modifications relating to progressive deformation and the results of the comparison between RSEM and KTA in terms of their methods for analyzing the impacts of defects during operation. Other proposed changes are presently being examined, including high cycle fatigue (> 106), thermal fatigue and the resulting cracking. A document summarizing the concept of "break preclusion" is currently being prepared, as well as a document that compares RSE-M against KTA for their methods for analyzing the impacts of defects. Finally, a proposed R&D program is being drafted to carry out a comparison between the different codes and standards for analyzing pressure equipment integrity.

The modification proposed by PG2 (RCC-MRx) concerning the use of the small punch test for selecting materials was endorsed by the RCC-MRx Subcommittee and will be introduced into the 2022 version of the code. An R&D program for this type of test is currently being developed alongside PG1. AFCEN is currently examining a proposal to include welding in the PTAN that provides guidance on the introduction of new materials. Plans to introduce a new rule for thermal crazing based on work under PWR conditions have been submitted to PG1 for an initial investigation.

PG3 (RCC-CW) has plans for a number of proposed modifications, including aircraft crashes, consideration for aging and the raft lift effect. Since the issue of wall shear criteria is such a vast topic, cooperation is required with the OECD's WGIAGE project before it can potentially be incorporated into the code.

Although PG4 (RCC-E) has not progressed as far as the other PGs and currently does not have any plans to submit modification requests, it took part in several topics of interest by comparing different European practices (e.g. qualification of materials, management of aging facilities, LTO and equipment with embedded software).

Some of the topics concerning several PGs did not see any major progress, such as SMRs, additive manufacturing and criteria for serious accidents. However, the decision was taken by the end of Phase 3 to establish a standard glossary for the four PGs and better define the types of SMR that could be addressed by CEN/WS64.

As in 2020, the Director of the Fission Sector at the European Commission's Directorate-General for Research & Innovation presented Euratom's call for projects for 2021/2022.

AFCEN decided to extend Phase 3 (which was due to finish late 2021) by one year to finalize the proposed modification requests and the R&D program. Each PG is busy identifying the topics that cannot be covered by the end of 2022 and using this extended period to think about the prospect of pursuing CEN/WS64 by means of an additional phase (Phase 4). If the HARMONISE proposal is given the green light (refer to the next section), this new phase could be carried out in close liaison with what is a highly complementary project. Since the HARMONISE project is aimed at addressing licensing and coding needs for innovative reactors of a certain height, CEN/WS64 could harness the project's outputs and findings to supplement its own work program.

1.2.2.2 Participation in the HARMONISE proposal in response to Euratom's call for projects for 2021/2022

AFCEN responded to the **HORIZON-EURATOM-2021-NRT-01-06 call for proposals: Harmonisation of licensing procedures, codes and standards for future fission and fusion plants.** The consortium features 15 members, most of whom come from the ETSON network of European TSOs.

The aim is to initially identify innovative concepts, systems, components and manufacturing processes for future fission and fusion reactors, before proposing procedures for approving those innovations 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

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

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.

If the HARMONISE project receives the go-ahead, AFCEN's participation will help strengthen the association's reputation for collaborative and institutional projects across Europe in the short term and sharpen its credentials for taking part in Euratom's future calls for proposals. In addition, the way in which the HARMONISE project synergizes with the work of the CEN/WS64 workshop gives added weight to the argument for extending CEN/WS64.

1.2.3 China

Background

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

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

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

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

Chinese experts have strengthened their relationship with their French counterparts since 2015 by holding several technical sessions (Chinese Specialized Users Groups or CSUGs) to discuss the contents and interpretation of the codes. There are currently eight CSUGs covering all of AFCEN's technical fields. By December 2020, 54 CSUG meetings had been held in China, during which experts presented and discussed over 500 technical topics.

In 2017, AFCEN and NEA signed a long-term memorandum of understanding relating to nuclear standards and codes, which took AFCEN's codes one step closer to mainstream use in China. The agreement gives Chinese standardization bodies official permission to use AFCEN codes as a reference for drafting the country's future nuclear standards (NB standards), while allowing for their translation into Chinese. The agreement also encourages regular technical discussions between China and France with a view to working together in enhancing the nuclear codes and standards by incorporating the highly dynamic feedback from the nuclear industries in both countries.

Over the last two years, CGN and CNNC have completed the first round of translating AFCEN's codes. They are due to be published in 2022. As part of the agreement with NEA, a new form of collaboration was launched in 2019, known as PGs or Project Groups. These groups are managed and incorporated into the CSUGs. They are aimed at providing a platform for French and Chinese experts

to discuss a more specific range of 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 is due to be finalized in 2022, following which modification requests will be issued, based on the results of the groups' efforts. Both sides are currently discussing the prospect of setting up several new PGs.

AFCEN is planning to trial mirror drafting groups in China in 2022, which will be responsible for examining modification requests for the RCC-M code. This initiative will foster stronger cooperative ties between Chinese experts and AFCEN, and RCC codes can also reflect the development of standards and the best practices of China's nuclear industry.

Activities in 2021

In 2021, AFCEN's main actions relating to activities in China were as follows:

Implementation of the NEA-AFCEN agreement:

- AFCEN continued proving key information to allow China's experts to accurately translate the latest RCC codes into Chinese. At the present time, the translation has been completed and reviewed by the relevant experts for RCC-M 2017; RSE-M 2017 ; RCC-CW 2018 ; RCC-E 2016 ; RCC-F 2017 ; RCC-C 2018 ; RCC-MRx 2015. This action is a key component of the 2017 AFCEN-NEA agreement. With AFCEN's authorization, the Chinese version of the abovementioned standards should be published in 2022.
- Since 2019, technical collaboration between experts on standardization activities, which represents the second key component of AFCEN-NEA agreement, has been hosted in the CSUGs, and experts have the possibility of creating formal working groups to address technical subjects of joint interest: Project Groups (PG). In 2020 and 2021, the RCC-M PG held two meetings to investigate fatigue analyses and ratcheting analyses (progressive deformation).

All the calculations identified in the "Fatigue Benchmark" PG were completed in December 2021. The final report and a proposed modification to the RCC-M code based on the PG's results are currently in the pipeline.

JULY 2021 IN HANGZHOU
MEETING OF THE FATIGUE AND NON-LINEAR PGS, CHINESE PARTICIPANTS

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

Users Groups meetings in China and AFCEN training courses:

- In May, the annual meeting of the "Chinese Specialized Users Groups" (CSUGs) for the RCC-M code was held in Xi'an in China, and was attended by 40 representatives from such design institutes as CNNC, CGN and SPIC, and such manufacturers as DEC, SEC, Erzhong, Jiuli and Yingliu, as well as China's Safety Authority and its technical support arm (NNSA and NRC). AFCEN's delegated experts joined the meeting by videoconference.
  - The second session of the meetings for the eight CSUGs, which was initially scheduled for November 2021, was postponed as a result of the new wave in the Covid-19 epidemic. The RCC-CW and RCC-E meetings were held online on January 11 and 12, 2022. Each meeting received approximately 25 connections.
  - A new RCC-M training session was organized in Suzhou in June 2021. This session was subject to an agreement between SNPI and AFCEN, which was updated and signed this year. The session in question was the Chinese-language RCC-M course, which was formally certified by AFCEN in 2016.

Outlook for AFCEN in China in 2022

In 2022, AFCEN will pursue its policy of developing cooperation on codes and standards to honour its commitments towards its Chinese partners. The main milestones and prospects are as follows :

- In keeping with the process of creating operational structures for the MOU with NEA and to build a framework for interactions between experts, officially publish the Chinese translation of the RCC codes and form Project Group (PG) to continue a new type of technical interaction.
- As part of the CSUGs, trial a few mirror drafting groups in 2022 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.
- Participation of Chinese experts in the AFCEN Day in 2022, including the Subcommittee meeting and technical breakout sessions.
- Organize new meetings of the Chinese Specialized Users Groups to promote dialog on the use of AFCEN's codes in China, while encouraging technical discussions with particular emphasis on clarifying and interpreting specific aspects of the codes.
- Continue organizing a new series of training courses (RCC-M Design By Analysis) and update the RCC-M training courses according to version 2007 including the addenda up to 2012.

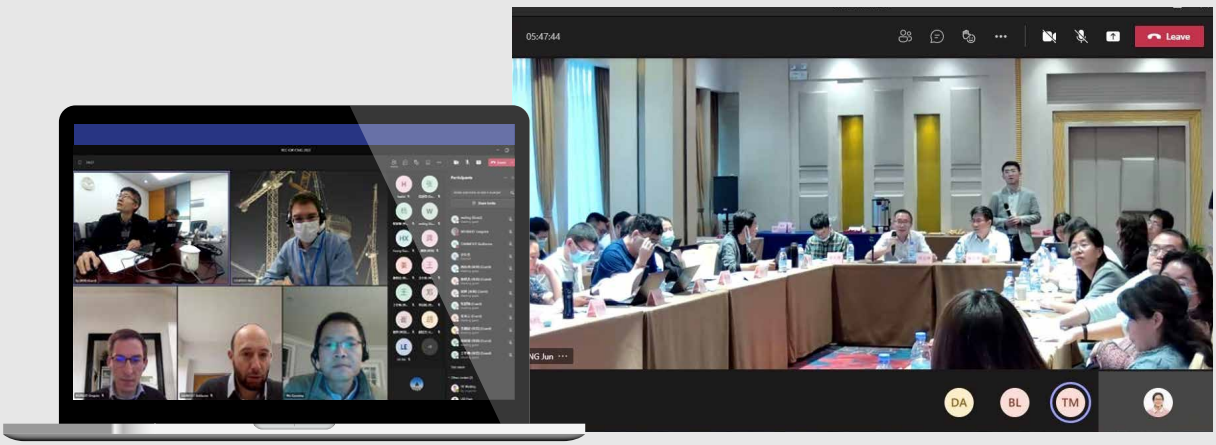


IMAGE DE LA RÉUNION CSUG RCC-M EN MAI 2021 ET RCC-CW AVEC LA PARTICIPATION À DISTANCE DES EXPERTS FRANÇAIS

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) postponed its 2021 session to 2022. The RCC-E Users Group held its first work session in November 2021.

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. An eagerly awaited virtual session was held in September 2021, as well as a webinar offering an introduction to the RCC-E code.

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 2022, AFCEN will continue supporting the proposal for six EPR units as part of the Jaitapur project.

STYLIZED VIEW OF THE JAITAPUR SITE

1.3 RELATIONSHIPS WITH STAKEHOLDERS

1.3.1 Relationship with ASN

AFCEN has been holding monthly meetings with ASN's Nuclear Pressure Components Division since 2015. The trust between both organizations was instrumental in the success of the three-year ESPN program, which culminated in the 2018 editions of the RCC-M and RSE-M codes. Work is continuing as part of the four-year roadmap, which introduces changes to the 2020 and 2022 editions of the RCC-M and RSE-M codes.

- AFCEN voiced its opinion on ASN Guidance and Justification Document for the revision of Guide 8 "Conformity assessment for nuclear pressure components", which is a highly strategic document for assessing the conformity of nuclear pressure components.
- Also note that AFCEN held discussions with ASN throughout 2021 in relation to ASN's draft decisions about Article 8.2 (concerning the performance of certain tests and analyses on nuclear pressure components) and Article 8.4 (relating to the integration of certain nuclear components pending a conformity assessment into a basic nuclear facility) of the ESPN Regulation. AFCEN voiced its views on the draft decisions during the associated public consultation processes.

1.3.2 Cooperation between organizations developing standards and harmonizing codes

As a key player in the nuclear codes sector around the world, and as part of its determination to continually incorporate industry best practices and local regulations for its code users, AFCEN is naturally involved in the harmonization programmes (UK English) either set up by international organizations or created at its own initiative.

For example, AFCEN contributes to the objectives of harmonizing mechanical codes through its participation in the international group of standards developing organizations (SDO Convergence Board), which was founded in 2010 to promote the introduction of compatible rules in each of the different mechanical codes. The SDO Board holds four meetings a year, alongside the ASME Code Week. AFCEN is member of the SDO Convergence Board, like ASME (US), JSME (Japan), KEPIC (South Korea), CSA (Canada), NIKIET (Russia), NTD (Czech Republic), ISNI (China). AFCEN presents its development objectives and contributes to convergence opportunities on the topics examined by the group.

Whether acting on its own behalf or through the SDO Convergence Board, AFCEN interacts with the dedicated working groups for mechanical standards and codes in OECD/NEA/CNRA (safety authorities) and WNA/CORDEL/MCSTF (industrial organizations). For instance, AFCEN is invited to share its feedback on CORDEL's reports relating to its RCC-M and RCC-MRx mechanical codes (such as in 2021 on recommendations for implementing mechanical non-linear analyses).

1.4 USE OF AFCEN CODES AROUND THE WORLD BACKGROUND

AFCEN codes are used as a reference for nuclear components and structure in over 100 power plants currently in operation (98), under construction (17) or in planning stages (14) around the world.

Since 1980, AFCEN codes have served as the basis for 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). 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		1	27	28	28	28	x	x	x	x			
CPR 600	China			6	6	6	6	x	x	x	x			
EPR	Finland			1	1	1		x						
	France		1		1	1	1	x	x	x	x	x	x	
	China			2	2	2	2	x	x	x	x	x	x	
	UK	2	2		4	4	4	x	x	x	x	x	x	
	India	6			6	6	6	x	x	x	x	x	x	
HPR1000	China	10	11	1	22	12	12	x	x	x		x	x	
	UK	2			2	2		x	x	x		x	x	
PFBR	India		1		1	1								x
RJH	France		1		1	1								x
ITER	France		1		1	1								x
ASTRID	France	1			1	1								x
		21	18	101	140	90	119							

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.

RJH

ITER

ITER used the 2007 version of the RCC-MR code as a reference for its vacuum vessel. This code was chosen for the vacuum vessel on both technical grounds (the equipment and technology are covered by the code) and regulatory grounds (the code is adapted to French regulations). RCC-MRx is also being used for the other components, including the test blanket modules (TBM) in Eurofer.

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.

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 2021, 52 of the 71 units in operation or under construction in China were using AFCEN codes, with 40 in operation and 12 under construction.

There units correspond to the M310, CPR1000 & ACPR1000, HPR1000, CPR600 and EPR projects in blue font in the table below.

FUQING 6

During 2021 :

- Fuqing 5, the world's first HPR-1000 unit, officially entered commercial service on January 30, 2021. Fuqing 5 was designed with the RCC-M code. Fuqing 6 was also successfully connected to the grid on January 1, 2022.
- The first concrete was poured in 2021 for three new HPR-1000 units, Changjiang 3 and 4, and San'Ao 2 on March 31, December 28 and December 30 respectively.
- Two new ACPR-1000 reactors designed according to AFCEN codes (Tianwan 6 and Hongyanhe 5) were commissioned. All that remains is a single Generation II+ reactor, which is currently being built in China.

Type of reactor	Units in operation (no.)	Units under construction (no.)	Total number
300 MWe	Qinshan I (1)		1
M310	**Daya Bay (2) Ling'Ao (2)**		**4**
CPR1000 & ACPR1000	**Ling'Ao (2) Hongyanhe (5) Ningde (4) Yangjiang (6) Fangchenggang (2) Fuqing (4) Fangjiashan (2) Tianwan phase III (2)**	**Hongyanhe (2)**	**28**
HPR 1000	**Fuqing (1)**	**Fuqing (1) Fangchenggang (2) Zhangzhou (2) Taipingling (2) SanAo (2) Changjiang (2)**	**12**
CPR600	**Qinshan II (4) Changjiang (2)**		**6**
CANDU 6	Qinshan III (2)		2
AP1000	Sanmen (2) Haiyang (2)		4
EPR	**Taishan (2)**		**2**
VVER-1000/428 (AES-91)	Tianwan (4)		4
VVER-1200 (AES-2006)		Tianwan IV (1) Xudapu (1)	2
HTR-PM		Shidaowan (1)	1
CFR-600		Xiapu (2)	2
CAP1400		Shidaowan (2)	2
ACP100		Changjiang (1)	1
Total number	**51**	**20**	**71**

LIST OF REACTORS CURRENTLY UNDER CONSTRUCTION OR IN OPERATION IN CHINA AS OF LATE 2021
(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).

1.4 USE OF AFCEN CODES AROUND THE WORLD BACKGROUND

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.

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. 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.

HPR1000 project

The UK version of the HPR-1000 reactor featuring Chinese technology (UK Hualong) has completed the certification phase in the UK (Step 4 of the GDA) under the coordination of an EDF-CGN joint venture (GNS). Its design is mainly based 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).

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.

afcen

Shaping the rules for a sustainable nuclear technology

2.1 CODES AND OTHER EDITORIAL PRODUCTS

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

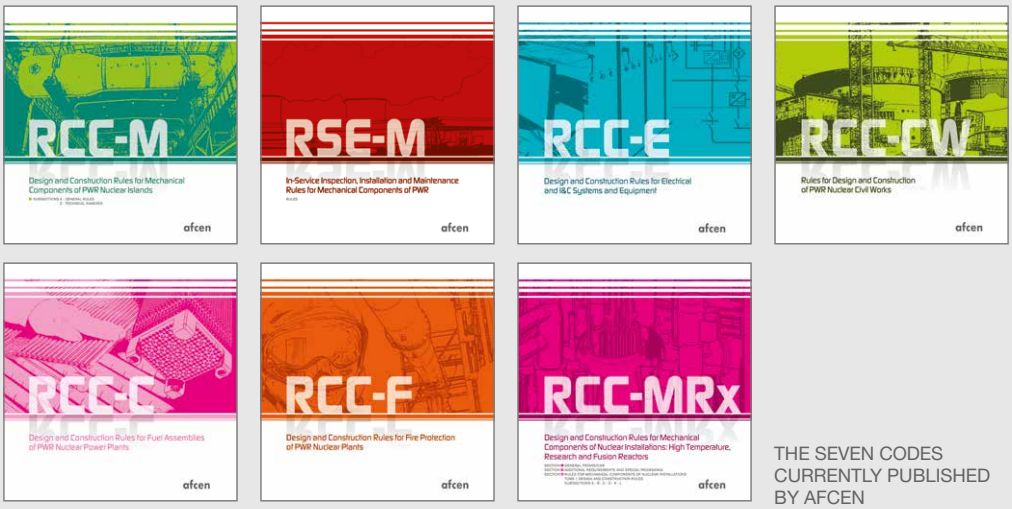
AFCEN's editorial activities involve:

- Producing and monitoring the work program 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-) developed and used by EDF.

Only the RCC-CW code was revised in 2021. The following table lists the codes available.

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 edition . Next edition: 2022
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 edition . Next edition : 2022

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 . Next edition : 2022
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: 2023

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 . Next edition: 2022
RCC-CW	Rules for design and construction of PWR nuclear civil works	. 2010 and 2012 ETC-C editions . Annual RCC-CW since 2015 . Next edition : 2022

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 . Next edition : 2022

LIST OF AFCEN CODES EDITIONS AVAILABLE

There are several reasons for updating AFCEN codes:

- the need to incorporate feedback
- developments prompted by scientific and technical breakthroughs
- changes to legislation and standards
- extensions to the scope of the codes

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. 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.

Some codes are accompanied by documents that describe the changes between successive editions (RCC-E and RCC-F gap analysis). AFCEN is working on reinforcing how the different changes are characterized (type, scope, etc.) 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. This especially applies to the RCC-M code.

In 2021, the Editorial Committee was involved in the following activities:

- Requirements engineering: the conclusions of the opportunity assessment were published. The methods for implementation will be incorporated into the code development process and editorial programme.
- Comparison between AFCEN and other international codes and standards: studies have been launched to cover the electrical and I&C sector (RCC-E vs. IEEE), and the fire protection sector (RCC-F vs. NFPA). The aim is to identify the main areas where the codes and standards converge and diverge, and thereby shed greater light on the challenge of obtaining approval for reactor projects modeled on different industrial standards.

2.1 CODES AND OTHER EDITORIAL PRODUCTS

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 developments, etc.). They are not directly related to the codes.

Examples include:

- RCC-CW: two studies on seismic dissipative and isolation 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.

The technical publications available are listed in Appendix B.

The following works were launched in 2021 and will be addressed in PTAN publications: cybersecurity requirements (RCC-E), requirements for industrial grade Category 0 piping in the nuclear island (RCC- M).

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 » program 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. The roadmap is designed to address the following major challenges:

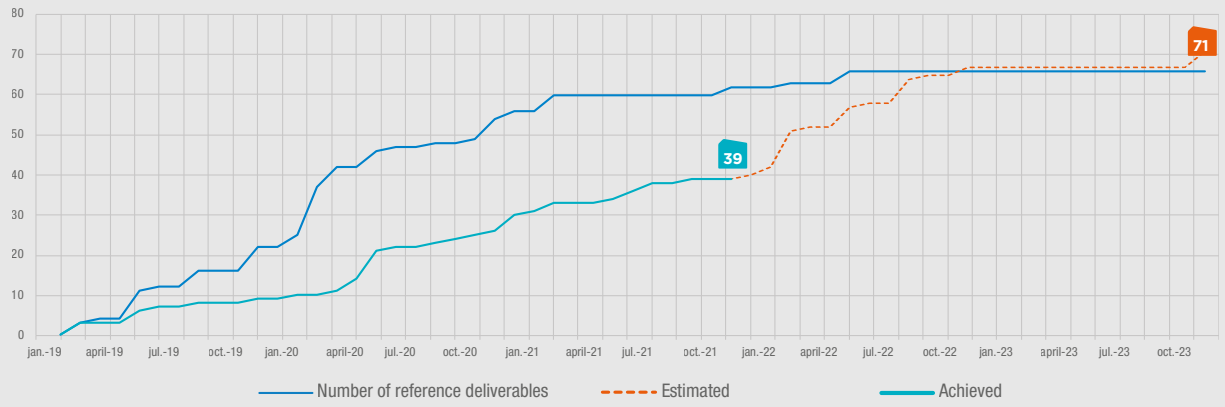
1. Incorporate feedback from the three-year programme

2. Maintain endorsement of the RCC-M code

3. Reinforce the applicability of the solutions across the industry by developing “standard solutions”

4. Shed greater light on certain aspects of the regulation

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



PROGRESS CURVE FOR THE DELIVERABLES OF THE FOUR-YEAR ROADMAP

2.1 CODES AND OTHER EDITORIAL PRODUCTS

In particular, this ambitious programme recorded a number of achievements in 2021:

- In response to its members' feedback on a number of recent industrial projects, AFCEN produced a Welding Feedback programme which sets out the related modifications that will be worked into the 2022 and later editions of the RCC-M code. The Welding Feedback programme was presented to ASN in April 2021 and is currently being implemented.
- AFCEN voiced its opinion on ASN Guidance and Justification Document for the revision of Guide 8 "Conformity assessment for nuclear pressure components", which is a highly strategic document for assessing the conformity of nuclear pressure components *(https://www.asn.fr/l-asn-reglemente/consultations-du-public/conformite-des-equipements-sous-pression-nucleaires-guide-n-8-de-l-asn).*
- AFCEN held discussions with ASN throughout 2021 in relation to ASN's draft decisions about Article 8.2 (concerning the performance of certain tests and analyses on nuclear pressure components) and Article 8.4 (relating to the integration of certain nuclear components pending a conformity assessment into a basic nuclear facility) of the ESPN Regulation. AFCEN voiced its views on the draft decisions during the associated public consultation processes:

. *https://www.asn.fr/l-asn-reglemente/consultations-du-public/projet-de-decision-reglementaire-de-l-asn-relative-aux-equipements-sous-pression-nucleaires-encadrant-la-realisation-de-certains-essais-et-analyses*

. *https://www.asn.fr/l-asn-reglemente/consultations-du-public/projet-de-decision-reglementaire-de-l-asn-relative-a-l-integration-au-sein-d-une-installation-nucleaire-de-base-de-certains-equipements-sous-pressi*

AFCEN produced the following deliverables as part of the four-year roadmap:

. "Organization of the conformity assessment for N1 nuclear pressure equipment according to module G"
. "Organization of the conformity assessment for N2/N3 nuclear pressure equipment according to module G"
. "Guide for preparing N1 nuclear material appraisals"

In 2021, GSEN (association of inspection bodies for Nuclear Equipment Safety) worked on endorsing the following AFCEN deliverables:

. «N2 hazard analyses»
. "Identification of unacceptable defects (first series)"
. "Generic analysis for classifying control rod driving mechanisms and reactor coolant pumps"

Working via the steering committees for the ESPN programme with ASN and GSEN, AFCEN prepared the foundations for the 2022 editions of RCC-M and RSE-M (produced by AFCEN, and recognition of the associated deliverables) and held discussions with ASN and GSEN about the terms for working on ESPN topics after 2022; these terms will be consolidated and expressed in a deliverable in 2022.

AFCEN is also continuing to take part in developing « ESPN Digital » tool, 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),
- 50 M310 (4), CPR-1000 (28), CPR-600 (6), HPR-1000 (10) and EPR (2) reactors in service or undergoing construction in China,
- 4 EPR reactors in Europe: Finland (1), France (1) and UK (2).

Background

AFCEN drafted the first edition of the code in January 1980 for application to France's second set of four-loop reactors with a 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.

2.2.3 Edition available in 2021

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

Some of the modification sheets relate to the commissioned studies relating to 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).

The 2020 edition is supplemented by the supplemented by various guides released as PTAN and addresses the essential safety requirements of the ESPN Regulation of December 30, 2015, as amended by the Regulation of September 3, 2018. AFCEN has produced an extensive set of documentation to justify how the requirements in the RCC-M code are compliant for N1, N2 and N3 nuclear pressure equipment.

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 sheets relating to appendices ZY and ZZ of the 2020 edition of the code. After examination, GSEN has concluded that the code still conforms to the requirements of the ESPN Regulation.

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

- Based on the work into Safety Factors and Uncertainties (SFU)/fatigue (technical development), further clarification is provided for assessing subcycles during fatigue testing, especially with reference to ISO 12110-2,
- The NC 15 Fe T Nb A and NC 19 Fe Nb grades have been excluded for pressure parts following the work by the "Technical Qualification" working group,
- In response to the FSI commissioned study, limitations have been specified for the scope of application for Section C 3223.6 (minimum thickness for elliptical heads),
- An improvement has been made to C 3200 with clarification about the validity of the formulae used to determine the minimum thickness for torispherical heads,
- Based on the FSI commissioned study, further details are proposed for classifying stresses in pipes
- Clarification is also provided for taking account of thermal-hydraulic phenomena, based on the FSI/Fatigue commissioned study,
- A method for performing the calculations according to B 3200 with stress indices, resulting from the FSI/Fatigue commissioned study,
- A modification to B 3234.8 on thermal ratcheting and a proposed assumption for a parabolic temperature distribution,
- Incorporation of the 2017 edition of EN ISO/IEC 17025,
- New section M 116 for the specific use of a manufacturing process not listed in RCC-M.

CONTENTS OF THE 2020 EDITION OF THE RCC-M CODE

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.

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

The next edition of RCC-M is scheduled for 2022 to leverage initial feedback on the use of the 2018 and 2020 editions. This edition will incorporate the modifications relating to the follow-up work on the ESPN Regulation.

The new 2022 edition of the code will also incorporate the feedback on the code's use in current projects (EPR UK, TSN, FA3, replacement steam generators, etc.) and on the results of the development or assessment work carried out in AFCEN's working groups (France and China Users Groups) by ASN or in international groups (Europe and MDEP).

AFCEN proposed a programme to take account of feedback from welding on the main secondary system of the FA3 EPR. The programme contains 29 code modification targets divided into nine categories. There are plans to add some of the targets to the 2022 edition of the code. The nine categories are listed below:

- Welding quality and organization (post-2022)
- Suitability of basic materials for welding (2022)
- Selection, qualification and acceptance of welding consumables (2022 + post-2022)
- Qualification of welding procedures (QWP) (2022)
- Welding authorization (2022)
- Stress-relieving heat treatment (SRHT) (post-2022)
- Non-destructive testing (NDT) (post-2022)
- Welded repairs (2022)
- Weld test coupons (post-2022)

2.2.5 RCC-M technical publications

Publication of interpretation requests

In 2018, the RCC-M Subcommittee released an initial compilation of the interpretation requests relating to the editions of the RCC-M code published since 2007 and their addenda. This publication is presented as a compilation of anonymous interpretation requests arranged by edition and topic. An update was published in 2020 to encompass the interpretation requests up to the 2018 edition.

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

Development work has been launched to allow users to view interpretation requests directly on the AFCEN website. The work was completed in 2021 and will provide users with an easier way of looking up information about all interpretation requests. Interpretation requests 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 relating to the ESPN Regulation and referenced by the 2020 edition of RCC-M have been made available to users.

Some PTAN have been published in English:

- Allowable limits N1 guide ;
- Allowable limits N2-N3 guide ;
- Manufacturing visual examinations guide ;
- Dimensional Reference N2-N3 guide ;
- Methodological guide for preparing Nuclear Material Appraisal for N2 N3 ;
- Inspectability N1 guide ;
- Inspectability N2-N3 guide ;
- Retention of material guide ;
- Pressure and safety accessories guide.

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 roadmap in 2019 (2019-2022).

Various deliverables were defined following this work:

- Generic modifications introduced into the body of the code
- Modifications specific to French and European regulations and introduced in appendices ZY and ZZ exclusively for projects in France
- Technical publications in the form of guides and criteria (some PTAN publications are referenced in appendices ZY and ZZ)

2.2.7 2019-2022 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 to be developed over the 2019-2022 period with assistance from its members, with the focus on the 2020 edition and the next edition in 2022.

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.

2.2 MECHANICAL FIELD FOR PRESSURIZED WATER REACTORS RCC-M

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

- update to Volume H on supports,
- update to Appendix Z G with the aim of addressing the fields that are presently not covered and updating the approach to reflect feedback from current projects,
- coverage of progressive deformation in Appendix Z C on non-linear finite element analyses,
- introduction of design by analysis rules for tube sheet plates,
- update to Volume S 8000 on hard coatings,
- finalization of the update to Appendix Z V on the design of flanged connections.

A number of topics identified in this programme should be given the green light in 2021, including:

- The use of ultrasonic testing (UT) techniques as an alternative to radiographic examination (RT) for level 1 ferritic steels in RCC-M to take account of welding feedback
- incorporation of 2017 edition of EN ISO 15614-1.

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.

Concerning events in 2021, a half-day CSUG (Chinese Specialized Users Group) session was organized in May 2021 with four experts from the RCC-M Subcommittee. This session was conducted as a videoconference, this year was marked, once again, by the Covid19 epidemic. A robust logistical effort allowed the session to go ahead. This meeting attracted over 50 Chinese members from various local companies and allowed the experts to answer several dozen questions which, where applicable, resulted in code interpretation or modification requests. Two technical presentations were given:

- The first presentation was delivered by a French expert and focused on the current revision of appendix Z G “Fast Fracture Resistance” with the aim of highlighting the recent developments introduced into RCC-M.
- The second presentation was given by a Chinese expert and addressed the use of the PAUT technique (“Phased Array Ultrasonic Testing”) as an alternative to radiographic examination.

In 2021, the RCC-M Subcommittee also took part in several international working groups and participated in the associated events:

- RCC-M experts play an active role in the Convergence Board of Mechanical Standards Developing Organizations (SDO Convergence Board) during the ASME Code Week. Members are currently taking an in-depth look at several topics for harmonization.
- At the European level, Phase 3 (launched in 2019) of the GEN II/III Prospective Group (PG1) of CEN workshop WS 64 is continuing and is scheduled to last until end of 2022 (refer to the dedicated paragraph in Section 1.2.2).

In 2022, there are plans to maintain international initiatives:

- focusing on international comparisons by reviewing the studies performed by WNA/CORDEL and the SDO Convergence Board in line with the expectations of the other SDOs,
- furthering the aims of OECD/NEA/CNRA, by continuing relevant work on equivalent codes and regulations alongside the Safety Authorities in the WGCS,
- by leading AFCEN’s Chinese Users Groups, and the corresponding international training courses,
- at the European level as part of the CEN/WS 64 workshop.

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

THE RSE-M CODE

2.3.1 Purpose and scope

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

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

2.3.2 Use and background

Use

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

To date:

- the 56 units of France nuclear fleet enforce the in-service inspection rules of the RSE-M code,
- the operation of 38 commissioned units in China's nuclear infrastructure, corresponding to the M310, CPR-1000, ACPR-1000, CPR-600 and EPR reactors, is based on the RSE-M code (since 2007, use of AFCEN codes has been required by NNSA for Generation II+ reactors).

Background

AFCEN drafted and published the first edition in July 1990.

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

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

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

2.3.3 Edition 2020

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

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

- Introduction of two ultrasonic inspection methods into A 4220 (TOFD US, echo method and multi-element translators)
- To clarify the case of examinations that should not be considered to be NDTs, incorporation of two new sections on thickness measurements (A 4630) and cleanliness examinations (A 4640)
- Rewriting of section A 4700 - Qualification and certification of testing personnel: supplements and alignment with Appendix 4.3 – IX
- Creation of a section in Volume D, entitled “Aims and techniques of examinations performed during inspections”
- Incorporation of PTAN RS.18.006 for equipment subject to the French regulation in D 8410
- Clarification on the terms for examining significant variation in A 5000
- Further details about the possibility of using the mechanical justification rules in Appendix 5.7 on volumetric defects
- Addition of table B 8500-8-1 specifically relating to the SEBIM RCP controlled valve to the tables in B 8500 for classifying maintenance operations
- Clarification of the terms for performing pre-service inspections of components at the factory (case of replacement steam generators)
- Modification to the status in Appendix 5.2 (changed from “to be defined by the operator” to “for guidance only”)
- Definition of the welding requirements for volumetric examinations during maintenance operations.

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

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

INSTALLATION OF NPE (Nuclear Pressure Equipment)

NPE subject to appendix V, points 1 to 4

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

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

NPE subject to appendix V, point 5

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

PIPING REQUALIFICATION

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

N2 OR N3 NPE REPAIR OR MODIFICATION

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

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

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

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

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

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

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

CONTENTS OF THE 2020 EDITION OF THE RSE-M CODE

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

2.3.4 Outlook and next edition

2022 edition

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

- inclusion of feedback on the ESPN guides,
- creation of an RSE-M PTAN containing a thesaurus and definitions,
- adoption of a requirements engineering format for the code,
- introduction of the digital radiographic examination technology in A 4000 (digital recording medium),
- addition of material data to Appendix 5.6 (in alignment with the overhaul of Appendix ZG in RCC-M),
- improvement of the defect interaction rules in case of a high number of multiple defects (Appendix 5.1).

ULTRASONIC EXAMINATION OF WELDS

2.3.5 Other RSE-M technical publications

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

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

PTAN RS.17.019 Criteria “Appendix 5.4»

These criteria were published in 2017.

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

PTAN RS.18.026 Criteria “Appendix 5.5”

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

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

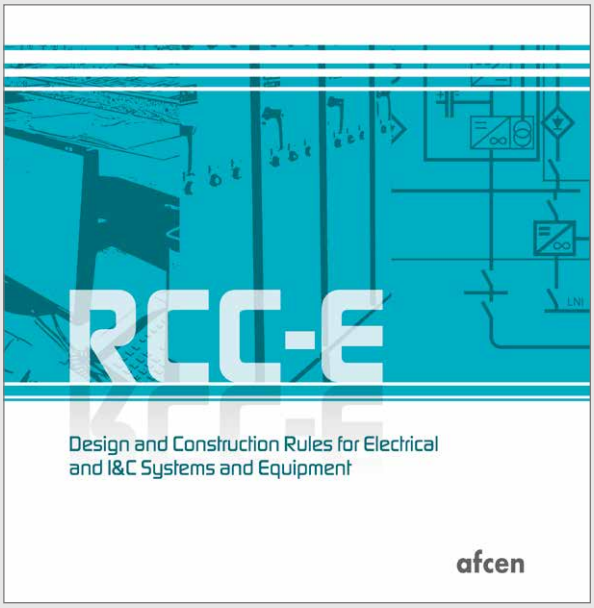
PTAN RS.19.013 “Guide for qualifying ultrasonic NDT processes - Definition of performance”

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

Are you familiar with the technical publications (PTAN) of the RSE-M code?

PTAN DESCRIPTION VIDEO

2.4 ELECTRICAL AND I&C SYSTEMS
RCC-E



THE RCC-E CODE

2.4.1 Purpose and scope

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

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

The code's scope covers:

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

2.4.2 Use and background

Use

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

- France's last 12 nuclear units (1,300 MWe (8) and 1,450 MWe (4)),
- 2 CP1 reactors in South Korea (2),
- 50 M310 (4), CPR-1000 (28), CPR-600 (6), HPR-1000 (10) and EPR (2) reactors in service or undergoing construction in China,
- 1 EPR reactor in France and 2 reactors in the UK (Hinkley Point C).
- The RCC-E code is used for maintenance operations in French power plants (56 units) and 32 Chinese M310 and CPR-1000 power plants.

Users include:

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

Background

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

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

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

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

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

2.4.3 Edition available in 2021

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

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

- feedback from facilities under construction and in operation,
- the Nuclear Safety Authorities' investigation process,
- user inquiries,
- changes in the standards used and IAEA's requirements,
- changes in industry's maturity.

The 2019 edition:

- is an update 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.

Reasons for updating the code include:

- a clearer insight into safety approaches (defense-in-depth examinations, design standard, events and deterministic approach, failure-oriented principle to encourage protective action, consistency of hazards with the French Regulation on basic nuclear facilities, etc.),
- the WENRA handbook on the design of new reactors,
- changes to IEC standards relating to the SC 45 Technical Committee and IEC industry standards,
- feedback from current projects: EPR, ITER, RJH and ASTRID,
- lessons learned following the British Safety Authority's investigation into the UK's EPR as part of the generic design assessment into the electrical and I&C systems,
- feedback following Fukushima,

2.4 ELECTRICAL AND I&C SYSTEMS RCC-E

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

Requirements are:

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

CONTENTS OF THE 2019 EDITION OF THE RCC-E CODE

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

2.4.4 Technical publications of the RCC-E Subcommittee

Edition gap analysis

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

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

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

- a document that compares the 2012 and 2005 editions of the code entitled “Nuclear Codes & Standards: RCC-E 2012 Gap analysis with the RCC-E 2005”,
- a document that compares the 2016 and 2012 editions of the code entitled “Nuclear Codes & Standards: RCC-E 2016 Gap analysis with the RCC-E 2012”.

For future editions, this comparison will be supplemented by an impact analysis of the modifications made, thus providing decision elements for the projects.

In addition, a “Guide to preparing project specifications associated with RCC-E 2019” is provided with RCC-E 2019. This guide aims to simplify the process of identifying the requirements stipulated for the RCC-E 2019 code and help users when producing project specifications. Cross tables are used to locate in the 2012/2016/2019 revisions the requirements to which the project data book refers. Users can click on the link in this document to download an electronic template of the document to be completed.

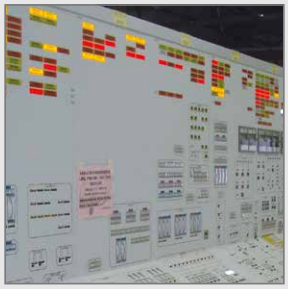
PTAN «Class III design qualification of systems using equipment families certified according to IEC 61508»

This PTAN supplements Volume 3 of RCC-E 2019.

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

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

It is available in French and English, and will be referenced in the new edition of the code currently under revision.

2.4.5 Outlook

AFCEN took advantage of 2021 to finalize the studies required to produce the 2022 revised edition of the code. The work topics for the next editions will include:

- feedback from the application of RCC-E 2019,
- measurement, control and regulation systems,
- design extension situations,
- PTAN cybersecurity,
- inclusion of the provisions in the PTAN addressing the qualification of automatic protection systems certified to IEC 61508 Class III,
- development of the aspects relating to separation and isolating devices (IEC standards) and the links with the RCC-CW and RCC-F codes,
- feasibility of taking account of SMR requirements.

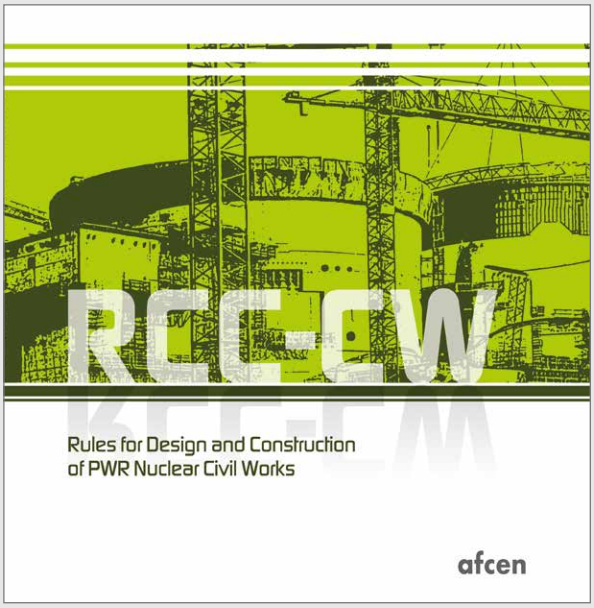
2.4.6 International activities

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

Due to the health pandemic in 2020, French experts connected online to the CSUG face-to-face meetings held in China. The CSUG seminars in 2021 were put back to January 12, 2022, for the same reasons. Note that Chinese participants in the CSUG were keenly interested in the changes introduced by the revised 2016 edition in relation to their work on developing new designs.

The UK Users Group to address the specific characteristics of the British projects currently undergoing construction (Hinkley Point, Sizewell and Bradwell) has been formalized. Several preliminary meetings have been held, and an initial seminar was organized in November 2021. A second seminar has been scheduled for Q2 2022.

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.

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 - 2022	Renewed edition: . post-Fukushima level & methods . improvements & updates . extensions of scope	Updated editions to be used as reference for New Build Projects

SUCCESSIVES VERSIONS OF RCC-CW

2.5.3 Edition available in 2021

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

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

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

2.5 CIVIL WORKS RCC-CW

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

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

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

- correction of various editorial mistakes,
- thorough revision of DANCH chapter on anchors and inclusion of the latest changes to EN 1992-4.

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

- rules for anchor channels and active channels have been worked into DANCH and CANCH chapters,
- CCONC chapter has been completely revised to ensure a better fit with EN 13670 and has been based on the latest version of EN 206,
- a new CCOAT chapter has been created for paints and coatings,
- the actions to be considered in design extension hazards have been amended (DGENR chapter),
- requirements for seismic soil column calculations have been included (Appendix DA).

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

- improved requirements related to the minimum reinforcement rate,
- introduction of requirements for post-installed anchors and recently updated standards,
- changes to the contents for reinforcements (CREIN) in alignment with EN 13670,
- general revision of the requirements relating to tolerances (CA).

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

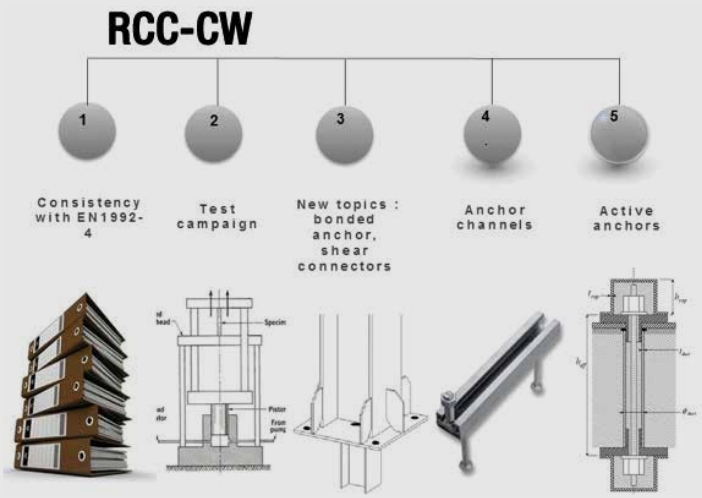
- evolution of the scope of durability requirements (DCONC § 3000, 4110, 9000),
- removal of diameter pressure failure mode for anchor design (DANCH),
- improvement of requirements for bending steel on site (CREIN),
- evolution of leak detection requirements for pools and tanks (DPLIN & CPLIN),
- introduction of industrial feedback for containment testing and monitoring (MCONT).

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

- update to the requirements of the quality management system (GGENP, GA) with the possibility of applying ISO 19443,
- clarification of the load combination (LC10) for structural steelwork (DGENR 3400),
- requirements relating to deep foundations (DGEOT 7000, CGEOT 8000),
- evolution of leak-tightness requirements SLS (DCONC 6000),
- evolution of durability requirements: reinforced concrete cover (DCONC, CA),
- optimization of requirements for the minimum reinforcement rate: scale effect for containments (DCONC),
- evolution of requirements for the design and installation of anchors (DANCH, CANCH),
- evolution of the seismic appendix (DA),
- general revision of prestress requirements (CPTSS, CC, CCONC, DCONC),
- new CGEOM section on geomembranes,
- new CCONT section on containment construction,
- new AM part (aging management) with two new sections:
  - AMGENR: general requirements,
  - AMCONT: containment aging management.

The 2021 edition of the RCC-CW code includes the following improvements:

- revised terminology for pool temperature loads (DGENR),
- improvement of the code requirements concerning water levels (DGENR),
- change in requirements for liquefaction (DGEOT-CGEOT),
- change in requirements for liner mean yield stress (DCONC, CCLIN),
- change in requirements for lamellar tearing (DSTLW),
- introduction of T-head bolts and shear connectors (DANCH 5000, DANCH 6000),
- rewording of the requirements in the seismic appendix (DA),
- improvement of the code requirements for concrete shrinkage (DB),
- changes to the welding for anchor systems (CANCH),
- changes to construction joints (CCONC),
- concerning Part AM (aging management):
  - AMCONT: clarification of aging management requirements for containments,
  - AMCONC: aging management for reinforced concrete structures (new chapter),
  - AMGEOT: aging management for geotechnical structures and structures in strong interaction with the soil (new chapter).



THE RCC-CW CODE COVERS ANCHOR-RELATED TOPICS

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

RCC-CW CODE DESCRIPTION VIDEO

2.5 CIVIL WORKS RCC-CW

CONTENTS OF THE 2021 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
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/WS 64 set up to prepare the future nuclear codes,
- according to AFCEN's requirements and development objectives, develop appendices and addenda specifically addressing how the code can be adapted to the AFCEN code users' countries.

The work program includes the following core topics:

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

2.5.5 Technical publications on seismic isolation and dissipation

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

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

This publication enables European industry to:

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

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

2.5.6 International activities

CEN WS-64

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

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

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

Chinese Users Group (CSUG)

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

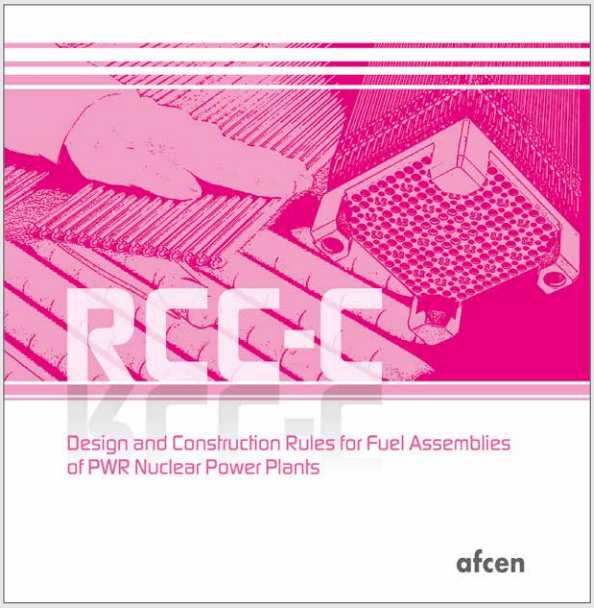
Any interpretation requests for AFCEN codes issued during the meetings are examined by the Subcommittee.

UK Users Group

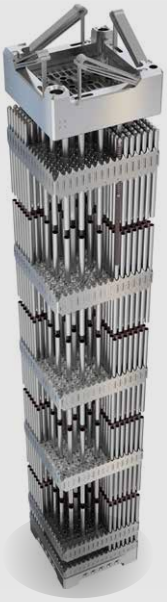
The UK Users Group on civil engineering codes includes the main companies involved in the Hinkley Point C project. The Users Group was officially launched during the AFCEN 2017 Congress. The group held two meetings in 2017 and one meeting in 2018, 2019 and 2020.

The next meeting is due to be held in 2022.

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 and English. The 2005 edition has been translated into Chinese.

Background

The first edition of the AFCEN RCC-C code was published in 1981 and mainly covers fabrication requirements. The second edition of the code was released in 1986 and supplemented the first edition by including design requirements in a specific section at the end of the code. This structure remained unchanged, 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 amended when requests are issued by ASN following the Permanent Working Groups on fuel, especially regarding design aspects.

2.6.3 Edition available in 2021

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

CONTENTS OF THE 2020 EDITION OF THE RCC-C CODE

CHAPTER 1 - GENERAL PROVISIONS
1.1 PURPOSE OF THE RCC-C
1.2 DEFINITIONS
1.3 APPLICABLE STANDARDS
1.4 EQUIPMENT SUBJECT TO THE RCC-C
1.5 MANAGEMENT SYSTEM
1.6 PROCESSING OF NONCONFORMANCES
1.7 CUSTOMER SURVEILLANCE

CHAPTER 2 - DESCRIPTION OF THE EQUIPMENT SUBJECT TO THE RCC-C
2.1 FUEL ASSEMBLY
2.2 CORE COMPONENTS

CHAPTER 3 - DESIGN
3.1 SAFETY FUNCTIONS, OPERATING FUNCTIONS AND ENVIRONMENT OF FUEL ASSEMBLIES AND CORE COMPONENTS
3.2 DESIGN AND SAFETY PRINCIPLES

CHAPTER 4 - MANUFACTURING
4.1 MATERIALS AND PART CHARACTERISTICS
4.2 ASSEMBLY REQUIREMENTS
4.3 MANUFACTURING AND INSPECTION PROCESSES
4.4 INSPECTION METHODS
4.5 CERTIFICATION OF NDT INSPECTORS
4.6 CHARACTERISTICS TO BE INSPECTED FOR THE MATERIALS, PARTS

CHAPTER 5 - SITUATIONS OUTSIDE THE NUCLEAR STEAM SUPPLY SYSTEM
5.1 FRESH FUEL
5.2 IRRADIATED FUEL

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

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 mid-2022.

2.6.4 Outlook

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

This process should be completed during the course of 2022. The modification sheet has been prepared in its most comprehensive version to date and is currently being examined by working group members and the relevant technical experts. The RCC-C Subcommittee’s work on adapting the design requirements will focus on incorporating the conclusions of the French 2017 Permanent Working Group on fuel performance criteria once ASN’s follow-up letter has been examined. The first modification sheets concerning the cladding deformation criterion and corrosion are scheduled for Q1 2022.

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

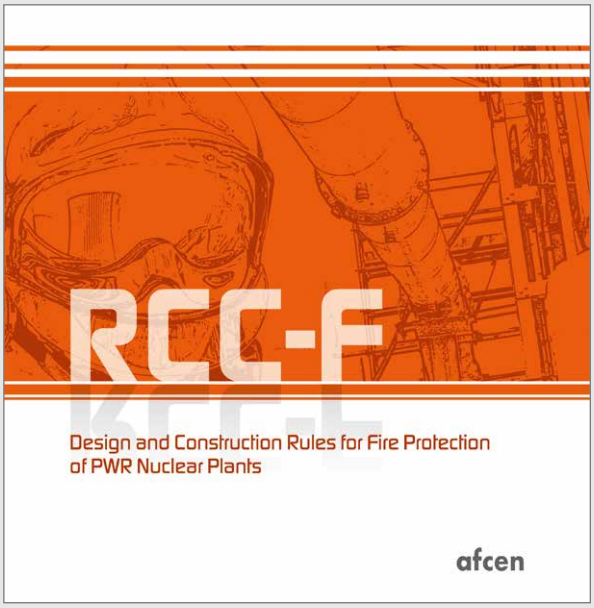
The cleanliness requirements specified in RCC-C are still being analyzed. Code users are gathering feedback from the plants.

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

RCC-C is still undergoing a global review in an effort to standardize the terminology and references from one section to the next. The review should be completed in 2022.

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

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.

2.7 FIRE PROTECTION FOR PRESSURIZED WATER REACTORS RCC-F

The code is divided into five main sections:

- Generalities
- Design safety principles
- Fire protection design bases
- Construction provisions
- Rules for installing the fire protection components and equipment

The RCC-F code is generally 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.

2.7.3 Edition available in 2021

The RCC-F 2020 edition is the most recent version. The English reference version of RCC-F 2020 was published late December 2020, while the French version 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: 2015,
- minor modifications for the purpose of improving compatibility with WENRA Safety Levels 2014,
- improvements to the fire resistance of ventilation ducts,
- clarification on sizing fire pumps*,
- additional information about cable arrangements*,

- deletion of Appendix F on EDF proprietary documents and dissemination of practical information and relevant requirements in the body of the text,
- various editorial or minor improvements, translations*, organization of certain sections.

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

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 regulations was carried out in 2021.

2.7.4 International activities

The Chinese working group comprises 19 permanent members and was created in March 2015 (Beijing). Every year, a meeting is organized in China to improve interaction and help address the interpretation and/or modification requests issued by the CSUG. In 2019, the meetings (in November) culminated in a joint visit with RCC-F representatives at CGN's Taishan site. The meetings due to be held in 2021 were rescheduled for early 2022 in light of the difficulties caused by the health crisis. Interactions were maintained for the purpose of addressing the CSUG's requests.

As part of the AFCEN/NEA memorandum of understanding, a Chinese-language version of RCC-F was published in 2021.

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

2.7.5 Outlook and preparation of the RCC-F 2023 edition

Outlook

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

- integrate state of the art and feedback from projects currently under development or construction,
- drive the code's application on a European and international level by including international standards and regulations. 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

The RCC-F Subcommittee plans to incorporate AFCEN's 'Requirements engineering" process into the code, with the create in 2022 a prototype version based on the 2020 edition of the code. The process will be continued and fine-tuned in successive versions of the code.

Edition RCC-F 2023

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

New changes were requested when examining the RCC-F code as part of the EPR2 project (answers to the questionnaires issued by IRSN). Those requests will be forwarded by the project.

In early 2022, the Subcommittee will decide on the key changes to be implemented in the 2023 version. The following macro-topics have been identified :

- fire containment (especially the definition of fire volumes)
- regulatory aspects (protective measures for people)
- type of common methods
- nuclear safety principles
- fire-fighting/extinguishing

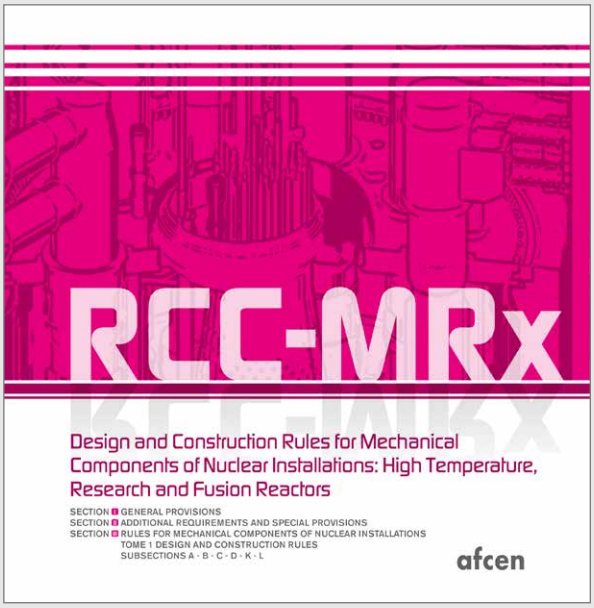
There are plans to update the appendix on UK regulations to reflect analyses on the codes for Sizewell C project.

The process of comparing the code with international reference standards will continue (WENRA 2020 and IAEA DS494)

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

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

2.8.3 Edition available in 2021

CONTENT OF THE 2018 EDITION OF THE RCC-MRX CODE

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

The 2018 edition is the most recent version.

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

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

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

Furthermore, this edition pays special attention to ensuring consistency between RCC-MRx and the other reference documents that interact with the code, including RCC-M, European and international standards (such as incorporation of ISO 3834) and regulations (e.g., updated versions of France’s nuclear regulations).

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

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

2.8.4 Outlook

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

Similarly, volumes 1 and 2 will be reorganized and streamlined to make them easier to use.

Another key objective is to pursue and contribute to the success of Phase 3 of CEN/WS 64 by working on the modifications identified by the workshop (such as an alternative rule for creep-fatigue in materials subject to cyclic softening, the use of small-punch tests, and additional requirements for countries whose quality management regulations are based on NQA-1).

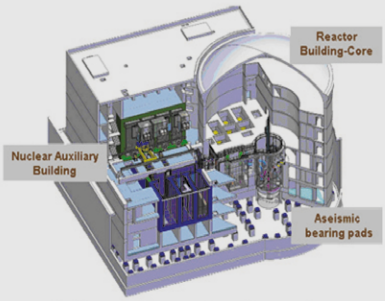
Other improvements will also be incorporated, such as updates to non-linear analyses, quality assurance according to ISO 19443, but also the creation of new volumes dedicated to metal enclosures or internal reactor devices.

2.8.5 Technical studies

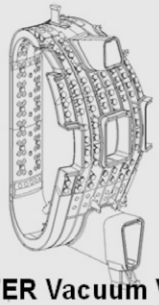
In 2016, work was finalized on the commissioned study entitled "Terms for introducing a new material into RCC-MRx". This study led to the publication of a methodological guide (AFCEN/RX.17.004 "Guide for introducing a new material in RCC-MRx"), which explains, when introducing a non-codified material 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 2022 to include the precautions relating to intergranular corrosion.

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

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

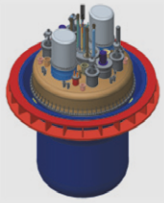


Jules Horowitz Reactor

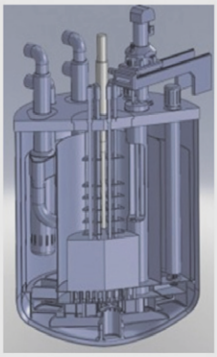


ITER Vacuum Vessel

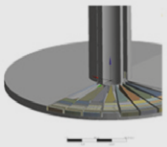
Indian PFBR



MYRRHA primary system



ASTRID



European Spallation Source target

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

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Shaping the rules for a sustainable nuclear technology

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

In 2021, the 13 organizations that have signed a partnership agreement with AFCEN to deliver technical training are as follows: APAVE, BUREAU VERITAS, CEF Ingénierie, EFECTIS, Framatome, INSTN, PONT FORMATION CONSEIL, SICA NUCLEAIRE, SNPI (Groupe CGN), UFPI, VINCOTTE Academy et SOCOTEC.

PARTNERSHIP AGREEMENTS SIGNED BY AFCEN AND TRAINING ORGANIZATIONS BY THE END OF 2021

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 2021, the Committee had 41 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	Type de formation	Durée	Langue	Partenariat
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
	The RCC-M code applied to meet NPE regulations	3 days	FR	1 partner
	Design and sizing	2 days	FR / EN	2 partners
	Manufacturing - Welding	2 days	FR	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	2 partners
	Comprehensive code training 2012 / 2016 / 2019	2 to 4 days	FR/EN	2 partners
	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	Type de formation	Durée	Langue	Partenariat
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 2021 (DTEAILS IN APPENDIX C)


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ATTESTATION

de suivi de la session de formation

« TITRE DE LA FORMATION »

Titre du Code

Logo Organisme

Délivré à : M. /Mme Prénom Nom
de la société : Société

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

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

Fait à Lieu, **le** jj mmm 20xx

Pour l'AFCEN
Le Correspondant Formation CODE
Prénom Nom

Pour l'Organisme
Le Responsable de la Formation
Prénom Nom

www.afcen.com

www.site organisme

AFCEN CERTIFICATE OF ATTENDANCE

AFCEN 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 2021

In 2021, 32 training sessions were held and covered all codes, representing 434 trainees and 1321 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 five courses.

In 2020, AFCEN and its partners finished developing courses focusing on the ESPN documentation (guides, changes to the RCC-M code, etc.). The first sessions were available early 2021, and Framatome held a training session (nine trainees).

By the end of 2021, the certified training catalog was enhanced with three new certified courses and several online courses.

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.

3.1 TRAINING

In 2021, courses were delivered in China and 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. In 2021, 46 trainees completed the RCC-M course.

In India, a partnership was set up by AFCEN, EDF, BUREAU VERITAS et 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).

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 programs:

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

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

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

3.3.1 Introduction – project objectives

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 building on the courses that AFCEN provides for universities and other institutes of higher education.

3.3.2 - General description of the project

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

AFCEN is providing the industry with tools for suppliers to self-assess their expertise in the RCC-M code (mechanical components for pressurized water reactors) and RCC-E code (electricity and I&C systems).

AFCEN is also proposing to develop tools allowing clients to assess suppliers' expertise in the RCC-M code by means of two guides:

- Guide 1: allow manufacturers to effectively assess a supplier's or subcontractor's level of technical expertise in the RCC-M code (Class 2 & 3 equipment).
- Guide 2: allow clients to effectively assess a manufacturer's level of technical expertise in the RCC-M code (Class 2 & 3 equipment).

A guide is also available to assess the degree of expertise in the RCC-E code:

- Guide RCC-E: allow clients to effectively assess a manufacturer's level of technical expertise in the RCC-E code.

The self-assessment tools will be 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

A - In 2020, training courses on AFCEN's codes were held online (due to the health situation). The particular problem with this format is the difficulty in making the codes available to trainees during the course. Trainees do not have a copy of the code being taught and it is unreasonable to expect them to purchase a copy before starting the course. Requiring them to buy the code could dissuade companies from enrolling. At the same, giving away copies of the codes to trainees would severely affect AFCEN's business model. Consequently, there are plans to develop a specific secure portal where AFCEN's codes would be available temporarily during the course (in electronic and read-only format).

In light of the method currently used to disseminate AFCEN's codes, the decision has been taken to use AFNOR's COBaz platform. Not only is this platform secure, but it also has the necessary features for providing this particular service. A specific development is required for creating temporary access for trainees. This development will be carried out by AFNOR's internal development teams. This system will apply to all the codes and all the AFCEN-certified training courses (38 types of training delivered by 13 partners).

B - The course offering an introduction to AFCEN's codes for universities and other institutes of higher education can play an important role in increasing the nuclear industry's ability to attract new talent, while showing the high level of technical skills involved and its strong ties with industrial developments and innovation. These courses need to be developed by training professionals, but this initiative is hampered by the fact that the profit margins are too low with these types of service. The funding available from higher education organizations only covers part of the expenditure required, which is putting the brakes on development.

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

AFCEN is pursuing an ambitious program to develop training modules as follows:

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 program 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 program that builds on the previous program 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 program 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 not developed

AFCEN is inviting its training partners to develop training materials for the PERF 2 modules (RCC-M and RCC-E) and redesign the training materials for the [GENERAL] module (valid for all the codes) and [PERF1] module for the RCC-M and RCC-E codes.

This solution will ensure that AFCEN's modules are more widely available to universities, while guaranteeing that courses are up-to-date for the sector's most important codes (RCC-M and RCC-E). Another advantage is that recent graduates taking their first steps in the nuclear industry will already be familiar with the key codes for nuclear safety.

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AFCEN
RESOURCES

4.1 GOVERNING MEMBERS

AFCEN is an international association which was founded by EDF and Framatome in 1980 and bring 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.

EDF and Framatome (AFCEN's founder members) and CEA sit on AFCEN's Board of Directors. AFCEN's Board of Directors manages and administers the association, and 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 program. The Executive Committee is assisted by a General Secretariat, which is responsible for the general coordination of the association's activities, a Training Committee, an Editorial Committee and seven Subcommittees (one for each code). 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 Secretary-General and the Deputy Secretary-General, 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 2021, AFCEN had 71 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 drafting groups. Each Subcommittee Chair approves the member's involvement in the drafting groups after verifying its skills and/or expertise in the chosen field. In some Subcommittees, leadership of the drafting 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 drafting groups.

By the end of 2021, AFCEN had 71 members:

Membership renewed in 2021 **New member for 2021**

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

AFCEN MEMBERS IN 2021

Member involvement in the Subcommittees

In 2021, AFCEN members were involved in the Subcommittees as described in the box below.

RCC-M (42 members)
ALPHATEST, APAVE, ASAP, AUBERT & DUVAL, BUREAU VERITAS EXPLOITATION, CEA, CETIM, CGNPC, CLYDEUNION PUMPS SAS, CNNC, DAHER VALVES, EDF, EDVANCE, EMERSON PROCESS MANAGEMENT, ENDEL, ENSA, ESI GROUP, FIVES NORDON, FLOWSERVE SAS, FRAMATOME, GISMIC, INTERCONTROLE, JIULI, LISEGA SAS, MANGIAROTTI, NAVAL GROUP, NNB, ONET TECHNOLOGIES, ORANO, ORTEC, PONTICELLI, REEL SAS, SIGEDI, SNCT, SULZER, TECHNICATOME, TUV UK Ltd, TRILLIUM FLOW, VALINOX NUCLEAIRE, VELAN SAS, VINCOTTE SA, WESTINGHOUSE FR.

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

4.2 MEMBERS AND THEIR INVOLVEMENT IN THE SUBCOMMITTEES

RCC-E (18 members)
APAVE, BERNARD CONTROLS, CEA, CGNPC, CNNC, EDF, EDVANCE, FRAMATOME, GENERAL ELECTRIC, JACOBS, NNB, PETERCEM, REEL SAS, ROLLS ROYCE CN SAS, SCHNEIDER ELECTRIC, SICA NUCLEAIRE, TECHNICATOME, WESTINGHOUSE FR.
RCC-CW (26 members)
APAVE, BOUYGUES TP, CEA, CGNPC, CNNC, CSTB, DEXTRA MANUFACTURING, EDF, EDVANCE, EGIS INDUSTRIES, EIFFAGE GC, FRAMATOME, FUSION FOR ENERGY, GEODYNAMIQUE ET STRUCTURE, HALFEN GMBH, HILTI France, JACOBS, NFM SYSTEMS, NNB, ORANO, SITES, TECHNICATOME, TERRASOL, TRACTEBEL Engineering, VINCI CONSTRUCTION, WUERTH.
RCC-C (7 members)
CEA, CGNPC, CNNC, EDF, FRAMATOME, NNB, WESTINGHOUSE FR.
RCC-F (10 members)
CEA, CGNPC, CNNC, EDF, EDVANCE, EFECTIS France, EPM INC, FRAMATOME, NNB, NUVIA PROTECTION.
RCC-MRx (17 members)
APAVE, BUREAU VERITAS EXPLOITATION, CEA, CNNC, EDF, ENSA, FRAMATOME, FUSION FOR ENERGY, ILL, ITER, MANGIAROTTI, ONET TECHNOLOGIES, ORANO, SCK CEN, TECHNICATOME, VALINOX NUCLEAIRE, VINCOTTE SA.

AFCEN MEMBER INVOLVEMENT IN THE SUBCOMMITTEES IN 2021

4.3 EXPERTS

Each member company sends its experts to participate in the activities of the Subcommittees, working groups and drafting groups. Experts taking part in a drafting 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 and working/drafting groups is as follows for 2021 (not including the Users Groups): 772.

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

Studies related to the four-year ESPN program: 73
Foreign experts in the Users Groups: 247 (China), 42 (UK)

4.4 NEW MEMBERS IN 2021

Four new organizations became AFCEN members in 2021:

Aubert & Duval designs and produces leading-edge metal solutions in the form of forged parts, closed die forged parts, long products, and metal powders made from high-performance steel, superalloys, titanium and aluminum. Since a major part of Aubert & Duval's production activities is subject to RCC-M, the company joined the RCC-M Subcommittee to help develop and enhance the code.

Fives Nordon designs and manufactures pipes and high-performance equipment for all types of industries. Fives Nordon is committed to promoting the sheet metalwork and piping sector. The company is also a member of GIFEN, SNCT, COFREND and UIMM (administrator), and involved in developing standards. Fives Nordon applied to join the RCC-M Subcommittee

REEL designs, manufactures, installs and maintains equipment for the nuclear industry (fuel handling systems, filtration solutions, containment equipment for reactor buildings, and fuel storage systems). REEL joined the RCC-M and RCC-E Subcommittees to play an active role in their activities and keep track of the latest changes to the technical standards.

Sulzer specializes in manufacturing pumps and servicing rotating machinery. As a user of the RCC-M code, Sulzer applied to join this Subcommittee to provide its expertise and anticipate the latest changes and developments.

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Shaping the rules for a sustainable nuclear technology

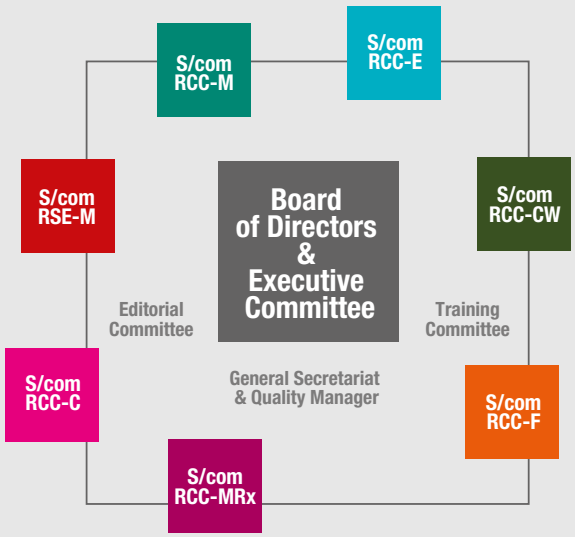
ORGANIZATION

AND OPERATION OF L'AFCEN

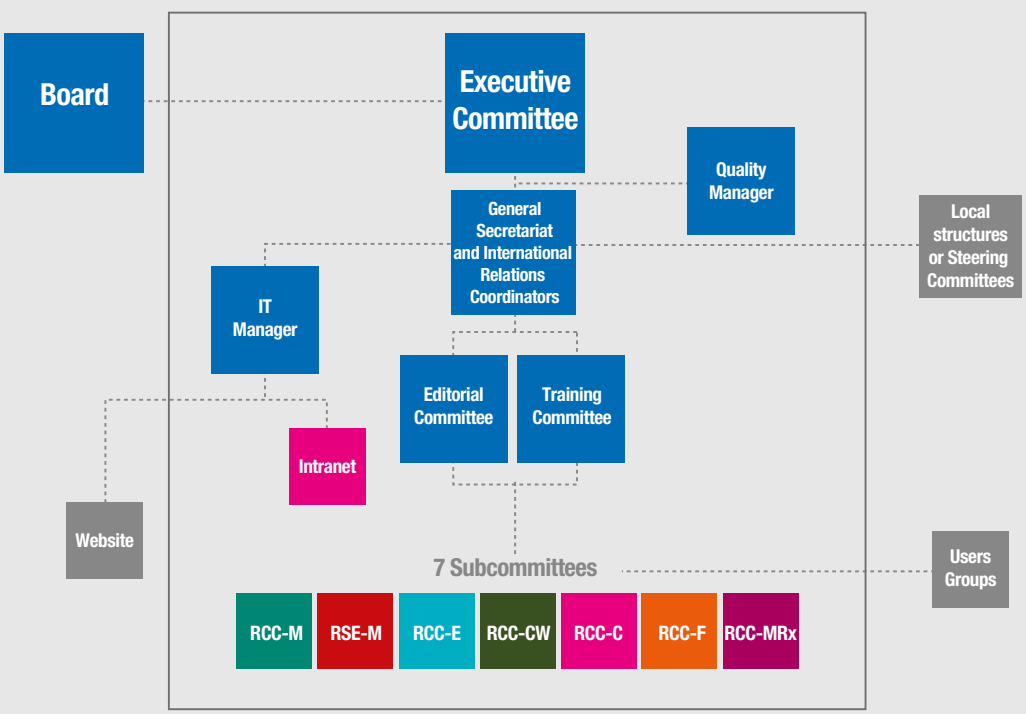
A.1 ORGANIZATION AND OPERATION

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

ÉRIC PROUST
CEA ADMINISTRATOR

MANUEL CARRASCO
EDF ADMINISTRATOR

NICOLAS GILLET
FRAMATOME ADMINISTRATOR

CHRISTINE MURISON
GENERAL SECRETARY

BRUNO MARQUIS
DEPUTY GENERAL SECRETARY

AFCEN'S BOARD OF DIRECTORS

In 2021, AFCEN's Board of Directors held two meetings, and members organized their General Meeting on March 24, 2021. During the General Meeting, members validated the :

- financial results for 2020, and the 2021 budget
- membership fees for 2022
- general strategic directions prepared by the Board of Directors

AFCEN GENERAL ORIENTATIONS IN 2021

- In France, keep our commitments for conformity of mechanical construction code with French ESPN regulations
- Support EDF in preparation of PWR international nuclear offers and SMR
- Reinforce AFCEN international position to be reference in Europe
- Pursue the development of our open policy towards new members and reinforce their technical participation
- Strengthen our provision of adapted AFCEN training courses to reply to industrial demand
- Reinforce relationship with GIFEN, support Excell Plan
- Continue to implement digitalization within the Association
- Maintain AFCEN financial performance and organization efficiency

A.1 ORGANIZATION AND OPERATION

A.1.3 General Secretariat

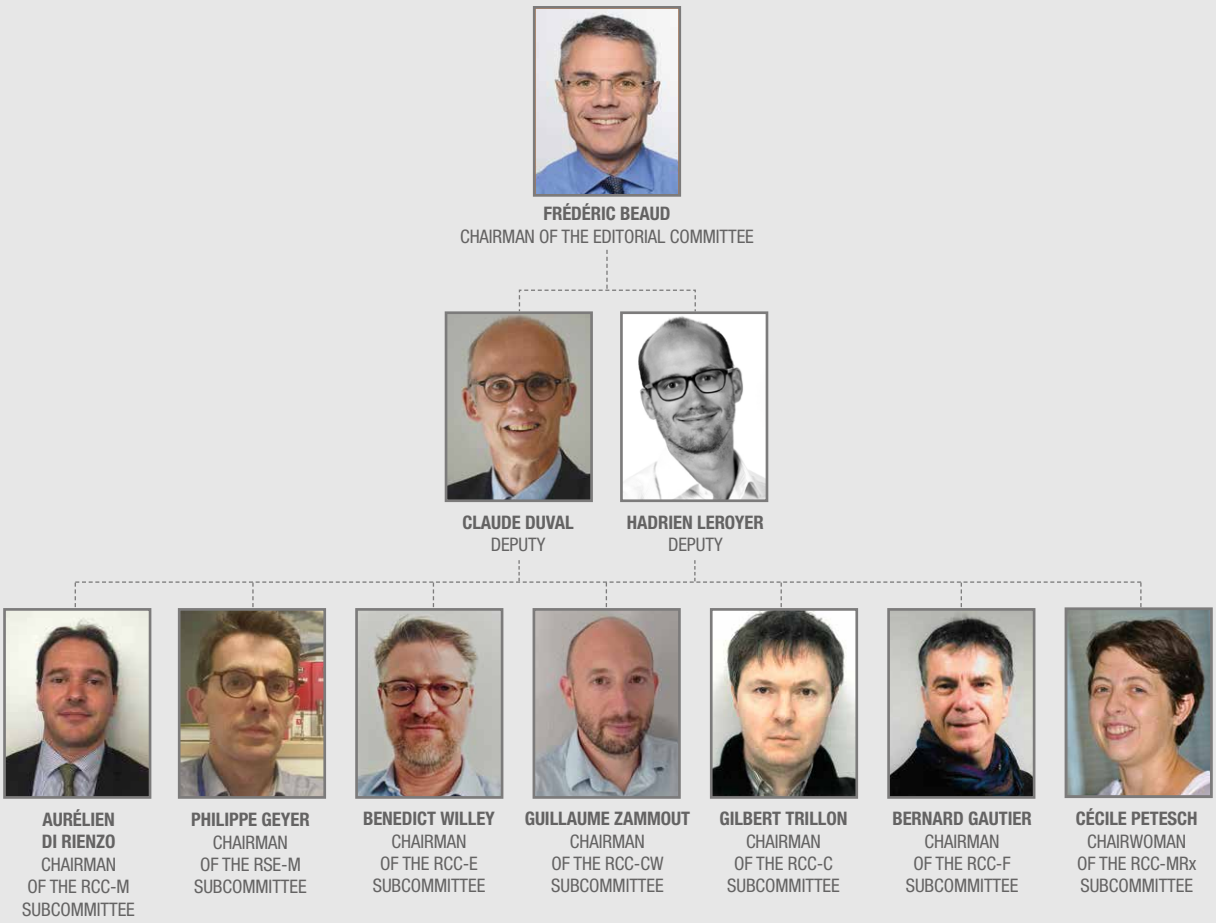
The General Secretariat organizes the process of producing and distributing codes, and supports all AFCEN activities deployed by the Editorial and Training Committees. The General Secretariat interfaces with the association's members, clients and interested parties. It oversees AFCEN's communication and biennial international Congress, as well as the association's participation in international exhibitions, such as WNE 2021.

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 program, 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 programs commissioned by the Editorial Committee.



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 program, monitors and guides the work of the Subcommittees and approves the code editions and PTAN prior to publication.

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

A.1 ORGANIZATION AND OPERATION

The Editorial Committee's editorial program is aimed at responding to the needs of AFCEN's members. Standard practice is for members to express their needs by means of code Requests for Modification (RM) or Requests for Interpretation (RI). Such needs may also be voiced during AFCEN's general meetings or any events organized by the Association, as well as during meetings between AFCEN and its different stakeholders (major projects, nuclear safety authority, etc.). The various international schemes set up by AFCEN (Users Groups, CEN/WS 64, etc.) are intended to ascertain potential requirements. These needs are addressed in the different Subcommittees or directly by the Editorial Committee where topics concern several Subcommittees.

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

General activity of the Editorial Committee in 2021:

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

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

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

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

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

BRUNO MARQUIS
CHAIRMAN OF TRAINING COMMITTEE

CHRISTINE MURISON
DEPUTY

RÉMI MORITZ
MANAGER FOR TRAININGS ON RCC-M

ANNE DE BUTTET
MANAGER FOR TRAININGS ON RSE-M

THOMAS RIOU
MANAGER FOR TRAININGS ON RCC-E

ALEXANDRE BOULE
MANAGER FOR TRAININGS ON RCC-CW

LUDOVIC QUEMARD
MANAGER FOR TRAININGS ON RCC-C

MICKAËL CESBRON
MANAGER FOR TRAININGS ON RCC-F

THIERRY LEBARBE
MANAGER FOR TRAININGS ON RCC-MRx

AFCEN'S TRAINING COMMITTEE

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

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

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

GENERAL ACTIVITY OF THE TRAINING COMMITTEE IN 2021

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

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

The Training Committee has adapted to the health crisis accordingly. As part of a collaborative effort with the voluntary training organizations, virtual training sessions were carried out at the end of summer in accordance with the principles for certification. Certification has been arranged for distance learning courses, and three partners offer AFCEN-certified distance courses.

The Training Committee consolidated 41 training courses and issued 434 certificates of attendance for courses on AFCEN codes. Three new courses, entitled "RCC-M in accordance with the ESPN Regulation" (by Framatome), "Update to RCC-E 2012 – 2016 – 2019" and "RCC-E 2019 qualification and manufacturing of electrical equipment" (by SICA Nucléaire) obtained certification in 2021.

A.1 ORGANIZATION AND OPERATION

The committee also completed work on creating a training program on the documentation associated with the ESPN regulation, which is now available to accompany the publication of the 2018 editions of the RCC-M and RSE-M codes. The first session was organized by Framatome in September 2021.

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 2021

In 2021, seven Subcommittees were active:
. **RCC-M:** Design and construction rules for mechanical components of PWR nuclear islands
. **RSE-M:** In-service inspection, installation and maintenance rules for mechanical components of PWR
. **RCC-E:** Design and construction rules for electrical and I&C systems and equipment
. **RCC-CW:** Rules for design and construction of PWR nuclear civil works
. **RCC-C:** Design and construction rules for fuel assemblies of PWR nuclear power plants
. **RCC-F:** Design and construction rules for fire protection of PWR nuclear plants
. **RCC-MRx:** Design and construction rules for mechanical components of nuclear installations: high-temperature, research and fusion reactors

The Subcommittees are responsible for:

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

Each Subcommittee comprises :

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

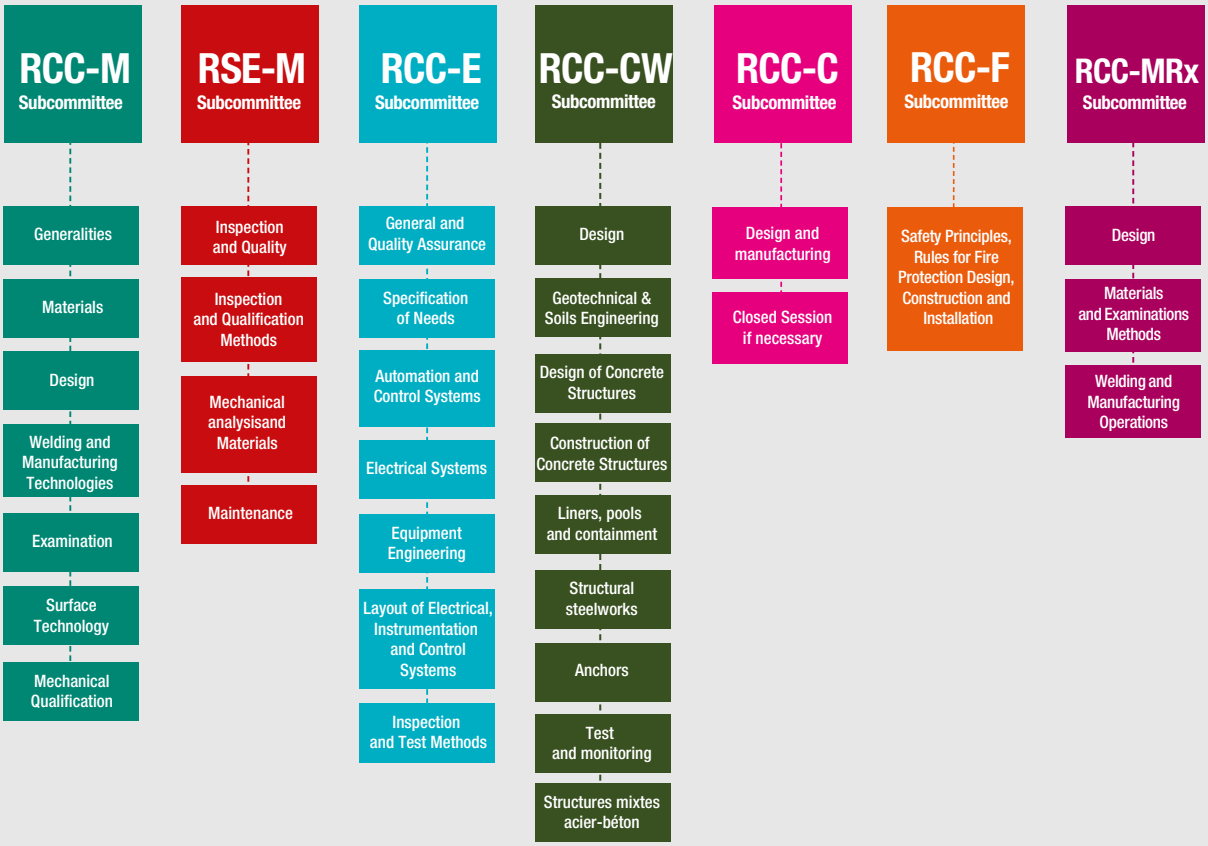
The Subcommittee Board represents the Subcommittee's decision-making and arbitration body, and features a Chair, a Vice-Chair and a restricted number of experts appointed by the Subcommittee Chair based on their skills. The Subcommittee Chair designates the working group leaders from the experts in the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

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

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

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

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



AFCEN'S SUBCOMMITTEES AND PERMANENT WORKING GROUPS

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.1 ORGANIZATION AND OPERATION

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 2021 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 postponed its 2021 session to 2022.
The RCC-E Users Group held its first work session in November 2021.

In 2021 in China:
The RCC-M CSUG held a meeting in May. The fall sessions for each code had been scheduled for November 2021, but unfortunately they had to be postponed until early 2022 (RCC-CW, RCC-E in January 2022) due to the health crisis. The CSUGs also host the working groups between AFCEN and NEA (National Energy Administration) based on collaborative projects with Chinese standards, including the translation of AFCEN's codes into Chinese.

GENERAL ACTIVITY OF THE AFCEN CODE USERS GROUPS IN 2021

A.2 AFCEN QUALITY MANAGEMENT

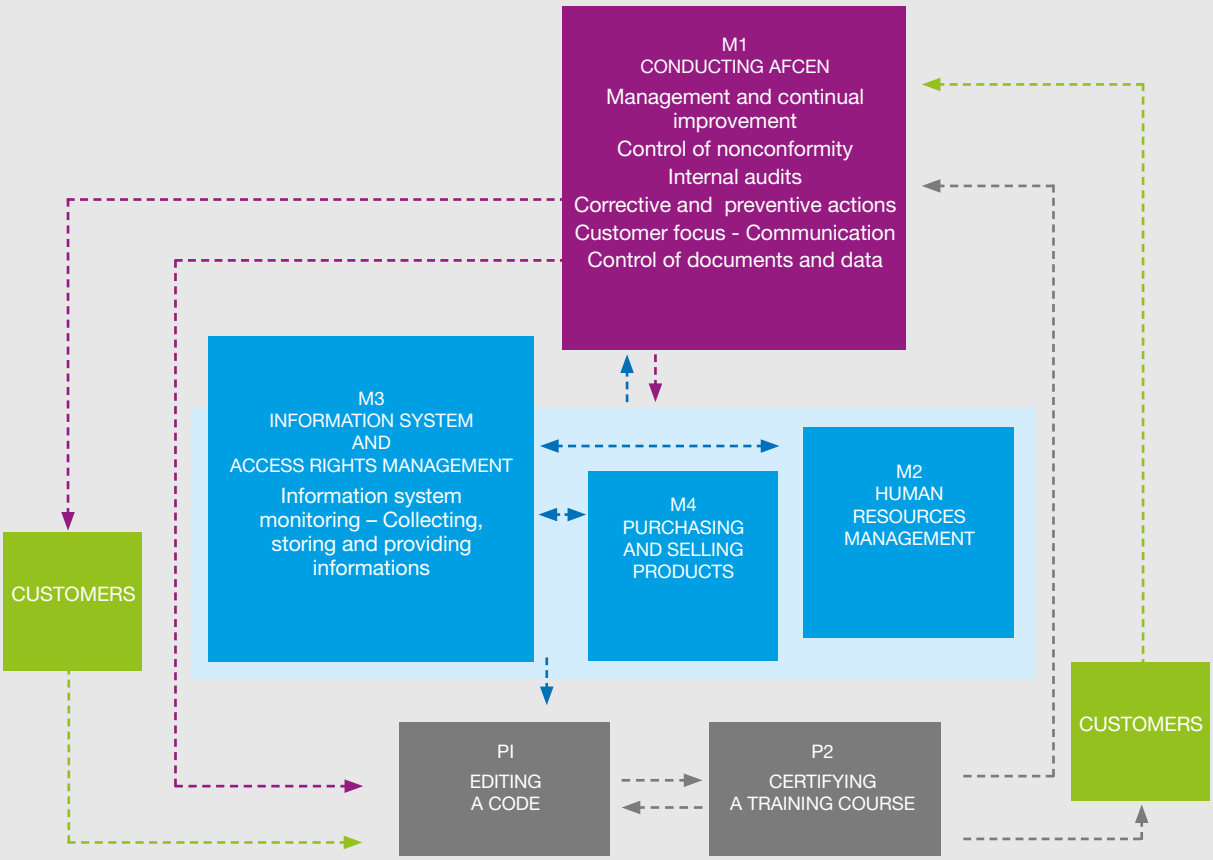
AFCEN has set up a process-based management system to perform its missions, namely produce and disseminate reference publications and codes for building, operating and using nuclear facilities.

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 programs.

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

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

A.2 AFCEN QUALITY MANAGEMENT

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 2021, the certification follow-up audit concluded that AFCEN's quality management system was sufficiently robust and effective, in particular culture of companies members of AFCEN, which leads to a high maturity of teams regarding quality approach.

AFCEN's general quality management activities in 2021 are summarized in the box below.

An internal audit was conducted in 2021 into the process for managing the information system and access rights.

Two process reviews were performed respectively for certifying training and purchase and sale of products.

The AFCEN management review was held on February 5, 2021. It enabled the association to:

- fine-tune the Quality indicators of the production processes in alignment with the objectives of AFCEN's management policy,
- check the actions taken to resolve any identified nonconformities and implement the association corrective actions,
- consider the interested parties and assess their expectations,
- examine the risk assessments for the processes that changed during 2020 and decide which actions need to be implemented to mitigate such risks, while considering the opportunities for improving process performance,
- analyse feedback from the AFCEN Day in June 2020,
- check that the customer focus principle is correctly applied when dealing with requests from AFCEN members, and the French and English Safety Authorities.

The new quality policy and strategy were communicated at every opportunity so that process owners can roll them out, as well as ensure that each member is familiar with their content. Deployment involves implementing a number of actions to address interpretation requests with greater speed and accelerate the certification process for distance learning courses.

Certification follow-up audit:

On October 22, 2021, AFCEN passed the certification renewal audit on its quality management system (ISO 9001: 2015). The auditor highlighted a number of strengths, including the prospect of certifying distance learning courses with accurate definitions of AFCEN's recommendations (P2), the identification of the resources section in the strategic plan in accordance with the challenge of ensuring AFCEN's ability to support an industrial strategy (M1), and the improved interface between users and the AFCEN website for accessing the code interpretation forms.

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 2021, 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 2021, 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. Since 2019, users can also sign up for AFCEN's events on the website. Some publications are available free of charge.
- subscribe to the Association,
- access the forms for submitting interpretation and modification requests,
- discover the training courses on AFCEN's codes by our partners.

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

A.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,

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.

A.3 INFORMATION AND SALES SYSTEM

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 gradually replaced with CObaz, a platform that offers users a wider range of features. There are plans to switch WEBPORT users over to CObaz by 2023 at the latest.

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

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

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APPENDIX

B

CATALOG

OF AFCEN CODES AND DOCUMENTS AVAILABLE FOR SALE

B CATALOG OF AFCEN CODES AND DOCUMENTS AVAILABLE FOR SALE

Codes and publications	Description	Available lang.	Paper book format (€ excl tax)	PDF single format (€ excl tax)	Subscription format* (€ HT)
Subscription RCC-M	Publications included in the subscription: RCC-M 2020 / RCC-M 2018 / RCC-M 2017 / RCC-M 2016 / RCC-M 2012 + add 1, 2, 3 / RCC-M 2007 + add 1, 2, 3 / RCC-M 2000 + add 1 / ERRATA RCC-M 2018 FR / ERRATA RCC-M 2020 EN / ERRATA APPENDIX ZG - Ed 2000 addenda 2007 and following editions / PTAN 2014 RCC-M Criteria prevention damage mechanical components / PTAN 2015 Radioprotection / PTAN 2018 Radioprotection / PTAN 2016 ADR N1 / PTAN 2018 ADR N1 / PTAN 2018 ADR N2 / PTAN 2016 Dimensional Reference N1 / PTAN 2018 Dimensional Reference N1*N2 N3 / PTAN 2017 Inspectabilité N1 / PTAN 2018 Inspectability N1 / PTAN 2018 Inspectabilité N2 N3 / PTAN 2016 KV Faibles Epaisseurs / PTAN 2016 Notice instructions / PTAN 2018 Notice d'instructions / PTAN 2018 Corrosion des aciers inoxydables austenitiques N1 N2 et N3 / PTAN 2018 Identification of allowable limits N1 / PTAN 2018 identification of allowable limits N2 N3 / PTAN 2018 Modalités de l'examen visuel final / PTAN 2018 Manufacturing visual examinations / PTAN 2018 Methodological guide for preparing NPMAs for N2 N3 / PTAN 2018 Pressure and safety accessories / PTAN 2018 Retention of materials / PTAN 2018 SRMCR N2 N3 / PTAN 2018 Surveillance de la fabrication des composants non soumis à QT spécifique / PTAN 2018 Vieillissement des aciers inoxydables austenitiques N2 N3 / PTAN 2020 AIP conception fabrication / PTAN 2020 Qualification Technique ESPN	•	/	/	2600
RCC-M 2020	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	2 950	/	Cf. Subscription
RCC-M 2018	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	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 + add 1, 2, 3 add 1, 2, 3 = addendum 2013, 2014, 2015	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	2 820	/	
RCC-M 2007 + add 1, 2, 3 add 1, 2, 3 = addendum 2008, 2009, 2010	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	/	1 620	
RCC-M 2000 + add 1 add 1= addendum 2002	Design and Construction Rules for Mechanical Components of PWR Nuclear Islands	FR	/	1 620	
PTAN 2014 RCC-M Criteria	Prevention of damages in mechanical components. Introduction to the design, analysis and construction rules of the RCC-M	FR, EN	1 590	1 540	
PTAN 2015 Radioprotection	Radiation protection guide for the design of Nuclear Pressure Equipment for PWR plants in France	FR, EN	/	30	
PTAN 2018 Radioprotection	Guide de radioprotection pour la conception des équipements sous pression nucléaires des centrales REP installées en France.	FR	/	30	
PTAN 2016 ADR N1	Guide Analyse de risques pour ESPN N1	FR	/	210	
PTAN 2018 ADR N1	Guide Analyse de risques pour ESPN N1	FR	/	255	
PTAN 2018 ADR N2	Analyses de risques pour les équipements ESPN de niveau N2 fabriqués selon RCC-M	FR	/	325	
PTAN 2016 Dimensional Reference N1	Dimensional reference standard of N1 nuclear pressure equipments	FR, EN	/	85	
PTAN 2018 Dimensional Reference N1*N2 or N3	Dimensional reference standard for N1*, N2, or N3 nuclear pressure equipment	FR, EN	/	80	
PTAN 2016 KV Faibles épaisseurs	Justification de l'exemption d'essai de flexion par choc pour les composants de faible épaisseur en aciers inoxydables austénitiques et les alliages base nickel	FR	/	70	
PTAN 2017 Inspectabilité N1	Guide de l'inspectabilité pour la conception des équipements sous pression nucléaires de niveau N1 des centrales REP installées en France	FR	/	30	
PTAN 2018 Inspectability N1	Inspectability guide for the design of N1 level nuclear pressure equipment of PWR plants installed in France	FR, EN	/	40	
PTAN 2018 Inspectabilité N2 N3	Guide de l'inspectabilité pour la conception des équipements sous pression nucléaires de niveau N2 ou N3 des centrales REP installées en France	FR	/	30	
PTAN 2018 Pressure and safety accessories	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	
PTAN 2018 Retention of materials	Retention of Material resulting from the Manufacture of parts of Level 1 Nuclear Pressure Equipment	FR, EN	/	70	
PTAN 2018 Corrosion des aciers inoxydables austenitiques N1*, N2 et N3	Note support à la rédaction des EPMN pour équipements ESPN N1*, N2 et N3 Corrosion des aciers inoxydables austénitiques et austéno-ferritiques	FR	/	145	
PTAN 2018 Modalités de l'examen visuel final	Guide sur les modalités de réalisation de la Vérification Visuelle dans le cadre de l'Examen Final	FR	/	25	
PTAN 2016 Notice Instructions	Guide for the contents of the operating instructions for nuclear pressure equipment	FR, EN	/	85	
PTAN 2018 Notice Instructions	Guide pour le contenu de la notice d'instructions d'un équipement sous pression nucléaire	FR	/	65	
PTAN 2018 Manufacturing visual examinations	Guideline about the execution of manufacturing visual examinations requested by the hazard analysis. Application: level 1,2 or 3 pressure equipment	FR, EN	/	25	
PTAN 2018 Methodological guide for preparing NPMAs for N2 N3	Methodological guide for preparing NPMAs for N2/N3 nuclear pressure equipment	FR, EN	/	80	

Codes and publications	Description	Available lang.	Paper book format (€ excl tax)	PDF single format (€ excl tax)	Subscription format* (€ HT)
PTAN 2018 SRMCR N2 N3	Guide de conception des SRMCR installés sur les REP pour protéger les ESPN de niveau N2 ou N3	FR	/	95	Cf. Subscription
PTAN 2018 Surveillance de la fabrication des composants non soumis à QT spécifique	Guide méthodologique pour la surveillance de la fabrication des composants non soumis à qualification technique spécifique	FR	/	70	
PTAN 2018 Vieillissement des aciers inoxydables austenitiques N2 N3	Note support à la rédaction des EPMN pour équipements ESPN N2 et N3 Vieillissement thermique des aciers inoxydables austénitiques et austéno-ferritiques	FR	/	135	
PTAN 2018 Identification of allowable limits N1	Identification of allowable limits of the MPS/MSS	FR, EN	/	50	
PTAN 2018 Identification of allowable limits N2 N3	Identification of allowable limits of nuclear pressure equipment excluding MPS/MSS	FR, EN	/	45	
PTAN 2020 AIP conception fabrication	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	
PTAN 2020 Qualification Technique ESPN	Qualification Technique ESPN	FR	/	845	
Subscription RSE-M	Publications included in the subscription: RSE-M 2020 / RSE-M 2018 / RSE-M 2017 / RSE-M 2016 / RSE-M 2010 + add 1, 2, 3, 4 / PTAN 2016 RSE-M WPS / PTAN 2017 RSE-M Appendix 5.4 / PTAN 2018 RSE-M Appendix 5.5 / PTAN RS 16 007 ind E / PTAN RS 16 009 ind B / PTAN RS 16 010 rev E / PTAN RS 17 022 ind B / PTAN RS 18 003 ind A / PTAN RS 18 004 ind C / PTAN RS 18 006 ind A / PTAN RS 18 007 rev A / PTAN RS 19 013 ind A	•	/	/	1600
RSE-M 2020	In-Service Inspection, Installation and Maintenance Rules for Mechanical Components of PWR	FR, EN	1 760	/	Cf. Subscription
RSE-M 2018	In-Service Inspection, Installation and Maintenance Rules for Mechanical Components of PWR	FR, EN	1 760	/	
RSE-M 2017	In-Service Inspection Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	1 760	/	
RSE-M 2016	In-Service Inspection Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	1 760	/	
RSE-M 2010 + add 1, 2, 3, 4 add 1, 2, 3, 4 = addendum 2012, 2013, 2014, 2015	In-Service Inspection Rules for Mechanical Components of PWR Nuclear Islands	FR, EN	1 760	/	
PTAN 2016 RSE-M WPS	Principle and substantiation for taking Warm Pre-Stressing (WPS) into account in PWR vessel fast fracture resistance criterion	FR, EN	/	85	
PTAN 2017 RSE-M Appendix 5.4	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	
PTAN 2018 RSE-M Appendix 5.5	Principles of and background to the formulation of the criteria in Appendix 5.5 of the RSE-M code relating to the fast fracture strength of pressure equipment displaying a planar defect during operation	FR, EN	/	110	
PTAN RS 16 007 ind E	Guide for Periodic Requalification of Class N2 or N3 ESPN piping	FR, EN	/	45	
PTAN RS 16 009 ind B	Professional guide to repairs and modifications of nuclear pressure equipment subject to Points 1 to 4 of Appendix V of the amended Order of December 30, 2015	FR, EN	/	Free	
PTAN RS 16 010 rev E	Professional guide to significant repairs/modifications of nuclear pressure equipment subject to Points 1 to 4 of Appendix V of the amended Order of December 30, 2015	FR, EN	/	110	
PTAN RS 17 022 ind B	Professional guide for the design and manufacture of main pressure parts (MPP) intended for nuclear pressure Equipment in the MPS-MSS	FR,EN	/	Free	
PTAN RS 18 003 ind A	Professional guide covering the requirements and procedures for assessing the conformity of permanent joints used to install NPEs that are subject to Appendix V, paragraph 4.1.a of the amended order of 12/30/2015	FR, EN	/	Free	
PTAN RS 18 004 ind C	Guide méthodologique de la protection pour l'installation d'un ESPN	FR	/	Free	
PTAN RS 18.005 rev 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 En cours d'instruction par l'ASN en vue de son acceptation	FR	/	Free	
PTAN RS 18 006 ind A	Professional guide to the requirements applicable to repairs and modifications of nuclear pressure equipment subject to Points 1 to 4 of Appendix V of the amended Order of December 30, 2015 and procurement of parts for this purpose	FR, EN	/	Free	
PTAN RS 18 007 rev A	Guide professionnel pour les interventionssur des ESPN du CPP-CSP	FR	/	40	
PTAN RS 19.013 Ind A	Guide pour la qualification de procédés END par ultrasons. Etablissement des performances	FR	/	Free	
Subscription RCC-E	Publications included in the subscription: RCC-E 2019 / RCC-E 2016 / RCC-E 2012 / Gap analysis RCC-E 2016 - 2019 (only EN) / Gap analysis RCC-E 2005 - 2012 (only EN) / Gap analysis RCC-E 2012 - 2016 (only EN) / PTAN Guidebook for defining RCC-E 2019 Book of Project DATA / PTAN 2019 RCC-E Class 3 qualification	•	/	/	950
RCC-E 2019	Design and construction rules for electrical and I&C systems and equipment + PTAN Guidebook for defining RCC-E 2019 Book of Project DATA	FR, EN	1 000	/	Cf. Subscription
RCC-E 2016	Design and construction rules for electrical and I&C systems and equipment + Gap analysis RCC-E 2012 - 2016	FR, EN	1 000	/	
RCC-E 2012	Design and construction rules for electrical equipment of nuclear islands + Gap analysis RCC-E 2005 - 2012	FR, EN	625	/	
PTAN 2019 RCC-E Class 3 Qualification	Class 3 design qualification of systems using equipment families certified according to IEC 61508	FR, EN	/	45	

B CATALOG OF AFCEN CODES AND DOCUMENTS AVAILABLE FOR SALE

Codes and publications	Description	Available lang.	Paper book format (€ excl tax)	PDF single format (€ excl tax)	Subscription format* (€ HT)
Subscription RCC-CW + ETC-C	Publications included in the subscription: 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 2021	Rules for design and construction of PWR nuclear civil works	FR, EN	1 500	/	Cf. Subscription
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 in english 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	
Subscription RCC-C	Publications included in the subscription: RCC-C 2020 / RCC-C 2019 / RCC-C 2018 / RCC-C 2017 / RCC-C 2015 / RCC-C 2005 + add 1 / PTAN 2019 RCC-C Qualification OCS	•	/	/	820
RCC-C 2020	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	Cf. Subscription
RCC-C 2019	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	
RCC-C 2018	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	
RCC-C 2017	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	
RCC-C 2015	Design and construction rules for fuel assemblies of PWR nuclear power plants	FR, EN	850	/	
RCC-C 2005 + add 1 add 1 = 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	
Subscription RCC-F	Publications included in the subscription: RCC-F 2020 / RCC-F 2017 / ETC-F 2013 / ETC-F 2010 / Gap analysis RCC-F 2020 (only EN) / PTAN RCC-F 2020 Compatibility analysis with reference documents	•	/	/	380
RCC-F 2020 + Gap analysis RCC-F 2020 (only EN)	Design and Construction rules for fire protection of PWR nuclear plants + Gap analysis RCC-F 2020	FR, EN	400	/	Cf. Subscription
RCC-F 2017	Design and Construction rules for fire protection of PWR nuclear plants	FR, EN	400	/	
ETC-F 2013	EPR technical code for fire protection	FR, EN	400	/	
ETC-F 2010	EPR technical code for fire protection	FR, EN	275	/	
PTAN RCC-F 2020 Compatibility analysis with reference documents	RCC-F 2020 Compatibility analysis with reference documents – WENRA SRL 2014	EN	/	65	
Subscription RCC-MRx + RCC-MR	Publications included in the subscription: RCC-MRx 2018 / RCC-MRx 2015 / RCC-MRx 2012 + add 1 / RCC-MR 2007 / ERRATUM RCC-MR 2007 Appendix A6 / PTAN 2017 RCC-MRx new material / PTAN 2019 RCC-MRx seismic analysis components	•	/	/	2670
RCC-MRx 2018	Design and Construction Rules for Mechanical Components of nuclear installations : high-temperature, research and fusion reactors	FR, EN	2 940	/	Cf. Subscription
RCC-MRx 2015	Design and Construction Rules for Mechanical Components of nuclear installations : high-temperature, research and fusion reactors	FR, EN	2 940	/	
RCC-MRx 2012 + add 1 add 1 = addendum 2013	Design and construction rules for mechanical components of nuclear installations	FR, EN	2 880	/	
RCC-MR 2007	Design and construction rules for mechanical components of nuclear installations	FR, EN	/	2 140	
PTAN 2017 RCC-MRx new material	PTAN Guide for introducing a new material in the RCC-MRx	FR, EN	/	100	
PTAN 2018 RCC-MRx Seismic Analysis Components	PTAN Guide for seismic analysis of components	FR, EN	/	65	

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

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

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Shaping the rules for a sustainable nuclear technology

APPENDIX

TRAINING
CATALOG

TRAINING CATALOG

Field	Reference	Code	Title of training	Duration	Language	Organisme
Mechanics	M-001	RCC-M	Supply and materials according to RCC-M	1 d	French	APAVE
	M-002		Quality assurance according to the RCC-M code	1 d	French	APAVE
	M-003		Control methods according to the RCC-M code	1 d	French	APAVE
	M-006		Understanding of the RCC-M code	2 d	French	APAVE
	M-007		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	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 2018 - Level 2 & 3	3 d	French	SICA
	M-019		Knowing and applying the code RCC-M	4 d	French / English	SOCOTEC
	M-020		Discovery of RCC-M code	1 d	French / English	SOCOTEC
	M-021		RCC-M in application of the ESPN	2 to 5 d	French	FRAMATOME
	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
	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	5 d	French	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-003		Discovery of the code RCC-MRx	3 d	French	INSTN
	MRx-004		Discovery of the code RCC-MRx	2 d	French / English	BUREAU VERITAS
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
Electricity	E-001	RCC-E	Discovering the RCC-E code, 2012 edition	1 d	French / English	FRAMATOME
	E-002		RCC-E 2012 - Qualification and manufacturing of an electrical equipment	3 d	French / English	SICA
	E-003		Use of the RCC-E code, 2012 edition	4 d	French	APAVE
	E-004		RCC-E 2016 - 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-007		RCC-E 2016 - Qualification and manufacturing of an electrical equipment	2 d	French / English	SICA
	E-008		RCC-E 2016 - Overview	1 d	French / English	SICA
	E-009		Upgrade RCC-E 2012 - 2016	1 d	French / English	SICA
	E-010		RCC-E 2019 - Qualification and manufacturing of an electrical equipment	3 d	French / English	SICA
	E-011		Knowledge of RCC-E code, 2016 edition focus on equipment	2 d	French	APAVE
	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
Fire protection	F-001	RCC-F	ETC-F : fire protection conception and construction rules	4 d	French	EFECTIS

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

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GLOSSARY

	FR	EN
ASN	AUTORITÉ DE SÛRETÉ NUCLÉAIRE	FRENCH SAFETY AUTHORITY
CEN	COMITÉ EUROPÉEN DE NORMALISATION	-
CF	COMMISSION DE FORMATION	TRAINING COMMITTEE
CR	COMMISSION DE RÉDACTION	EDITORIAL COMMITTEE
CSUG	-	CHINESE SPECIALIZED USERS GROUPS
CVF	CONTRÔLE VISUEL DE FABRICATION	-
DI/ IR	DEMANDE D'INTERPRÉTATION	INTERPRETATION REQUEST
DNRE	DIMENSIONS NÉCESSAIRES AU RESPECT DES EXIGENCES	-
DM/MR	DEMANDE DE MODIFICATION	MODIFICATION REQUEST
END	EXAMEN NON DESTRUCTIF	-
EPMN	EXIGENCE PARTICULIÈRE DE MATÉRIAU NUCLÉAIRE	-
ETSON	-	EUROPEAN TECHNICAL SAFETY ORGANIZATION NETWORK
ESPN	EQUIPEMENT SOUS PRESSION NUCLÉAIRE	-
FM	FICHE DE MODIFICATION	MODIFICATION FORM
GDA	-	GENERIC DESIGN ASSESMENT
GK	GRAND CARÉNAGE	-
GR	GROUPE DE RÉDACTION	-
GSEN	GROUPEMENT POUR LA SECURITÉ DES EQUIPEMENTS NUCLÉAIRES	-
IEEE	INSTITUTS DES INGÉNIEURS ELECTRICIENS ET ELECTRONICIENS	INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS
INB	INSTALLATION NUCLÉAIRE DE BASE	-
KTA	-	GERMAN NUCLEAR SAFETY STANDARDS COMMISSION (KERNTECHNISCHER AUSSCHUSS - KTA)
LTO	-	LONG TERM OPERATION
MNE	-	MASTER OF NUCLEAR ENERGY
MOU	-	MEMORENDUM OF UNDERSTANDING
NB	NORMES CHINOISES NATIONALES	-
NEA	-	NUCLEAR ENERGY ADMINISTRATION (IN PRC)
NFPA	-	NATIONAL FIRE PROTECTION ASSOCIATION
OCDE	ORGANISATION DE COOPÉRATION ET DE DÉVELOPPEMENT ÉCONOMIQUE	-
ONR	-	OFFICE FOR NUCLEAR REGULATION
PG	-	PROSPECTIVE GROUP
PG	-	PROJECT GROUPS
PTAN	PUBLICATION TECHNIQUE DE L'AFCEN	-
R&D	RECHERCHE ET DÉVELOPPEMENT	-
REX	RETOUR D'EXPÉRIENCE	EXPERIENCE FEEDBACK
SDO	-	STANDARD DEVELOPMENT ORGANIZATION
SG	SECRÉTARIAT GÉNÉRAL	-
SMR	-	SMALL MODULAR REACTOR
SWOT/MOFF	MENACES OPPORTUNITÉS FORCES FAIBLESSES	STRENGTHS, WEAKNESSES, OPPORTUNITIES, THREADS
TBM	-	TEST BLANKET MODULE
TS	-	TECHNICAL SECRETARY
TSO	-	TECHNICAL SAFETY ORGANIZATION
WS	-	WORKSHOP

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