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REACTORS TRAINING CENTER

FRAMATOME ACADEMY

Training catalog 2024

English version

Revision 15 january 2024

Qualiopi
processus certifié

RÉPUBLIQUE FRANÇAISE

La certification qualité a été délivrée au titre de la catégorie d'action suivantes :
Action de formation

The Reactors Traning Centrer

Developing and maintaining skills is a major challenge facing the nuclear industry. To continuously strengthen the skills of our employees, to develop our performance and to support our customers and partners around the world, Framatome Academy brings together, our numerous training centers and programs to provide relevant training solutions to our customers.

Recently Qualiopi certified, Framatome is proactive in the continuous improvement program of our training centers to ensure the highest level of customer satisfaction. Within Framatome Academy, the Reactor Training Center (CFR) designs, develops and implements technical training courses related to Pressurized Water Reactor (PWR) technology, in particular the EPR.

Our trainers, specialists and experts in various domains such as Process, Mechanical Equipment and Systems, Instrumentation & Control, Testing as well as Nuclear Services, design our training programs and share their operational knowledge, which is directly beneficial to a wide range of professional disciplines. The Reactor Training Center deploys an active approach to learning in the design of its training courses. Many programs include various exercises, using real-time simulators, digital models or simulation models.

Based in Paris, the Reactors Training Center deploys its programs in Paris, Lyon or in other locations upon request. The satisfaction of our trainees is of great importance to us. This is why, in addition to the training courses described in this catalog, we also have the capacity to develop programs which are specifically tailored to your needs. Please do not hesitate to consult us.

In 2023, the Reactor Training Center taught more than 1400 trainees, representing various technical disciplines, earning a customer satisfaction rate of 89%.

For information regarding particular accommodations for students with disabilities, the Reactor Training Center recommends contacting : christel.duval@framatome.com

For all other information regarding the training program, in particular prices and planning,
please contact : formation.reacteurs@framatome.com

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Pressurized Water Reactors Operation

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9. ULTIMA

Pressurized Water Reactor Discovery

Illustrations based on EPR technology
EPR2 specificities not presented in the training.
Blended Learning

Duration : 19 hours :
8 hours asynchronous
11 hours synchronous

Language : English, French

Participants : 10 to 12

Location : remote training

Level 1 Fundamentals

Prerequisite : None

Contact:
formation.reacteurs@framatome.com

Revision 15 january 2024

Your are

A junior engineer or technician, or anyone from a non-technical background wishing to acquire a global vision and discover the main characteristics of a nuclear Pressurized Water Reactor (PWR).

During the training, you will

- Understand the principles of nuclear physics in reactor operation
- Be made aware of nuclear safety
- Discover the main components and main systems of PWRs
- Study the general operation of PWRs
- Discover accidental operation, and systems designed for these situations

After the training, you will be able to

- Décrire et expliquer le fonctionnement général des REP
- Identifier les principaux systèmes participant au fonctionnement normal ou accidentel
- Décrire les principes fondamentaux de la sureté nucléaire
- Suivre des réunions techniques étendues à d'autres domaines que le vôtre

Course strengths

- Training consists of e-learning and virtual classes
- Visualization on a 3D model
- Illustration of operation on simulator videos

Content

Theoretical classes :

- Global energy context and place of nuclear energy in the world economy, key figures
- Basic notions in neutron physics and radiation protection
- Presentation of reactor normal operation and associated systems
- Nuclear safety principles and safety functions, reactor accidental operation and associated systems

Training based on simulator video :

- Illustration of normal operation
- Illustration of operation in accidental situations

Evaluation

- Learning assessment survey
- Assessment of trainees' satisfaction

Advanced EPR

Illustrated on different EPRs (OL3, FA3...). EPR2 specificities not presented in the training.

Duration : 35 hours

Language : French, English

Participants : 10 to 15

Location : French, English

Level 2 Advanced

Prerequisite :
Good knowledge of Pressurized Water Reactor technology

Contact:
formation.reacteurs@framatome.com

You are

- An engineer who participates in the phases of design, construction, commissioning, maintenance, and operation of an EPR
- An engineer with experience in the technology of reactors other than the EPR, who wants to discover EPR-specific features

During the training, you will

- Discover EPR-specific features

After the training, you will be able to

- Describe the design requirements and the main operation modes of EPR reactors
- Outline safety requirements and implementation in EPR reactors
- Identify the characteristics of the reactor core coolant system of an EPR reactor
- Describe EPR auxiliary systems: their roles, components, and interfaces in normal operation
- Describe EPR safeguard systems: their roles, components, and interfaces in accident and post-accident situations
- Understand EPR electrical distribution main features
- Describe the EPR Instrumentation & Control architecture

Course strengths

- Course providing an overview of the main systems
- Course designed to facilitate interaction

Contenu

- Design requirements of a nuclear island, its operation modes
- Nuclear safety requirements applied to systems, accidental situations and hazard events considered
- Functions and architecture of the reactor core coolant system
- Functions and architecture of the steam generator and associated systems
- Functions and architecture of auxiliary systems
- Functions and architecture of safeguard systems and severe accident systems
- Study of a design basis accident
- Overview of pools and their purification and cooling system
- Overview of electrical systems
- Overview of the architecture of I&C systems

Evaluation

- Learning assessment survey
- Assessment of trainees' satisfaction

ELECTRA EPR

EPR normal operation
Illustrated on different EPRs (OL3, FA3...).
EPR2 specificities not presented in the training.

Training path

SYSTEMA EPR ▶ ***ELECTRA EPR***

Duration : 28 hours

Language : French, English

Participants : 8 to 12

Location : Paris

Level 2 Advanced

Prerequisite :

General knowledge of EPR operation

Contact:
formation.reacteurs@framatome.com

You are

An engineer or a technician having a general knowledge of EPR operation and wishing to acquire specific knowledge on EPR normal operating modes.

During the training, you will

Study behavior and operation strategy of EPRs in normal operating situations (startup/shudown, load follow) and during normal operating transients in accordance with safety criteria.

After the training, you will be able to

- Understand and objectively analyze the plant operating state by respecting the design assumptions and ensuring coherence with EPR Operating Technical Specifications (OTS)
- Explain the different operating modes and the associated limits of an EPR in normal operating situations

Course strengths

- Theoretical classes given by normal operation experts or specialist
- Application of theoretical learning by the use of the SOFIA engineering simulator
- Discussions and sharing of experiences

Content

Theoretical classes :

- Standard states, operating domains and OTS
- Normal operating rules
- Main automatic control channels
- Neutronics (parameters with impact on reactivity)
- Criticality
- T mode (EPR core control)

Applied training on the SOFIA simulator :

- Normal operation from state C (AN/RRA) to state B (AN/GV)
- Main automatic controls channels – House load
- Criticality strategy after reactor trip
- Core control in state A (reactor in power) and with T mode
- Pilotage en état A (RP) et mode T

Evaluation

- Learning outcomes assessment
- Assessment of trainees' satisfaction

OPERA EPR

Emergency operating procedures of an EPR reactor
Illustrated on different EPRs (OL3, FA3...).
EPR2 specificities not presented in the training.

Training path

Basics Safety applied to PWR design ▶ *SYSTEMA EPR* ▶ *PHYSICA EPR* ▶ ***OPERA EPR*** ▶ *ULTIMA*

Duration : 35 hours

Language : French, English

Participants : 10 to 12

Location : Paris

Level 3 Specialization

Prerequisite :
Advanced knowledge of PWR operation, safety, and systems

Contact:
formation.reacteurs@framatome.com

You are

An engineer or technician having already acquired a good experience of Pressurized water reactors (including systems and physics of accidents) and wishing to increase her/his knowledge of the post-accidental behavior of the EPR reactor
A design engineer, and/or a nuclear safety and/or radiation protection engineer, training instructor or operator

During the training, you will

- Study the State-Oriented Approach to post-accident operation
- Put knowledge into practice by performing post-accident operating procedures on the SOFIA engineering simulator

After the training, you will be able to

- Identify the principles of post-accident operation of an EPR reactor
- Analyze the different approaches used to control accident and crisis situations

Course strengths

- Classes given by Framatome specialists and/or experts
- Practical exercises on the SOFIA engineering simulator
- Sharing of experience
- Knowledge sharing

Content

Theoretical classes :

- Introduction to post-accidental operation
- Presentation of the generic principles of operation
- State diagnosis and strategies of operation
- Presentation of strategies of operation
- Design specificity of EPR impacting operation in incident and accident situations
- Computerized operation and Human-Machine Interfaces

Applied training on SOFIA simulator

Evaluation

- Learning assessment survey
- Assessment of trainees' satisfaction

PHYSICA EPR

Physics in accidental transients of an EPR reactor
Illustrated on different EPRs (OL3, FA3...).
EPR2 specificities not presented in the training.

Training path

Basics Safety applied to PWR design ▶ *SYSTEMA EPR* ▶ ***PHYSICA EPR*** ▶ *OPERA EPR* ▶ *ULTIMA*

Duration : 35 hours

Language : French, English

Participants : 8 to 12

Location : Paris

Level 2 Advanced

Prerequisite :
Knowledge of safety and main systems of an EPR reactor, basic knowledge of EDF Coding System (ECS)

Contact:
formation.reacteurs@framatome.com

You are

An engineer or technician having already acquired a good experience of PWRs and wishing to deepen her/his knowledge of physical phenomena inherent to accidental transients

Design engineer, and/or a nuclear safety and/or radiation protection engineer, training instructor or operator

Pendant la formation en ligne, vous allez

- Study physical phenomena and interactions between systems under abnormal or accident conditions
- Familiarize yourself with the dynamics of the EPR reactor

After the training, you will be able to

- Explain the dynamics and the interactions of the systems called upon during accidental transients of an EPR reactor

Course strengths

- Theoretical classes given by Framatome specialists
- Practical application of theoretical learning by the use of the SOFIA engineering simulator
- Discussions and sharing of experiencess

Content

Theoretical classes :

- Neutronic accidents
- Loss of Coolant Accidents
- Secondary accidents and Steam Generator Tube Rupture
- Physics of degraded situations / mitigating action
- Accidents during shutdown states
- Disruption of primary flows / Natural circulation
- Mass and Energy Released
- Severe accidents

Applied training on SOFIA simulator

Evaluation

- Learning assessment survey
- Assessment of trainees' satisfaction

SYSTEMA EPR

Systems, automatic control and protection means of an EPR.
Illustrated on different EPRs (OL3, FA3...). EPR2 specificities not presented in the training.

Training path

SYSTEMA EPR ▶ *ELECTRA EPR*
SYSTEMA EPR ▶ *PHYSICA EPR* ▶ *OPERA EPR* ▶ *ULTIMA*

Duration : 35 hours

Language : French, English

Participants : 8 to 12

Location : Paris

Level 2 Advanced

Prerequisite :

Basic knowledge of PWR operation

Contact:
formation.reacteurs@framatome.com

You are

Engineer or technician having a basic knowledge of PWR operation and wishing to acquire specific knowledge on systems, automatic control and protection means of an EPR.

During the training, you will

- Understand the functions, architecture and design of the main auxiliary and safeguard systems, and the automatic control and protection channels of Nuclear Steam Supply System (NSSS) of an EPR
- Study the operation of these systems, automatic control and protection channels during the normal, incidental and accidental conditions of an EPR

After the training, you will be able to

- Describe the functions, architecture and design principles of EPR auxiliary and safeguard systems, and their associated automatic control and protection channels
- Distinguish the different EPR operating conditions and describe the operation of systems, automatic control and protection means during these conditions

Course strengths

- Theoretical classes given by experts or specialist
- Application of theoretical learning by the use of the SOFIA engineering simulator
- Discussions and sharing of experiences

Contenu

Theoretical classes :

- Reactor Coolant System
- Main auxiliary systems
- Main NSSS automatic control channels
- Control mode T
- Main safeguard systems
- Main NSSS protections: design principles, protections of primary/secondary origin and core protections

Applied training on the SOFIA simulator :

- Normal operation from the normal shutdown in RIS-RA mode (AN/RRA) to the normal shutdown with Steam Generators (AN/GV)
- House load
- Load follow (T mode)
- Loss Of Coolant Accident (LOCA)
- Steam Generators Tubes Rupture (SGTR)

Evaluation

- Learning outcomes assessment
- Assessment of trainees' satisfaction

EPR Safeguard systems

Safeguard systems of an EPR.
Illustrated on different types of EPRs (OL3, FA3...). EPR2 specificities not presented in the training.

Duration : 14 hours

Language : French, English

Participants : 8 to 12

Location : Paris

Level 2 Advanced

Prerequisite :

Basic knowledge of PWR operation

Contact:
formation.reacteurs@framatome.com

You are

Engineer or technician having a basic knowledge of PWR operation and wishing to acquire specific knowledge on safeguard systems of an EPR.

During the training, you will

- Learn functions, architecture and design of the main fluid systems used for the accidental operation of an EPR
- Study the activation modes of these systems, based on examples of different accidental situations

After the training, you will be able to

- Describe the main EPR safeguard systems, their functions, architecture principles and major design choices (including main components and characteristics)
- Understand the overall operation of these safeguard systems combined with their associated protection channels

Course strengths

- Theoretical classes given by fluid systems experts or specialists
- Application of theoretical learning by the use of the SOFIA engineering simulator
- Discussions and sharing of experiences

Content

Theoretical classes :

- Introduction (including overall architecture of safeguard systems)
- Safety injection and residual heat removal system (RIS-RA)
- Steam Generators emergency feedwater (ASG)
- Safety boration (RBS)
- Pressurizer safety relief valves (RCP)
- Main steam safety valves and main steam isolation valves (VVP)
- Main steam relief train system (VDA)
- For each of these systems: presentation of the functions allocated to the system, its overall architecture, design (included main components) and associated operating modes.

Applied training on the SOFIA simulator :

- Activation modes of safeguard systems

Evaluation

- Learning outcomes assessment
- Assessment of trainees' satisfaction

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Main and Auxiliary Systems – 900-1300 MWe Pressurized Water Reactors (PWR) and EPRs

Auxiliary systems of the French PWR fleet and EPR.
Illustrated on 900 MWe and 1300 MWe technologies for French PWR fleet. EPR2 specificities not presented in the training.

Duration : 14 hours

Language : French, English

Participants : 8 to 12

Location : Paris

Level 2 Advanced

Prerequisite :

Basic knowledge of PWR operation

Contact:
formation.reacteurs@framatome.com

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Your are

Engineer or technician having a basic knowledge of PWR operation and wishing to acquire specific knowledge on the auxiliary systems of the French operating PWR fleet and EPR reactors.

During the training, you will

- Learn functions, architecture and design of the main fluid systems used for normal operation of the French PWR fleet and EPRs
- Study the automatic control modes of these systems, based on examples of different operating situations

After the training, you will be able to

- Describe the main auxiliary systems, their functions and architecture principles
- Describe the design of these auxiliary systems (including their main components) and the differences between the French PWR fleet and EPRs
- Understand the overall operation of these auxiliary systems combined with their automatic control means

Course strengths

- Theoretical classes given by fluid systems experts or specialists
- Application of theoretical learning by the use of the SOFIA engineering simulator
- Discussions and sharing of experiences

Content

Theorectical classes :

- Main Coolant System (RCP)
- Chemical and volumic control System (RCV)
- Residual heat removal system (RRA / RIS-RA)
- Component Cooling Water System and Essential Service Water System (RRI/SEC)
- Rod control system (RGL)
- Steam Generator normal feedwater (ARE)
- Heating, ventilation and air-conditioning (HVAC)
- For each of these systems: presentation of the functions allocated to the system, its overall architecture, design (included main components) and associated operating modes.

Applied training on the SOFIA simulator :

- Regulation modes of auxiliary systems

Evaluation

- Learning outcomes assessment
- Assessment of trainees' satisfaction

ULTIMA

Severe Accidents (SA)
Illustrated on 1300 MWe technology and EPR. EPR2 specificities not presented in the training.

Training path

Basics Safety applied to PWR design ▶ SYSTEMA ▶ PHYSICA ▶ OPERA ▶ ***ULTIMA***
Basics Safety applied to PWR design ▶ SYSTEMA EPR ▶ PHYSICA EPR ▶ OPERA EPR ▶ ***ULTIMA***

Duration : 21 hours

Language : French, English

Participants : 10 to 15

Location : Paris

Level 3 Specialization

Prerequisite :

Advanced knowledge of PWR operation, safety and systems

Contact:
formation.reacteurs@framatome.com

You are

An engineer having an advanced knowledge of Pressurized Water Reactor (PWR) operation, safety and systems, and wishing to acquire specific knowledge on Severe Accidents (SA), their phenomenology, mitigation means and emergency operation strategies

During the training, you will

- Study the physical phenomena related to the fusion of a nuclear reactor core
- Evaluate the different means and actions performed during a SA to mitigate its consequences
- Understand the human organization implemented to manage a SA situation

After the training, you will be able to

- Describe the SA phenomenology in case of in-vessel or ex-vessel fusion core events
- List the different means used for the SA mitigation
- Identify the objectives of emergency operation strategies applied during situations with core damages
- Explain the origin and the evolutions of emergency operation strategies as proposed in the SA Intervention Guide

Course strengths

- Theoretical classes given by SA experts or specialist
- Tour of Framatome crisis center
- Discussions and sharing of experiences

Content

Theoretical classes :

- Introduction: SA competencies within Framatome
- SA safety approach
- SA physics – First part: in-vessel phenomena
- Presentation of the Three Miles Island (TMI) accident
- SA physics – Second part: ex-vessel phenomena
- Presentation of the Chernobyl accident
- SA mitigation systems
- Presentation of the Fukushima accident
- Level 2 Probabilistic Safety Analyses (PSA) and their application
- SA emergency operation strategies, human organization and SA Intervention Guide

Tour of the Framatome crisis center

Evaluation

- Learning outcomes assessment
- Assessment of trainees' satisfaction

Mechanical

1. RCC-M code overview
2. An introduction to the RCC-M code
3. An introduction to the RCCMRx code
4. Pressurized Water Reactor (PWR) Materials : The Fundamentals
5. Pressurized Water Reactor Materials : Application to components
6. Damage Sequences
7. Valves as per RCC-M 2018
8. Seismic and Dynamic Analysis

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RCC-M[1] code overview

Duration : 1 hour 30 minutes

Language : English

Participants : unlimited

Location : e-learning

Level 1 Fundamentals

Prerequisite : None

Contact:
formation.reacteurs@framatome.com

You are

- An engineer or a technician working on mechanical components of the nuclear island.
- Managers and sales engineers wishing to gain a better understanding of the architecture of the RCC-M code

During the e-training, you will

- Be introduced to the structure of the RCC-M code and the links between its different sections

After the training, you will be able to

- Understand the orientations, the logic and the general philosophy of parts of the code and the general guidelines of the different areas covered.
- Search for information in the RCC-M code
- Follow our full-scale 'Introduction to the RCC-M code' training

Course strengths

- All Materials developed and presented by a professional trainer, specialist of the RCC-M code
- Flexibility due to long term playable materials (2 months minimum)

Content

- Introduction of AFCEN[2] organization
- Quality management
- Design and failure modes
- Materials and procurement
- Manufacturing, welding and control methods
- Comparison between RCC-M and BPVC[3] of ASME[4]

Evaluation

- Learning assessment survey
- Assessment of trainees' satisfaction

[1] Design and Construction Rules for Mechanical Components of Pressurized Water Reactor Nuclear Islands

[2] International association
[3] Boiler & Pressure Vessel Code
[4] American society of Mechanical Engineers

An introduction to the RCC-M[1] code

Duration : 27,5 hours

Language : French, English

Participants : 12 to 15

Location : Lyon, Paris or at the customer's request

Level 1 Fundamentals

Prerequisite : None

Contact:
formation.reacteurs@framatome.com

You are

- An engineer or a technician working on mechanical components of the nuclear island
- A manager or sales engineer wishing to gain a better understanding of the architecture of the RCC-M code

During the training, you will

- Study the different chapters of the RCC-M code and understand how it is organized

After the training, you will be able to

- Define the main objectives of the RCC-M code, describe the structure of the code and its organization
- Describe the AFCEN[2] activities and development methods for the RCC-M code
- Navigate through the code to identify the parts that are useful to your business
- Identify the specifications of the RCC-M in relation to other building codes and applicable regulations

Course strengths

- Involvement of specialists and experts
- Illustrations based on examples and exercises
- Discussions and sharing of experiences
- AFCEN certified training

Content

- Introduction and general points
- Design and analysis methods
- Materials and procurement
- Manufacturing and welding
- Methods of control
- Link between RCC-M and European regulations and standards
- Comparison between the RCC-M / ASME[3] BPVC (and other codes)
- Quality management system
- Update and application of the code

Evaluation

- Learning assessment survey
- Assessment of trainees' satisfaction

[1] Design and Construction Rules for Mechanical Components of Pressurized Water Reactor Nuclear Islands

[2] International association

[3] American society of Mechanical Engineers

[4] Boiler & Pressure Vessel Code

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An introduction to the RCCx-M[1] code

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Duration : 21 hours

Language : French, English

Participants : 12 to 15

Location : At the customer's request

Level 1 Fundamentals

Prerequisite : None

Contact:
formation.reacteurs@framatome.com

You are

- An engineer or a technician working on mechanical equipment and experimental devices used in research reactors
- A manager or sales engineer wishing to gain a better understanding of how the RCC-MRx code is used

During the e-training, you will

- Study the different chapters of the RCC-MRx code and understand how it is organized

After the training, you will be able to

- Explain the origins of the RCC-MRx code
- Describe the organization and the different sections of the code
- Describe the interlocking of rules, connections with equipment specifications, and the procedures for application
- Navigate through the code to find the requirement you are looking for

Course strengths

- Involvement of specialists and experts
- Illustrations based on examples and exercises
- Discussions and sharing of experiences
- AFCEN[2] certified training

Content

- Introduction and general points
- Link between safety class and requirement levels of the code
- Design and analysis (including piping & supports)
- Materials & Procurement
- Manufacturing & Welding
- Methods of inspection
- Practical use of the code and difficulties encountered

Evaluation

- Learning assessment survey
- Assessment of trainees' satisfaction

[1] Design and Construction Rules for mechanical components of nuclear installations: high-temperature, research and fusion reactors

[2] International association

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Pressurized Water Reactor (PWR) Materials : The Fundamentals

Training path

PWR Materials: Fundamentals ▶ *PWR Materials: Application to Components*

Duration : 14 hours

Language : French, English (teaching materials in English)

Participants : 10 to 15

Location : Lyon, Paris or at the customer's request

Level 1 Fundamental

Prerequisite :

Basic knowledge of mechanics and materials science

Contact:
formation.reacteurs@framatome.com

You are

Design engineer or technician, Business engineer, materials engineer or inspector with knowledge of mechanics or materials science wishing to understand the choices of materials used for the design of primary and auxiliary circuits by identifying constraints:

- mechanical behavior
- damaging
- manufacturing techniques
- testing techniques used

During the training, you will

- Study the parameters that influence the microstructure of materials and their properties
- Discover the various metallurgical defects that can affect the behavior of the material
- Discover the general mechanisms of degradation of materials in service

After the training, you will be able to

- Distinguish the different structures and mechanical properties of materials
- Explain manufacturing techniques of primary and auxiliary circuits equipment on PWR
- Explain the damage phenomena of materials used in the manufacture of equipment
- Understand the meaning of mechanical testing

Course strengths

- Involvement of Framatome specialists
- Illustration by concrete cases
- Sharing the French and international REX

Content

- The basics of steels and nickel-based alloys metallurgy
- Methods of preparation of Materials used in PWR
- Interaction of manufacturing processes on mechanical properties
- Mechanical tests for material characterization
- Defects induced by production and manufacturing processes
- General principles of material degradation induced by operating conditions

Evaluation

- Learning assessment survey
- Assessment of trainees' satisfaction

Pressurized Water Reactor (PWR) Materials : Application to components

Training path

PWR Materials: Fundamentals ▶ ***PWR Materials: Application to Components***

NEW

Duration : 14 hours

Language : French, English (support in English)

Participants : 10 to 15

Location : Lyon, Paris or at the customer's request

Level 2 Fundamental

Prerequisite :
Basic knowledge of mechanics;
Knowledge of metallurgy, "PWR Materials: Fundamentals" training or equivalent

Contact:
formation.reacteurs@framatome.com

You are

Engineer or technician with mechanical knowledge who wants to understand the choice of materials used for the design of primary and auxiliary circuits by identifying constraints:

- mechanical behavior
- damaging
- of manufacturing techniques
- the testing techniques used

During the training, you will

- Study all components of primary and auxiliary circuits from a metallurgical point of view
- Assess the design choices made considering technical constraints, thermal, mechanical and environmental stresses
- Discover feedback on the use of materials based on practical cases

After the training, you will be able to

- Identify the main phenomena of material damage on the main components of nuclear installations of PWR type
- Justify the choice of material grades adapted to the equipment

Course strengths

- Involvement of Framatome specialists
- Illustration by concrete cases
- Sharing the French and international REX

Content

- The materials of the reactor pressure vessel (RPV)
- The materials of the RPV internals
- Materials of the pipes of the primary circuit
- Materials of steam generators
- Materials of the auxiliary circuits
- Corrosion of Nickel-based Alloys
- Materials of the bolting

Evaluation

- Learning assessment survey
- Assessment of trainees' satisfaction

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Damage Sequences

Duration : 17.5 hours

Language : French, English

Participants :10 to 15

Location : At the customer's request

Level 2 Advanced

Prerequisite :
Basic knowledge in mechanics

Contact:
formation.reacteurs@framatome.com

You are

- Mechanical engineer working in any specialist domain linked to analyses of structures based on design, repair, manufacturing follow-up or metallurgical expertise activity on new or in-service mechanical equipment for which the RCC-M, RCC-MRx or BPVC code is applicable
- Architect or Technical Manager of equipment subject to the RCC-M, RCC-MRx or ASME BPVC

During the training, you will

- Detail all of the possible phenomena leading to failure of mechanical equipment of a nuclear power plant

After the training, you will be able to

- Distinguish the different damage sequences of equipment
- Recognize logical links between the physical phenomena, their representation and the design rules used

Course strengths

- Theoretical learning with illustrations based on examples from the nuclear industry
- Sharing of experiences with specialists

Content

- Introduction to failure modes
- Excessive deformation and plastic instability
- Wear/corrosion synergy
- Buckling
- Fatigue
- Non-mechanical failure modes
- Progressive deformation
- Effects of high temperatures
- Harmfulness of defects

Evaluation

- Learning assessment survey
- Assessment of trainees' satisfaction

Valves-as per RCC-M[1]

Duration : 20 hours

Language : French, English

Participants : 10 to 15

Location : At the customer's request

Level 2 Advanced

Prerequisite :

- Regular use of the RCC-M code

or

- AFCEN certificate of completion of an Introduction to RCC-M code training (or equivalent)

or

- results >80% e-learning "RCC-M overview

Diploma in mechanics recommended

Contact:
formation.reacteurs@framatome.com

You are

- Engineer or mechanical technician involved in the design and/or manufacture of the valves on the nuclear island

During the training, you will

- Detail all of the steps involved in the design and manufacturing of a valve as per the RCC-M code

After the training, you will be able to

- List valves technologies in a PWR
- Define, in the RCC-M code, the elements applicable to the valves
- Apply design, manufacturing and control requirements to valves according to RCC-M
- Identify the specificities of the RCC-M concerning valves compared to other building codes and regulations in place

Course strengths

- Theoretical learning illustrated based on examples from the nuclear industry
- Sharing of experience with specialists
- French association for design, construction and in-operation supervision rules for nuclear island component (AFCEN) certified training
- Training leading to certification

Content

- Valve technologies and location in a PWR
- Design/sizing
- Materials
- Welding, Manufacturing, Hydrostatic tests
- ESPN Component classification
- Link to RPP4[2] Mechanical Qualification
- Hardfacing
- RCC-M/BPVC[3] of ASME[4] comparison
- Practical Case Studies

Evaluation

- Learning assessment survey
- Assessment of trainees' satisfaction

[1] Design and Construction Rules for Mechanical Components of Pressurized Water Reactor Nuclear Islands

[2] Probationary Phase Rules
[3] Boiler & Pressure Vessel Code
[4] American society of Mechanical Engineers

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CENTRE DE FORMATION REACTEURS
FRAMATOME ACADEMY

Seismic and Dynamic Analysis

NEW

Durée : 25 hours

Langue : French, English

Participants : 10 to 15

Lieu :
- At the customer's request (note : Technical Center visit excluded)
Or to partake in a Framatome Technical Center visit :
- Le Creusot (France) or
- Erlangen (Germany)

Level 2 Advanced

Prérequis :
Knowledge of mechanical analyses
Experience in numerical calculations preferred

Contact :

formation.reacteurs@framatome.com

You are

- An experienced or beginner-level computation engineer who wants to perform dynamic or seismic analyses in the nuclear industry

During the training, you will

- Learn or re-visit the theory of dynamic and seismic analysis with a focus on the nuclear industry
- Practice on simple case studies
- Discover experimental methods

After the training, you will be able to

- Identify the dynamic phenomena that take place in EPRs
- Perform linear and nonlinear dynamic analyses

Course strengths

- Practical training given by experienced Framatome experts
- Numerical "hands-on" sessions with industrial tools (SAT, ANSYS)
- Experimental "hands-on" learning in one of our Framatome Technical facilities
- Wide range of examples from the nuclear industry

Content

- Introduction to dynamic physical phenomena in a nuclear power plant
- Basics of dynamic analysis (theory + hands-on learning)
- Experimental determination of Eigen Shapes / Eigen Frequency (hands-on session Numerical representation of the loads and responses (theory + hands-on learning)
- Modeling of mechanical systems (theory + practical examples)
- Methods and tools for linear dynamic analysis (theory + hands-on learning)
- Methods and tools for non-linear dynamic analysis (theory + practical examples)

Evaluation

- Learning assessment survey
- Assessment of trainees' satisfaction

Instrumentation & Contrôle

1. EPR Nuclear instrumentation

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EPR Nuclear instrumentation

Duration : 28 hours

Language : French, English

Participants : 10 to 15

Location : At the customer's request

Level 2 Advanced

Prerequisite :
Knowledge of basic PWR (Pressurized Water Reactor) operation

Contact:
formation.reacteurs@framatome.com

You are

- Project Manager, Technical Pilot, Sales Engineer or I&C Project Manager
- Design engineer: in control (architecture studies, system design, etc.) but also in systems, processes or safety
- Engineer or technicians in charge of interventions: tests, intervention manager

During the training, you will

- Discover how In-core Instrumentation System (RIC), Nuclear Instrumentation System (RPN), Boron Concentration Measurement System (BCMS) and Full-length Rod Control System (RGL) take part in the surveillance and control of the EPR reactor core
- Gain a broad understanding of the commissioning tests, periodic tests and maintenance to be carried out

After the training, you will be able to

- Define the functional role of each system in the process
- Describe the different sub-assemblies of nuclear instrumentation from a hardware point of view
- Define the main steps of commissioning and maintenance
- Integrate material and functional feedback

Course strengths

- Sharing of experiences with training instructors involved in the design, commissioning and system maintenance

Content

- Nuclear instrumentation needs
- The mechanical architecture of the RIC
- Aeroballs Measurement System Study (AMS)
- Study of the Self Powered Neutron Detectors (SPND) system
- Study of the Core Outlet Thermocouples system
- Study of the Reactor Pressure Vessel (RPV) system
- Study of the excore RPN system and reactivity meter
- Study of the BCMS
- Study of the RGL system

Evaluation

- Learning assessment survey
- Assessment of trainees' satisfaction

Specialization

1. Nuclear Safety Culture Fundamentals
2. Basic of nuclear safety applied to Pressurized Water Reactor design
3. Introduction to ISO 19443 Safety Culture and CFSI
4. ISO 19443 Impacts on processes

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Nuclear Safety Culture Fundamentals

Duration : : 4 hours

Language : French, English

Participants : 8 to 15

Location : At the customer's request

Level 1 Fundamentals

Prerequisite : None

Contact:
formation.reacteurs@framatome.com

You are

- An engineer, a technician, a manager, or anyone beginning in the nuclear industry and eager to discover and understand the essential stakes of this domain

During the training, you will

- Learn what is meant by "Nuclear Safety Culture"
- Understand how to implement a "Nuclear Safety Culture" in your company
- Explore Reliability tools and practices
- Discover through real cases the impact of failures to comply with nuclear safety culture

After the training, you will be able to

- Explain the difference between nuclear safety and nuclear safety culture
- List the 3 pillars of nuclear safety culture development
- Describe the fundamental behaviors to be adopted by each individual
- Illustrate, with real life examples, the consequences of failures to comply with nuclear safety culture

Course strengths

- Interactive pedagogy based on experience sharing and illustrative videos

Content

- Experience feedback from the Chernobyl nuclear accident
- Introduction to Nuclear Safety Culture
- WANO 10 principles for a robust Nuclear Safety Culture
- Experience feedback on Davis BESSE nuclear incident
- Mechanisms on the collapse of a Nuclear Safety Culture
- Experience feedback from the Tokaï Mura nuclear accident

Evaluation

- Learning assessment survey
- Assessment of trainees' satisfaction

Basics on safety principles applied to Pressurized Water Reactor (PWR) design

Safety principles, studies and requirements applied on the PWR design.
Illustrated on EPR reactor and in a context of French regulation

Duration : 14 hours

Language : French, English

Participants : 10 to 15

Location : At the customer's request

Level 1 Fundamentals

Prerequisite :

Basic knowledge of PWR operation

Contact:
formation.reacteurs@framatome.com

Revision 15 january 2024

You are

An engineer or technician contributing to PWR design or modification studies or in charge of an activity related to PWR safety.

During the training, you will

- Learn the PWR design principles according to the safety regulatory context
- Get an overall view of the different types of events that have an impact on installation safety and of the demonstration of the plant's robustness towards these events
- Understand the interfaces and links between the safety analyses, the design studies and the rules for safe operation

After the training, you will be able to

- Identify the main regulatory texts that are applicable to design safety
- Apply the safety principles in the design, such as the in-depth defense
- Define the scope of safety analyses in terms of postulated events
- List the objectives of safety demonstration (including the studies criteria according to the type of events) and explain the interfaces and links between the different safety studies
- Make a synthetic diagram illustrating the interfaces and links between the safety analyses and the design requirements on Structures, Systems and Components (SSC)
- Illustrate with examples the interfaces and links between safety studies and Operating Technical Specifications (OTS)
- Define the benefits of the probabilistic safety approach, compared to the determinist approach

Course strengths

- Theoretical classes given by safety experts or specialists
- Illustration with examples and exercises
- Discussions and sharing of experiences

Content

- Regulatory context
- Objectives and principles of safety for design
- Events postulated for the design (accidents, internal and external hazards, practical elimination)
- Safety demonstrations for the different types of events
- Safety requirements applied to SSC (categorization, classification and related requirements) and System Engineering (SE) approach for requirements management
- Interfaces between design, safety and operation
- Probabilistic Safety Analyses (PSA)

Evaluation

- Learning outcomes assessment
- Assessment of trainees' satisfaction

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REACTORS TRAINING CENTER
FRAMATOME ACADEMY

Introduction to ISO 19443 Safety Culture and CFSI[1]

Duration : 7 hours

Language : English, French

Participants : 15 maximum

Location : At customer's request

Level 1 Fundamentals

Prerequisite : None

Contact:
formation.reacteurs@framatome.com

You are

- Nuclear energy sector supplier

During the training, you will

- Discover the origins of ISO 19443 and the impacts on your process
- Discover the safety culture
- Understand how to implement safety culture and CFSI countermeasures
- Learn about real cases of fraud and safety culture issues

After the training, you will be able to

- Explain the origins of ISO 19443
- List a minimum of 3 nuclear specific themes of ISO 19443
- Define at which level within the company the nuclear safety is necessary
- Explain the individual engagements necessary to implement a safety culture
- Define CFSI
- Explain the precursors of a CFSI occurrence
- Explain the differences between an equipment fabricated under ISO 9001 and the same equipment fabricated under ISO 19443
- Evaluate the impacts of ITNS2 requirements on a project organization

Course strengths

- Interactive learning based on experience sharing, exercises and illustrative videos

Content

- Introduction to nuclear reactor specificities and main characteristics of nuclear energy
- Introduction to ISO 19443, context, stakes, structure
- Experience feedback from the accident at Tchernobyl
- Introduction to nuclear safety
- The 10 principles for a robust nuclear safety culture
- Experience feedback from the incident at Davis BESSE
- Mechanisms that trigger the collapse of Nuclear Safety
- Experience feedback from the accident of Tokaï-Mura
- Principles regarding the fight against Counterfeit and Fraudulent Items
- Impacts of ISO 19443 on the processes
- The implications of an ITNS activity

Evaluation

- Learning assessment survey
- Assessment of trainees' satisfaction

[1] Counterfeit, fraudulent and Suspect Items [2] Important to nuclear safety

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REACTORS TRAINING CENTER
FRAMATOME ACADEMY

ISO 19443:2018
Impacts on processes

Duration : 14 hours

Language : English, French

Participants : 15 maximum

Location : At the customer's request

Level 2 Advanced

Prerequisite :
Use of ISO 9001:2015
Knowledge of ISO 19443:2018

Contact:
formation.reacteurs@framatome.com

You are

A nuclear energy sector supplier, in charge of :

- Strategic decisions
- Quality requirement deployment
- Project management of ITNS[1] products or services
- On-site activity management

During the training, you will

- Understand the ISO 19443 specificities: CFSI[2], graduated approach, safety culture, lessons learned and safety organization
- Evaluate the impacts on your quality management system
- Share good practices with other nuclear energy sector suppliers

After the training, you will be able to

- Translate the links between ISO 19443 requirements and safety stakes
- Identify audit topics specific to ISO 19443
- Implement improvements in your practices and concrete ideas to deploy ISO 19443 in your daily activity
- Improve your quality management system

Course strengths

- Course provided by Framatome auditors in charge of supplier qualification
- Animation of the training following a Framatome Audit Plan
- Interactive learning based on experience sharing
- Case studies

Content

- Introduction to ISO 19443, context, stakes, structure
- Presentation of nuclear context (safety)
- Leadership, management & organization
- Quality Management System
- Documentation management
- Human resources
- Project Management / Order Review
- Design & Development
- Supply Chain
- Manufacturing / site activities
- Purchasing and sub-contracting
- Performance evaluation and improvement

Evaluation

- Learning assessment survey
- Assessment of trainees' satisfaction

[1] Important To Nuclear Safety [2] Counterfeit, Fraudulent and Suspect Items

General terms and conditions for the supply of training services

GENERAL TERMS AND CONDITIONS FOR THE SUPPLY OF TRAINING SERVICES

These General Terms and Conditions (also referred to as "GTC") set out the terms and conditions for the supply by Framatome or one of its Affiliates as mentioned in the Contract (hereinafter the "Supplier"), to the purchaser (hereinafter the "Purchaser") of training services for the Purchaser's employees (hereinafter the "Services").

The Purchaser acknowledges that it has read these GTC and has a thorough understanding thereof.
The Supplier and the Purchaser are referred hereinafter to as the "Party" or collectively as the "Parties".

ARTICLE 1 - DEFINITIONS

The following terms beginning with a capital letter whether in the singular or in the plural shall have the meaning given to them below, unless it is specifically stated otherwise in these GTC or in the Contract :

Affiliate : shall mean any current or future company controlling Framatome or in which Framatome directly or indirectly holds or will hold a controlling interest in accordance with articles L.233-1 to L.233- 3-1 of the French Commercial Code.

Contract: shall all contractual documents of any kind, whether administrative or technical, general or specific, relating to the performance of the Services. The Contract is concluded between the Supplier and the Purchaser under these GTC. The Contract may be referred to as "Order" or "Agreement" or any other term agreed upon between the Parties.

Day : shall mean calendar day.

Purchaser: shall mean the legal entity concluding a Contract with the Supplier for the supply of Services.

Unless otherwise specified in the specific conditions, the Contract comprises the following documents in the following order of priority :

1. The specific conditions and any other document appended to the Contract or mentioned by the latter or its appendices
2. The Supplier's Ethics Commitments
3. The Supplier's technical specifications
4. These GTC
5. The proposal made by the Supplier to the Purchaser

The general terms and conditions of purchase of the Purchaser are not applicable to the Contract.

ARTICLE 2 - CONTRACT FORMATION

2.1. Unless otherwise agreed between the Parties, the Contract shall enter into force at the date of signature of its acknowledgement of receipt by the Supplier, or at the date of signature of the Contract by the Parties, if any.

2.2. The Contract may also be accepted by the Supplier, by sending an acknowledgement of receipt (by mail, email or fax) to the Purchaser, within fifteen (15) Days of receipt of the Contract. If the Purchaser does not receive the duly signed acknowledgement within the above deadline, (the Contract shall be deemed to have been refused by the Supplier.

2.3. The acceptance of the Contract by the Supplier constitute the complete and final agreement between the Supplier and the Purchaser. However, in the event that the Supplier expresses reservations in the acknowledgement of receipt of the Contract, the latter is concluded only when the Purchaser accepts in writing the reservations issued by the Supplier or when the Purchaser and the Supplier agree in writing on such reservations. The Parties agree that, if supposing that the reservations remain unanswered by the Purchaser within fifteen (15) Days of the sending by the Supplier of the acknowledgement of receipt with reservations,
the Purchaser is deemed to have fully accepted the reservations and the Contract is deemed formed.
verbale.

2.4. All the proposals of the Supplier's proposal are made in writing. The Supplier cannot be bound by a proposal made orally.

2.5. Unless otherwise stipulated in the proposal, or otherwise agreed in writing by the Supplier, the validity period of the proposal is limited to sixty (60) Days from the sending date of the proposal. Beyond this period, the Supplier is no longer bound by its proposal or is entitled to refuse the Contract or to change the terms and conditions of the proposal and/or the Contract.

2.6. Reservations made by the Purchaser on these GTCs shall apply only if and when expressly accepted by the Supplier in writing.

ARTICLE 3 - CHANGES

3.1. During the performance of the Contract, any modifications or changes of the Contract shall be subject to prior written approval of both Parties. In no case the Supplier shall have the obligation to implement changes or modifications requested by the Purchaser without a prior written agreement of the Parties.

3.2. The Parties expressly agree to derogate from the provisions of article 1195 of the French Civil code and agree that if, due to an unforeseen change in circumstances at the date of signature of the Contract, its contractual balance is seriously compromised and the legitimate interests of one of the Parties are seriously prejudiced, then the Parties shall meet at the request of that Party in order to restore the original balance of the Contract by an amendment to the Contract, within maximum sixty (60) Days from the date of the affected Party's request.
If the negotiation fails within the above deadline, the Parties may agree to terminate the Contract, and on the associated conditions to be agreed upon.

3.3. Notwithstanding the provisions of Article 3.2, the terms and conditions of the Contract are based on laws and/or regulations, including but not limited to codes, standards and safety regulations, and/or their

interpretation by the relevant authorities, in force at the date of the Supplier's proposal.

As a result, in case of changes in laws and/or regulations, including but not limited to codes, standards and safety regulations, and/or their interpretation by the relevant authorities, i after the date of the proposal and/or during the performance of the Contract, which affects the contractual provisions of the proposal and/or the Contract and/or the performance of Supplier 's obligations, th the Parties shall agree on the changes to be made in the contractual conditions affected - including price and time schedule - by reviewing the proposal and/or the Contract.

ARTICLE 4 - TIME SCHEDULE - POSTPONEMENT - CANCELLATION

4.1. The time schedule shall be stipulated in the Contract.

4.2. The time schedule can only be observed by the Supplier if the Purchaser has fulfilled its own obligations in time (such as, but not limited to supply of all documents or information necessary for the performance of the Contract, payment obligations).

4.3. The time schedule shall be automatically extended in the event of a delay not directly attributable to the Supplier and/or in the case of a Force Majeure event.

4.4. Unless otherwise stipulated in the Contract, a delay attributable to the Supplier does not constitute a substantial breach giving right to termination of the Contract.

4.5. If the Supplier fails to comply with the final performance deadline for reasons directly attributable to it, and if the Contract expressly provides it, the Supplier will be likely to be subject to payment of fully liquidated damages as provided for in the specific conditions of the Contract. Failing that, the Purchaser, after a grace period of two (2) weeks, may claim a compensation of 0.1% of the amount, excluding tax, of the item affected by the delay, for every completed week of delay. The Purchaser previously informs the Supplier in writing and sends him a request of payment corresponding to the compensation. In any event, these liquidated damages are capped at a maximum amount of three percent (3 %) of the amount, excluding tax, of the item affected by the delay and in any event to an overall and cumulative amount of three percent (3%) of the amount, excluding tax, of the Contract at the date of signature.

The payment of this compensation shall constitute the sole and exclusive remedy of the Purchaser and the exclusive liability of the Supplier for claims arising fom the delay. Beyond the amounts set out above, the Purchaser waives any and all rights to claim any additional compensation for damages resulting from delay.

4.6. Any postponement by the Purchaser shall be notified at least ten (10) working days before the start of the session. Otherwise, a compensation of ten percent (10%) of the price of the session concerned may be charged by the Supplier.

4.7. In the event of cancellation of a session by the Purchaser within fifteen (15) working days before the first day of the session, a compensation equal to thirty percent (30%) of the price of the session concerned shall be due to the Supplier by the Purchaser In the event of cancellation of a session by the Purchaser within four (4) working days before to the first day of the session, a compensation equal to seventy percent (70%) of the price of the session concerned shall be due to the Supplier by the Purchaser.

4.8. These compensations shall be paid in accordance with the provisions of Article 5.2.

4.9. The Supplier reserves the right to postpone and/or cancel a session if the minimum number of trainees is not reached.

The Supplier reserves the right to postpone one (1) or more sessions subject to notifying the Purchaser of the postponement at least fifteen (15) working days before the first day of the session. No compensation may be claimed to the Supplier as a result of such a postponement or cancellation.

ARTICLE 5 - PRIX - PAIEMENTS

5.1. Prices

Unless otherwise agreed by the Parties, the price of the Contract is expressed in EUROS and is exclusive of all taxes. Unless otherwise stipulated, and without prejudice to the provisions of Article 3, the price is firm and not adjustable.5.2. Payment

5.2.1. Invoices sent by the Supplier to the Purchaser shall be paid no later than thirty (30) Days from the date of invoicing, by bank transfer.

5.2.2. An advance of a minimum amount of ten percent (10 %) of the Contract price shall be paid to the Supplier, by bank transfer, within thirty (30) Days following the date of signature of the Contract. The Supplier reserves the right to request a payment guarantee from the Purchaser in the form of a first-demand bank guarantee issued by a leading bank in favor of the Supplier in accordance with the form proposed by the Supplier. In this case, the issuance of this payment guarantee will be one of the conditions of effectiveness of the Contract

5.2.3. A payment schedule shall be defined in each Contract. Regardless of the payment schedule, one hundred percent (100%) of the Services shall be paid no later than the date of completion of the Services.

5.2.4. Payments must be made without deduction of any kind. Claims by the Purchaser may not, under any circumstances, result in postponement, reduction or suspension of payments.

Any conventional or legal offsetting of the amounts due

by the Purchaser with payments due by the Supplier in respect of the Contract or any other contract between the Parties is excluded.

5.2.5. The Supplier may suspend at any time the performance of its contractual obligations under the Contract in the event of non-payment of one or more invoices by the Purchaser within the due date provided for in Article 5.2.1 without prejudice to the compensation provided for in favor of the Supplier in Article 15 If the aforesaid delay in payment exceeds forty-five (45) Days after the due date provided for in Article 5.2.1, the Supplier may terminate the Contract without prejudice to its right to be compensated for the consequences of such termination.

5.2.6. In addition, in the event of a delay in the payment by the Purchaser, interest shall be automatically applied as soon as a payment is not made within the time schedule set forth in Article 5.2.1 and without notice from the Supplier. The late payment interest rate applicable on the first Day of delay is equal to the interest rate applied by the European Central Bank (REPO rate: http://www.ecb.int/stats/monetary/rates/html/index. en.html) to its most recent refinancing operation, since it is specified that if this interest rate is negative, this rate will be deemed to be equal to (0), plus ten (10) percentage points. These late payment interests shall be paid quarterly by bank transfer thirty (30) Days from the invoicing date.

The Purchaser shall also be charged a set fee for recovery costs, the amount of which is set by decree. If by way of exception the said recovery costs incurred by the Supplier were to be higher than the aforementioned amount, the latter may ask the Purchaser for additional compensation provided that the Supplier hands over to the Buyer due evidence.

5.3 Taxes

Unless otherwise agreed by the Parties, the price mentioned is exclusive of all taxes, customs duties, export duties, fees or withholding tax applicable to the Contract and/or Services provided by the Supplier, its subcontractors, its suppliers and their respective employees.

All taxes, duties and fees which may be levied in connection with the Contract, as well as its execution shall be borne by the Purchaser.

ARTICLE 6 - PURCHASER'S OBLIGATIONS

6.1. The Purchaser shall provide in due time, to the Supplier, any information, plans, documents, authorizations, approvals, instructions or any information other than those expressly provided by the Supplier under the Contract, as necessary for performing the Contract.

6.2. All services, supplies, equipment, studies not expressly stipulated in the Contract are excluded from the contractual obligations of the Supplier and shall be under the responsibility of the Purchaser.

ARTICLE 7 - ACCEPTANCE

Not applicable.

ARTICLE 8 - TTRANSFER OF RISK - RETENTION OF TITLE

Not applicable.

ARTICLE 9 - GARANTIE

The Supplier warrants that the Services shall be performed by qualified personnel. The Supplier provides no warranties other than those expressly stipulated in this Article 9.

ARTICLE 10 - RESPONSABILITÉ

10.1. Under no circumstances shall the Supplier be held liable to the Purchaser for any error in the Services resulting from a defect or mistake in the plans, documents, information provided to the Supplier, and that the Supplier could not reasonably have been able to detect In no event and under no circumstances shall the Supplier be held liable to the Purchaser and/or to any third party for the use or misuse of the Services, or for any damage or loss resulting for the use of any Services and the consequences of any damage that could result therefrom (such as personal, property loss or damage, loss of profit, loss of production, loss of opportunity, loss of data, or any special, indirect, incidental and consequential damages, whether or not resulting from a nuclear incident with the meaning of the Paris Convention of 29 July 1960).

The Purchaser and its insurers shall hold harmless and indemnify the Supplier for all, claims or recourse of any kind, which would be brought against the Supplier, its employees, agents or subcontractors, by any third party as a result of the Services.

10.2. The total cumulative liability of the Supplier under the Contract shall in no case exceed ten thousand euro (10,000 euro). In no event and under no circumstances, whether based on contract, tort or strict liability or otherwise, shall the Supplier be liable to the Purchaser for any loss of profit, loss of production, loss of opportunity, loss of data or any special, indirect, incidental and consequential damages.

The Purchaser and its insurers waive any recourse against the Supplier and its insurers for any amount exceeding the above mentioned limits.

10.3. In any event, to the maximum extent permitted by law, the liability of the Supplier ends (12) months from the date of the last day of the training performed under the Contract.

ARTICLE 11 - INSURANCES

The Parties undertake to subscribe and maintain the necessary insurance policies, for a sufficient amount, to cover all risks and liabilities related to or arising from the performance of the Contract.

ARTICLE 12 - CONFIDENTIALITY

Refer to Article 13.

ARTICLE 13 - INTELLECTUAL PROPERTY - CONFIDENTIALITY

13.1. Documents, data and information of any kind on whatever support, directly or indirectly disclosed by the Supplier to the Purchaser or that may become known by the Purchaser in the course of the performance of the Contract (hereinafter «Information») remain the property of the Supplier, unless otherwise agreed in the Contract.

All Information must be considered by the Purchaser, its employees and agents to be strictly confidential and shall only be disclosed by the Purchaser to its employees and agents on a strict need to know basis for the purpose of the Contract. The Information shall not be disclosed to any other person without the prior express consent of the Supplier. This obligation of confidentiality will survive the termination and expiration of the Contract and will last until the Information falls into the public domain without fault of the Purchaser.

13.2. The Purchaser undertakes to use the Information for the purpose the Contract only. The Purchaser shall not copy, reproduce, modify, translate, adapt, nor sublicense to any third party, all or part of the Information.

13.3. The Purchaser undertakes, and causes its employee, its agents, and/or any person that may have access to the Information as described in Article 13.1, to comply with the obligations of this Article.

3.4. As soon as one of the Parties is aware of the possible infringement of third party's intellectual property rights through the performance of the Contract, or at the first claim by a third party against the Supplier or against the Purchaser alleging an infringement of its intellectual property rights, the Parties will share the information and records that may defeat that claim or action.

ARTICLE 14 - FORCE MAJEURE

14.1. Force Majeure event shall mean war (whether declared or not), terrorist attack, embargo, cancellation, suspension, non-renewal of licenses as required by the competent authorities, act of the government or competent authorities, serious fire and flood, tsunami, typhoon or earthquake, epidemic or pandemic or quarantine restriction, and any unforeseeable, unavoidable and insurmountable event which is beyond the control of the Party invoking it. Should the Party invoking it be delayed or prevented in performing any of its obligations under the Contract, then the time for performing such obligation shall be extended by a period commensurate to the duration of such Force Majeure event and the necessary time for resumption of the services.

14.2. The Party evoking it shall follow the occurrence of Force Majeure event notify the other Party first by e-mail and then confirm by registered letter with acknowledgement of receipt.

14.3. The Parties shall continue the performance of their other contractual obligations which are not directly affected by Force Majeure event. The Party evoking it shall be released from performing its contractual obligation affected by the Force Majeure event and relieved from liability for delay in such performance, but shall exert all reasonable efforts to mitigate the effects or potential effects of Force Majeure.

14.4. If either Party foresees that a Force Majeure event shall last for more than three (3) months counting from the receipt of notification, the Parties shall promptly discuss methods to resolve the difficulties arising therefrom. If no agreement can be reached on the measures to be taken within fifteen (15) Days from the request from one Party to discuss as per this Article, either Party may terminate all or part of the Contract.

ARTICLE 15 - SUSPENSION - TERMINATION

15.1. The Supplier shall be entitled to suspend the performance or to terminate the Contract in accordance with the provisions set forth at Article 15.2., in case of material breach of the Purchaser, such as but not limited to breach of its payment obligation at any due date and/or non-transmission of plans, data and others information, authorizations, approval that it must provide to the Supplier (the "Documents") under the Contract or under applicable laws or regulations in force during the performance of the Contract, Failure for the Purchaser to remedy its failure within twenty-one (21) Days after notification of such non- performance, the performance of the Contract may be suspended, by registered letter with acknowledgement of receipt sent by the Supplier to the Purchaser, until the contractual obligations concerned are fully performed.

If so, the contractual time schedule for the performance of the Services shall be extended automatically for the period necessary to resume the performance of the Contract (taking into account in particular the availability of the Supplier's employees, of its industrial facilities and those of its suppliers), and in any event for a duration at least equal to the suspension period.

In addition, in the event of suspension of the Contract, the Supplier shall be entitled to receive :

- payment of all Services already performed up to the date of suspension, notwithstanding any contrary stipulations possibly provided for in the terms of payment; and
- reimbursement of all costs resulting from the suspension, including those resulting from the relationship between the Supplier and its subcontractors or suppliers for the performance of the Contract.

15.2. Without prejudice to the stipulations of Article 15.1, in the event of a substantial breach by the Purchaser of one of its contractual obligations such as its payment obligation and/or its obligation to transmit the Documents, the Supplier give the Purchaser notice, by registered letter with acknowledgement of receipt, to remedy as soon as possible the aforesaid breach.

If, twenty-one (21) Days after this notification, the Purchaser has not remedied the breach, the Supplier is entitled to terminate the Contract, by registered letter with acknowledgement of receipt, without prejudice to the payment of the outstanding amount by the Purchaser on the date of termination and the damages to which the Supplier can claim. The termination shall be effective fifteen (15) Days after the sending of the aforesaid registered letter with acknowledgement of receipt.

The amount already paid to the Supplier shall be retained and the Supplier shall be be entitled to receive any costs incurred under the Contract including any costs related to the termination of the orders between the Supplier and its subcontractors or suppliers for the performance of the Contract as well as an adequate loss of profit.

15.3. In the event of a substantial breach by the Supplier of one of its essential contractual obligations, the Purchaser gives the Supplier notice, by registered letter with acknowledgement of receipt, to remedy the aforesaid breach.

If, forty-five (45) Days after this notification, the Supplier has not started to remedy the breach, the Purchaser is entitled to terminate the Contract, by registered letter with acknowledgement of receipt.

In that case, the Purchaser's claim shall be limited to the restitution of the remuneration already paid for the Services up to the termination, subject to the limitation of liability specified in the Article 10.

ARTICLE 16 - EXPORT CONTROL

16.1. The Parties shall fully comply with all applicable export control laws, from all the relevant countries of export or of origin as may be necessary, as the same may be amended from time to time.

16.2. Notwithstanding anything to the contrary contained in the Contract, the Parties shall ensure that all items, software, technology or services, or other information supplied by or on behalf of each Party or which is developed therefrom, which are or may be subject to any applicable export control laws ("Export Controlled Items"), are exclusively used for the purpose of the Project Services as defined in the Contract.

16.3. Without limitation to the foregoing, each of the Parties shall not directly or indirectly, transfer, export, re-export (including deemed export or deemed re-export) any Export Controlled Items and/or disclose any technology thereof supplied under this Contract to:

i. any third party without the written prior approval of the supplying party, and, as the case may be, without the written authorizations of the relevant export control authorities. For the purpose of this Article, a third party shall be any company that is not a Party or any individual that is not an employee of a Party.

or

ii. any company or individual listed in any controlled list by competent authorities. For the sake of clarity, the above shall also apply to any individual from the listed company that is seconded or transferred to any of the Parties and/or to any employee of a Party that is seconded or transferred to a listed company.

Disclosure by one Party to its employees of any Export Controlled Items shall be on a strict "need- to-know" basis and for the sole purpose of the Project pursuant to the Contract. Each Party shall ensure that its employees, to whom Export Controlled Items have been disclosed by the other Party, commits through an agreement not to make use of this Export Controlled Items outside the Project, and in particular in case of mobility outside the Party.

16.4. The Parties confirm that the Export Controlled Items shall be used for civil end-uses only; they shall not be used for development of nuclear weapons or other nuclear explosive devices and shall not be used to fulfill any military purpose.

16.5. The Parties shall co-operate in good faith to prepare, and apply for, all necessary export licenses and otherwise comply with all requirements under applicable law so as to be able to deliver Export Controlled Items for use for the purpose of the Contract. Each Party shall promptly, on request of the other Party provide all necessary end user certificates or undertakings including a statement of non-re-export to third country in order to facilitate the supply of Export Controlled Items.

16.6. Delivery of Export Controlled Items is subject to the obtaining of an export licenses demanded by the competent authorities. Should an export license not be obtained, or be cancelled or suspended, or not be renewed as required by the competent authorities, the Contract or part thereof may be immediately and automatically suspended by the Supplier upon notification to the Customer, until such license is delivered or restored. Such suspension shall not entail the bearing of any liability by the Supplier. Consequently, the Supplier shall be under no obligation to deliver Export Controlled Items related to such export license. If the suspension lasts more than four (4) months, the Supplier shall have the right to terminate the Contract or part thereof without bearing any liability. The provisions of the present Article 16 shall apply notwithstanding anything to the contrary contained in the Contract.

The provisions of the present Article 16 shall survive the termination or expiry of the Contract.

ARTICLE 17 - REACH

Not applicable.

ARTICLE 18 - ANTITRUST

The Parties undertake to take all necessary measures to comply with their obligations under competition law.

To this end, they undertake more particularly to limit their discussions to what is strictly necessary for the proper performance of the Contract and in particular not to discuss or exchange with each other, in any form, information relating to projects on which they are or could be in competition.

In addition, the Parties, where they are or could be in competition, refrain from any transmission of sensitive information which they may be aware of in the context of the negotiation or performance of the Contract, to any person within their company (including their Affiliates) who would not need to know it for the performance of the Contract.

ARTICLE 19 - ASSIGNMENT - SUBCONTRACTING

19.1. Neither Party may transfer or assign (including but not limited to transfer through a merger, demerger or spin-off), all or part of its obligations under this Contract to a third party (it being understood that Affiliates are not considered as third parties) without having received the prior written consent of the other Party.

19.2. The Supplier shall be entitled to subcontract the performance of the Services to third parties.

ARTICLE 20 - APPLICABLE LAW - DISPUTE RESOLUTION

The Contract shall be governed by the French law, to the exclusion of any rules of conflict of laws incompatible with this choice of law.

All disputes arising out of or in connection with the Contract shall be settled through amicable negotiations between the Parties. The Parties undertake to meet within fifteen (15) Days from the receipt of a written request from one Party by a registered letter with acknowledgement of receipt.
If no amicable settlement can be found within thirty (30) Days (hereinafter referred to as "Negotiation Period") from the meeting of the Parties, they agree to submit the dispute to mediation.
Except if otherwise agreed by the Parties reached within fifteen (15) Days from the expiration of the Negotiation Period, mediation will take place in accordance with the International Chamber of Commerce Mediation Rules.
If the dispute has not been settled pursuant to the said Mediation Rules within forty-five (45) Days following the appointment of the mediator or within such other period as the Parties may agree in writing, such dispute shall be submitted to the court of Paris (France), including in case of summary or emergency proceedings and other interim measures.

ARTICLE 21 - MISCELLANEOUS

21.1. The Purchaser acknowledges that the names and trademarks of the Supplier and its Affiliates are their property.

21.2. If any of the provisions in the Contract become null and void, such nullity shall not affect the rest of the Contract, and the Parties agree to replace any void provision with a valid provision having a purpose and economic effects as similar as possible to the void provision.

21.3. It is expressly agreed that the Contract represents the entire agreement between the Parties and cancels and replaces all communications, prior statements, oral and/or written guarantees exchanged between the Parties relating to the same purpose.

21.4. No delay or omission on the part of the Supplier in exercising its rights shall constitute a waiver of any of its rights under the Contract or be construed as such and, in any event, shall not prejudice any of the Supplier's rights under the Contract.

21.5. The stipulations of Articles 10 (Liability), 13 (Intellectual Property – Confidentiality), 16 (Export Control), 20 (Applicable Law – Dispute Resolution) and 21 (Miscellaneous) will survive the expiration or termination of the Contract for any reason whatsoever.

21.6. The Purchaser undertakes not to make any public publication or announcement (press release, advertising...) relating to the Contract or its relations with the Supplier without the Supplier's prior and written consent.

21.7. Not applicable.

21.8. As the Purchaser does not benefit from any exclusivity, the Supplier reserves the right to perform the same or similar Services for other customers.

21.9. Management of personal data

Each Party guarantees the other Party due observance of its statutory and regulatory obligations under legislation governing the protection of Personal Data, in particular the French data protection act (loi informatique et libertés) no. 78-17 of 6 January 1978 amended, on information technology, databases and civil liberties, and Regulation (EU) No 2016/679 of 27 April 2016 of the European Parliament and of the Council on the protection of natural persons (GDPR) with regard to the Processing of Personal Data and on the free movement of such data (the "Applicable Legislation").

Each Party shall ensure the security and confidentiality of the Personal Data.

Each Party, when qualified as (data) controller, shall personally accomplish all the preliminary formalities required under legislation governing the protection of Personal Data.

Definition

Controller : means the natural or legal person, public authority, agency or other body which, alone or jointly with others, determines the purposes and means of the Processing of Personal Data.

Personal Data : means any information relating to an identified or identifiable natural person ("data subject"); an identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person.

Processing : means any operation or set of operations which is performed on Personal Data or on sets of Personal Data, whether or not by automated means, such as collection, recording, organization, structuring, storage, adaptation or alteration, retrieval, consultation, use, disclosure by transmission, dissemination or otherwise making available, alignment or combination, restriction, erasure or destruction.

Processor : means a natural or legal person, public authority, agency or other body which processes Personal Data on behalf of the controller.

Subprocessor : means a natural or legal person engaged by the Processor to execute a part of the Services involving the Processing of Personal Data.

Third Country : means a country located outside of the European Union, that it is not recognized by the European Commission as ensuring an adequate level of protection of Personal Data.

Purchaser's obligation

In case of Personal Data collection and Processing, the Purchaser is qualified as "Controller" in the meaning of the Applicable Legislation.

The Processing of Personal Data for the Services will be documented in the record of Processing activities of the Purchaser's Data Protection Officer.

The Purchaser undertakes to :

i. provide the Supplier with a fact sheet of the Processing of Personal Data for performance of the Services. This description shall among other things include :
   a. the nature of operations carried out on the data,
   b. the purpose(s) of the Processing,
   c. the Personal Data processed,
   d. the categories of data subjects.

ii. document in writing any instruction concerning the data processed by the Supplier, as attached in Appendix;

iii. inform its employees of the Processing of their Personal Data by the Supplier for the performance of Services;

iv. before and during the Processing, ensure due observance of legal obligations governing data protection on the part of the Supplier;

v. supervise the Processing, and carry out audits and inspections of the Supplier.

Supplier's obligation

The Supplier is qualified as a "Processor" in the meaning of the Applicable Legislation.

The Supplier undertakes to take all necessary measures to ensure that it, its personnel and any subcontractors used for the Services, and more particularly:

i. process of data only for the purpose(s) of the Services, as defined in Appendix; in particular, the Supplier shall not consult or process any data other than data needed to perform the Services, even if access to such data is technically possible;

ii. process data only and in accordance with the Purchaser's documented instructions included in Appendix, and with any modifications subsequently made thereto. If the Supplier considers that an instruction contravenes the Applicable Legislation, if so, the Supplier informs the Purchaser forthwith. The Supplier reserves the right to not execute an instruction as long as its legality is not ensured. Moreover, if the Supplier is required to transfer data to a third country or an international organization pursuant to applicable legislative or regulatory provisions, the Purchaser must be informed by the Supplier of this legal obligation;

iii. take all necessary and appropriate technical and organizational measures to ensure and guarantee security of data;

iv. guarantee the confidentiality of Personal Data processed in connection with these Services; and in this respect, not disclose any of the processed data to any unauthorized third parties in any form what so ever;

v. ensure that persons authorized to process Personal Data undertake to (i) respect confidentiality or be bound by an appropriate legal non-disclosure obligation and, (ii) receive the necessary completion on the protection of Personal Data;

vi. with regard to its tools, products, applications or services, comply with the principles of data protection at design time and the protection of data by default;

vii. not insert any data unrelated to that entrusted by the Purchaser in its data Processing, or copy or store data other than that authorized in respect of the Services, or rent or sell such data without the Purchaser's permission;

viii. when the Services ends for any reason whatsoever, return the data to the Purchaser on a reliable tangible storage medium agreed on by the Parties. On returning such data, the Supplier shall destroy

all existing copies thereof in its information systems and produce written proof of such destruction;
ix. provide the Purchaser with any information demonstrating that it has met its obligations concerning the Processing of Personal Data to allow audits and inspections to be carried out by the Purchaser or another auditor engaged by the latter, and contribute to such audits;

x. notify the Purchaser in writing of any breach of Personal Data at the earliest and within no more than forty-eight (48) hours of becoming aware thereof. Such notification must be accompanied by any relevant documentation enabling the Purchaser, if necessary, to notify such a breach to the competent supervisory authority. The notification to the Purchaser must at least include :

- a description of the nature of the breach of Personal Data, if possible including the categories and approximate number of data subjects affected by the breach and the categories and approximate number of Personal Data records concerned;
- the name and contact details of the Data Protection Officer or another point of contact at the Supplier's from whom any additional information can be obtained;
- a description of the probable consequences of the breach of Personal Data;
- a description of the measures the Supplier has taken or proposes to take to remedy the breach of Personal Data, including where applicable any measures required to mitigate any negative consequences thereof.

Moreover, the Supplier undertakes to :

- help the Purchaser meet its obligation to accede to the data subjects' requests for exercising their rights with regard to their data. In instances where the requests of data subjects are addressed directly to the Supplier, the latter respond to them and shall then inform the Purchaser thereof;
- keep a written register of all the categories of Processing activities carried out on behalf of the Purchaser, including all the wordings meeting the requirements of the Applicable Legislation.

Data transferred to a third country

The Supplier may only transfer Personal Data to third countries or international organizations that have an adequate level of Personal Data protection as determined by a decision of the European Commission.

However, the Supplier may transfer Personal Data to a third country not benefitting from a Commission decision provided that the third country in question has an adequate level of protection, and do so without the permission of a regulatory authority when the Supplier provides appropriate guarantees of protection of Personal Data, and more or when its transfers of Personal Data include the standard contractual clauses of the European Commission.

Subprocessor

The Supplier may use the services of an external processor for the Processing of specific Personal Data. In this event, it must inform the Purchaser in advance and in writing of any change under consideration concerning the addition or replacement of any processor. This information must clearly state the subcontracted Processing activities, the technical and organizational measures planned, the identity and contact details of the processor and the dates of the subcontracting agreement.

This subprocessing can only be performed if the Purchaser has not object to it within thirty days of the information.

Due observance of this Clause 21.9 "Management of Personal Data" is an essential obligation binding upon the Supplier, who must include undertakings at least equivalent to those set out in the said clause in contracts with its subcontractors.

The processor is required to meet the obligations of the Services. It is up to the Supplier to ensure that the processor presents the same adequate guarantees regarding the implementation of appropriate technical and organizational measures, in such a way that the Processing meets the requirements of legislation governing the protection of Personal Data.