Welcome to your center for nuclear training courses

A company’s success and ability to compete critically depends on the competency of their employees. An important part of this is learning on the job and, if required, objective based training.

The AREVA Training Center offers suitable courses in the area of nuclear training. As well as established courses such as the various introductory courses, we also offer new courses for up-to-date AREVA technology and for digital Instrumentation and Control.

This catalog includes a range of standard courses, which we can also carry out onsite at your location.

Thanks to almost 40 years of experience, we will support you effectively to further develop your employees with appropriate training tailored to your needs, whether it be technical, plant or project specific.

Your success is our goal!
Catalog content

1. Generic plant introductory courses
   - Design, systems and operation of nuclear power plants
     - Introductory courses EPR™
     - Advanced and technology courses EPR™

2. Expert courses on nuclear power technology
   - Optimization of reactor control and limitation with TXS
   - Nuclear Safety

3. Digital Instrumentation and Control
   - Introduction to Instrumentation and Control in nuclear power plants
     - TELEPERM® XS

4. Know Why Trainings
   - Supplier Expert Knowledge and Experience in Nuclear Power Plant Technology
## Generic plant introductory courses

### EPR™

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Duration</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>B211EPR</td>
<td>EPR™ Introductory Course</td>
<td>6 weeks</td>
<td>5</td>
</tr>
<tr>
<td>B252EPR</td>
<td>EPR™ Short Introductory Course</td>
<td>5 days</td>
<td>6</td>
</tr>
<tr>
<td>B254EPR</td>
<td>EPR™ Technology Course</td>
<td>5 days</td>
<td>7</td>
</tr>
<tr>
<td>B257EPR</td>
<td>EPR™ Advanced Course</td>
<td>10 days</td>
<td>8</td>
</tr>
<tr>
<td>B480.1EPR</td>
<td>EPR™ TECHNOLOGY</td>
<td>5 days</td>
<td>9</td>
</tr>
</tbody>
</table>

Theoretical and Simulation Training
EPR™ Introductory Course

OBJECTIVES
The participants will gain an overview of the construction, design and the function of the different systems of a standard EPR™. The course is also focused on the conceptual background of the nuclear power plant and provides an insight into the operational interaction of all the systems involved as well as the behavior of a nuclear power plant under different malfunction and major accidents.

A short comparison with N4 and KONVOI is also included.

CONTENT
In addition to a general overview, the electrical systems, the interlocking and control of the systems, the plant operation (startup, power operation, shutdown and refueling) and accidents, the course discusses:

- Overview and history
  - Evolution of safety concept and design philosophy of the EPR™
  - Technical overview of the EPR™ plant for Nuclear Island and Turbine Island

- Reactivity control
  - Physical basics, control of core reactivity, inherently safe design principles, physics of the reactor operation
  - Reactivity coefficients, Xenon poisoning, fuel burn-up, Control Rod Drive Mechanism (CRDM)
  - Chemical & Volume Control System
  - Reactor Boron and Water Makeup System
  - Extra Borating System

- Heat transfer from the core
  - Thermohydraulics, heat transfer within the core
  - Reactor Cooling System, Pressurizing System (Pressure Control), Chemical & Volume Control System (Pressurizer Level Control)
  - Secondary Heat Sink, balance of plant
  - Medium Head Safety Injection, Low Head Safety Injection

- Activity Confinement
  - Containment Heat Removal System and Containment Spray System, Core Catcher

- Treatment of radioactive disposal and minimization of radioactive release
  - Water chemistry of the primary circuit
  - Chemical Injection System, Hydrogen dosing, Coolant Purification and Degasification Systems
  - Gaseous and Liquid Waste Processing Treatment

- Electric Energy Supplies & Instrumentation and Control
  - House load operation, auxiliary power supply, emergency power supply
  - Instrumentation and Control concepts

- Plant operation, accidents
  - Operational behavior, malfunctions and design basis events, beyond design basis accidents with core melting

PREREQUISITES
English knowledge required.
EPR™ Short Introductory Course

OBJECTIVES
This course gives an overview of the design philosophy of an EPR™ plant and introduces its main systems. The systems’ layout, main components and operation are discussed.

CONTENT
The course covers the following topics in detail:

- EPR™ history, design philosophy, main plant data
- EPR™ overview, main systems and their location
- Introduction to nuclear physics
- Overview of the primary circuits
  - Layout and main components
  - Instrumentation
- Overview of the auxiliary systems
  - Composition and function of the auxiliary systems
- Overview of the safety-related systems
  - Composition and function of the residual heat removal chain
- Secondary circuit – overview
  - Heat transfer, transportation and conversion
  - Main components of the secondary circuit
- Electrical systems and I&C – overview
  - Generator and power supply
  - Instrumentation and Control
- Overview EPR™ safety concept – overview
  - Nuclear safety and safety objectives
  - EPR™ main safeguard systems and severe accident mitigation

PREREQUISITES
English knowledge required.
EPR™ Technology Course

OBJECTIVES
Upon successful completion of the course, participants will be able to describe the construction, function and operating modes of the systems of the EPR™ and their main components. The EPR™ safety concept and its implementation are also discussed.

CONTENT
- EPR™ history – design philosophy
- EPR™ overview – locations of the main systems, safety concept
- Primary circuit
- Reactor core
- Auxiliary systems
- Safety systems
- Secondary circuit – overview
- Electrical systems
- Instrumentation and control
- Reactor: control, monitoring and limitation
- Reactor protection
- Startup and shutdown of the plant
- Plant behavior during disturbances and accidents
- Concept of the online operating manual

PREREQUISITES
English knowledge required.
EPR™ Advanced Course

OBJECTIVES
This course gives a detailed overview of the EPR™ design, taking into account safety and design principles relevant through all stages of the EPR™ lifecycle: design, construction, commissioning, operation and maintenance. It provides an in-depth knowledge of EPR™ systems and how they cooperate.

CONTENT
The course covers the following topics in detail:

- Safety and design philosophy of the EPR™
  - Safety objectives, regulations and design principles
  - Safety during design stage and operation
- Primary circuit
  - Reactor cooling system and advanced EPR™ components
  - Operating behavior of the primary circuit
- Heat transfer between the primary and secondary circuit
  - Design criteria and operation of the steam generator
  - Overview of the steam generator auxiliary systems
- Secondary circuit
  - Overview of the water-steam cycle & main components
  - T – S diagram of the process
- Electrical production and distribution – from the generator to the switchgears
  - General description of auxiliary and emergency power supply and distribution
  - Design principles and requirements of the power supply
- Instrumentation and Control
  - Design requirements & overview of the I&C architecture
  - Architecture & functions of safety & operational I&C
- Safeguard systems handling major events
  - Design of the Safety Injection Systems regarding Loss of Coolant Accidents
- Reactor auxiliary systems
  - Design and operation of the Chemical and Volume Control System (CVCS)
  - Overview of coolant purification, degasification, supply and storage and treatment of the Reactor Boron and Water Make-up System
  - Design and operation of the Gaseous Waste Disposal System
  - Concept of storage and treatment of radioactive waste

PREREQUISITES
English knowledge required.
EPR™ TECHNOLOGY, Theoretical and Simulation Training

OBJECTIVES

- Understand the architecture and the design principles of the main systems and circuits (primary, auxiliary, secondary and safeguard) of the EPR™
- Explain the roles of the main systems and circuits in normal, abnormal and accident conditions.

CONTENT

  - Operating mode, Safeguard Systems:
    - Safety Injection System (SIS)
    - Containment Heat Removal System (CHRS)
    - Emergency Feedwater System (EFWS)
    - Extra Borating System (EBS)
  - Design principles of the protection system.
  - Applications on FA3 engineering simulator – SOFIA: Operation from cold shutdown to hot standby, house load operation, practical exercise on controls. Emergency Operating Procedures for LOCA and SGTR

TEACHING APPROACH

- Acquisition of a theoretical knowledge during the first part of the day, with practical exercises on the FA3 Engineering Simulator during the second part of the day.

PREREQUISITES

- Basic knowledge of PWR technology.
- Professional English.
Expert courses on nuclear power technology

**PWR**

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Description</th>
<th>Duration</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>B840P</td>
<td>Nuclear Instrumentation PWR (German PWR Concept)</td>
<td>3 days</td>
<td>p. 11</td>
</tr>
<tr>
<td>B843P</td>
<td>Primary circuit controls PWR (German KONVOI Concept)</td>
<td>5 days</td>
<td>p. 12</td>
</tr>
<tr>
<td>B845P</td>
<td>Reactor Limitation PWR (German KONVOI Concept)</td>
<td>5 days</td>
<td>p. 13</td>
</tr>
<tr>
<td>B848P</td>
<td>Reactor power control PWR (German KONVOI Concept)</td>
<td>5 days</td>
<td>p. 14</td>
</tr>
<tr>
<td>B855P</td>
<td>Process based optimization of the reactor control and limitation with TXS</td>
<td>5 days</td>
<td>p. 15</td>
</tr>
<tr>
<td>B861P</td>
<td>Reactor protection system Instrumentation and Control, active safety systems in PWR (German KONVOI Concept)</td>
<td>5 days</td>
<td>p. 16</td>
</tr>
<tr>
<td>B880.1P</td>
<td>Nuclear Safety Basics</td>
<td>1 day</td>
<td>p. 17</td>
</tr>
</tbody>
</table>
Nuclear Instrumentation PWR (German PWR Concept)

OBJECTIVES
Course participants will gain an in-depth understanding of the operating performance of the plant through a practical presentation of the neutron flux measurement systems (incore, excore). The knowledge of nuclear instrumentation is transmitted through concrete examples from the plant operation.
Participants also learn about the neutron physical processes in the reactor core, the Instrumentation and Control process of the plant and get assistance for their own quantitative and anticipatory estimates during plant operation.
The course is based on the many years’ experience of the manufacturer in the design and operation analysis of different PWR plants and on theoretical calculations.

CONTENT
- Principal possibilities of the neutron flux measurement
- Neutron flux excore measurement:
  - Mechanical construction
  - Principle of the neutron flux measurement
  - Source, intermediate and power range
  - Cooperation of the measurement ranges, reactor protection
  - Processing of the neutron flux signals in the reactor protection calibration
- Physical monitoring of the core loading process
- Neutron flux incore measurement system
  (self powered nuclear detectors = SPND and aeroball measurement system):
  - Mechanical construction of the power distribution detectors PDD = SPND
  - Influence of the PDD failure on the process of the plant
  - Aeroball measuring system
  - Nuclear processing computer, POWERTRAX
  - Calibration of the PDD
  - Processing of the PDD signals in the limitation
  - PEAK Limitation Function
  - Power distribution monitoring
- Characteristics of the current loading and its influence on the process of nuclear instrumentation
- Neutron flux measurement signal noise and optimization potential with TXS

PREREQUISITES
Appropriate experience in a PWR power plant or participation in any introductory course is also recommended.
Primary circuit controls PWR (German KONVOI Concept)

OBJECTIVES
Course participants will gain an in-depth knowledge of the essential primary circuit controls with the exception of reactor power control (see course module B848D), with regard to:

- Instrumentation and Control structure and function
- The process-based requirements and backgrounds, as well as
- The connection with the reactor limitation, the reactor power control and with the secondary side turbine control

The course also discusses the operating experiences and events in connection with the primary circuit controls and the optimization potential with TXS Instrumentation and Control.

CONTENT
- Process-based principles: effectiveness of the control elements, component stress, system-based operating modes
- Coolant pressure control
- Pressurizer level control with high pressure reducer station
- Pressurizer level control and reactor coolant loop level control with low pressure reducer station
- High pressure cooler outlet temperature control in the volume control system
- Level control of the volume control tank / leakage makeup
- Connection of the given controls with the reactor limitations
- Process of the discussed controls with steam generator tube rupture and in emergency power mode
- Residual heat removal control

PREREQUISITES
Instrumentation and Control basic knowledge, appropriate work experience in a PWR power plant; participation in any PWR introductory course is an advantage.
Reactor Limitation PWR (German KONVOI Concept)

**OBJECTIVES**
Course participants will gain an in-depth understanding of reactor limitations with the following focuses:

- Instrumentation and Control structure and function
- Process-based requirements and backgrounds
- Connection with the primary and secondary controls and with the reactor protection system and emergency interlocks

The process-based requirements and backgrounds are a particular focus in this course. Operating experiences and events in connection with the reactor limitation are also discussed, and the optimization potential with the transfer to TXS Instrumentation and Control is shown.

**CONTENT**

- Overview of functions and cooperation of different limitation functions
- Reactor power limitations (RELEB) with power distribution monitoring (LVÜ) and control rod drop function (STEW)
- Control rod movement limitation (STAFAB) with secured demineralized injection block (GEDES)
- Coolant mass, pressure and temperature limitation (MADTEB) with actuator activation (STEGA) and secured functions for external impact (GEMAD)
- Individual manual control rod actuation (HEST)
- Control rod actuation function (BETÄT) and its connection with the electronic control rod actuation unit (ELSTABE)
- Measurement value failure, substitute value generation, repair times
- Concept of the limitation alarm and indication

**PREREQUISITES**
Appropriate experience in a PWR power plant. Participation in any introductory course is also recommended.
Reactor power control PWR (German KONVOI Concept)

OBJECTIVES
The course participants will gain in-depth knowledge of reactor power control. The following key points are discussed:

- Instrumentation and Control structure and function
- Process-based requirements and backgrounds, as well as
- Connection with the reactor limitations and the secondary side turbine control

The process-based requirements and backgrounds are of particular importance in this course. Operating experiences and events are also discussed in connection with reactor control and the optimization potential through TXS Instrumentation and Control is demonstrated.

CONTENT
- Reactor power control
- Neutron flux control
- ACT control
- ACT control with L- and D-banks
- Power distribution control
- L-bank position control
- Organization of the control rod drive commands
- D-bank control system:
  - Functions and operating modes
  - Generation of the D-bank setpoint
  - Generation of the D-bank control difference
  - Xenon calculation
  - D-bank position control with constant power
  - D-bank position control with instationary operation
  - Burn-up compensation
  - Requirements for boric acid and demineralized water injection
  - Leakage makeup
- Optimization potential with changeover to TXS

PREREQUISITES
Instrumentation and Control basic knowledge. Appropriate work experience in a PWR power plant or participation in any PWR introductory course is an advantage.
Process based optimization of the reactor control and limitation with TXS®

OBJECTIVES
The course provides in-depth process-based knowledge of reactor control and limitation, and explains the optimization potential of this Instrumentation and Control (I&C) using the example of the innovative backfitting of the Pre-konvoi / Konvoi pressurized water reactors. Some of these features are also implemented in other reactor designs.

Essential new possibilities result from TXS®:
- Filtering, application of replacement values, simulation of deadtime
- Conduction of reactivity, mixture and mass balances
- Exact determination of the recuperative heat exchanger temperature load
- Adaptation of the I&C according to the specific core

These optimizations ultimately allow more precise control and limitation, and make the reactivity management more transparent. New concepts regarding the handling of accidents and operating transients have also emerged, particularly in regards to the following events:
- Subcooling transients, stuck rod, ATWS
- Load rejection in stretch out operation
- Disturbances to the feedwater supply
- Steam generator tube rupture

CONTENT
- Reactor power control:
  - Adaptive power distribution and control rod bank position control (two point xenon calculation, new power distribution fine control concept, simplified setpoint selection, new reactivity balances, adaptation concept to actual core parameters)
  - Leakage makeup (new mixture balances)
- Limitations:
  - PEAK / DNB limitation (new structure, adaptive filtering, changed replacement value application)
  - Loop energy limitation (faulty closing of the Chemical & Volume Control System extraction line and ATWS)
  - Feedwater disturbances (additional consideration of subsystem based disturbances and optimization with regards to minor injection disturbances)
  - Steam generator overfeeding safeguarding (new concept)
  - Temperature monitoring after SCRAM for operational subcooling transients (automatic borating measures)
  - New concept for SCRAM controls as regards ATWS and stuck rod
- Examples of implementation of such features in other reactor designs

PREREQUISITES
Basic knowledge of I&C.
Reactor protection system
Instrumentation and Control, active safety systems in PWR (German KONVOI Concept)

OBJECTIVES
Alongside the Instrumentation and Control structure and the functional principle of the modules, the course participants will also learn about the process-based backgrounds of the reactor protection signals. Particular focus is placed on the limit signal processing of the reactor protection system and the steam generator overpressure protection, as well as the actuation of the individual safety systems.
Reference: Konvoi / Pre-konvoi.

CONTENT
- General safety considerations
  - Safety concept
  - Requirements, design
- Principle construction of the reactor protection system
  - Allocation related to External Impact Concept
  - Redundancy allocation
  - Analog / logic part, binary signal processing alongside the accident-relevant processing path, priority levels, testing interlocking
  - Memory set / memory reset
- Construction of the reactor protection panel
- Process engineering of the reactor protection trigger signals (terminating elements) including steam generator overpressure protection
- The following is explained for each trigger signal:
  - Function setting
  - Importance for the respective accident
  - Signal processing with measurement values, limit value transmitters, logical interlocking, trigger signal generation (terminating elements)
  - Memory, timing elements
- Calculation circuits for reactor power, decrease of main steam pressure, steam generator pressure comparison etc.
- Safety hazard alarms
- Safety systems:
  - Function setting
  - System construction (overview)
  - Actuation through trigger signals
- Integration of the reactor protection system in the priority level
- Alarm concept
- Coupling and decoupling of the reactor protection during shutdown / startup or fuel element exchange
- In-service inspection concept (re-testing concept)
- Measurement value failures (transducer failures, pressure measuring line break), faulty actuation of terminating elements
- Electronic module technology with dynamic logic (EDM / DM, concept and examples of dynamic logic)

PREREQUISITES
Instrumentation and Control basic knowledge or work experience in a PWR power plant, participation in any introductory course is an advantage.
Nuclear safety basics

OBJECTIVES
Course participants will gain an overview of the global safety concept of a nuclear power plant, using an EPR™ as an example:

CONTENT
The course covers the following topics:
- Protection targets
- Guidelines
- Safety aspects during the design phase
- PSA during design
- Safety aspects during construction
- Safety aspects during operation of the plant
- Safety improvement / post evaluation
- Nuclear safety: examples of application

PREREQUISITES
Basic knowledge of an NPP.
TELEPERM® XS-Training courses
for digital safety Instrumentation and Control (I&C)

The TELEPERM® XS training team offers training courses in almost all areas of digital TELEPERM® XS safety I&C. As well as our highly in demand system platform courses (hardware and software), you will also find courses related to systems, the fundamentals, engineering, maintenance, and test bay as integral parts of our educational program.

The modular design of our training concept enables us to adapt to specific customer requirements and to implement individually customized training concepts. We will gladly advise you on the development of your offer.

Our TELEPERM® XS training team is made up of competent and qualified trainers according to the AREVA Instructor Qualification and Certification Program (IQCP) including TÜV certification. Experienced lecturers with a great depth of combined expertise in all areas of digital safety I&C will support you competently while keeping your objectives in mind.

A balanced combination of theoretical teaching, individual and group exercises, and practical exercises using a real TELEPERM® XS system are the distinguishing features of our courses, allowing us to achieve a high degree of learning success with all participants.
## Digital Instrumentation and Control

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Description</th>
<th>Duration</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>L231.1</td>
<td>TELEPERM® XS-Fundamentals Including Practicals</td>
<td>5 days</td>
<td>21</td>
</tr>
<tr>
<td>L231.2</td>
<td>TELEPERM® XS-Fundamentals Overview</td>
<td>3 days</td>
<td>22</td>
</tr>
<tr>
<td>L231.3</td>
<td>TELEPERM® XS-Fundamentals Compact</td>
<td>2 days</td>
<td>23</td>
</tr>
<tr>
<td>L350.1</td>
<td>TELEPERM® XS-Hardware 2nd Generation</td>
<td>3 days</td>
<td>24</td>
</tr>
<tr>
<td>L420.1</td>
<td>TELEPERM® XS-PYTHON Fundamentals</td>
<td>5 days</td>
<td>25</td>
</tr>
<tr>
<td>L420.2</td>
<td>TELEPERM® XS-PYTHON Advanced</td>
<td>5 days</td>
<td>26</td>
</tr>
<tr>
<td>L531.1</td>
<td>TELEPERM® XS-Maintenance HW2G/SMS</td>
<td>5 days</td>
<td>27</td>
</tr>
<tr>
<td>L531.2</td>
<td>TELEPERM® XS-Maintenance HW2G/DIMAS</td>
<td>5 days</td>
<td>28</td>
</tr>
<tr>
<td>L531.5</td>
<td>TELEPERM® XS-Maintenance HW2G/DIMAS</td>
<td>10 days</td>
<td>29</td>
</tr>
<tr>
<td>L540.1</td>
<td>TELEPERM® XS-DIMAS Fundamentals</td>
<td>3 days</td>
<td>30</td>
</tr>
<tr>
<td>L540.2</td>
<td>TELEPERM® XS-Python for TXS</td>
<td>2 days</td>
<td>31</td>
</tr>
<tr>
<td>L631.1</td>
<td>TELEPERM® XS-Engineering Detailed Design</td>
<td>5 days</td>
<td>32</td>
</tr>
<tr>
<td>L631.2</td>
<td>TELEPERM® XS-Engineering Detailed Design-Compact</td>
<td>3 days</td>
<td>33</td>
</tr>
<tr>
<td>L632.1</td>
<td>TELEPERM® XS-SIVAT-V1.8 Verification and Validation</td>
<td>2 days</td>
<td>34</td>
</tr>
<tr>
<td>L632.2</td>
<td>TELEPERM® XS-SIVAT-V3.6 Verification and Validation</td>
<td>3 days</td>
<td>35</td>
</tr>
</tbody>
</table>
## Digital Instrumentation and Control

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Duration</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>L633.1</td>
<td>TELEPERM® XS-SYSADMIN-LINUX Fundamentals</td>
<td>2 days</td>
<td>p. 36</td>
</tr>
<tr>
<td>L635.1</td>
<td>TELEPERM® XS-QDS Applications</td>
<td>2 days</td>
<td>p. 37</td>
</tr>
<tr>
<td>L640.1</td>
<td>TELEPERM® XS-FunBase Applications</td>
<td>3 days</td>
<td>p. 38</td>
</tr>
<tr>
<td>L720.1</td>
<td>TELEPERM® XS-Test Bay and ERBUS</td>
<td>5 days</td>
<td>p. 39</td>
</tr>
<tr>
<td>L831.1</td>
<td>TELEPERM® XS-SPECIAL</td>
<td>10 days</td>
<td>p. 40</td>
</tr>
</tbody>
</table>

BASIC/ENG/MAINT/OPERATION
TELEPERM® XS-Fundamentals Including Practicals

OBJECTIVES
Upon successful completion of this course, course participants will be able to:

▪ Explain the basic system architecture of TXS I&C systems and the tasks and functions of the system computers
▪ Identify the most important hardware modules of the system platform and their basic functions
▪ Explain the system properties with regard to the function of the TXS digital I&C system and its fault tracking options
▪ Explain the tasks of the TXS engineering process in detail
▪ Perform routine tasks using the engineering system SPACE
▪ Explain the possibilities and principles of maintenance

This course provides the basis for the advanced courses
▪ TXS MAINT
▪ TXS-QDS
▪ TXS-HW2G
▪ TXS-SIVAT
▪ TXS-ADMIN

CONTENT
This course covers the overall concept of the safety I&C system platform TELEPERM® XS (TXS). The course participants learn about the individual hardware and software components of a TXS system and acquire a general understanding of the TXS safety I&C system architecture in general and based on specific examples. The most important hardware modules of a TXS system and the system properties resulting from the application of digital I&C will also be explained. Furthermore, course participants will get an overview of the engineering process, including the function specifications, verification and validation methods, the SPACE engineering tools and maintenance of the system platform. The theory will be supplemented with practical exercises.

The course covers the following topics in detail:
▪ Basics of the TXS system
▪ TXS functional computer and system architecture
▪ Overview of the most important TXS hardware modules
▪ TXS system properties
▪ Overview of the TXS engineering process and the function specification with V&V
▪ Detailed engineering (specification of a database)
▪ Engineering tools (SPACE tools)
▪ Maintenance (overview)

PREREQUISITES
General knowledge of automation technology for safety systems in nuclear power plants.
TELEPERM® XS-Fundamentals Overview

OBJECTIVES
Upon successful completion of this course, course participants will be able to:
▪ Explain the basic concepts of function computers and I&C system architectures
▪ Identify the most important hardware modules of the system platform and their basic properties
▪ Identify the system properties with regard to the function of the TXS digital I&C system and its fault tracking options
▪ Explain the most important tasks of the engineering process and its engineering tools (SPACE)
▪ Explain the possibilities and principles of maintenance

CONTENT
This course essentially covers the same content as L231.1, but in a more condensed form. Course participants learn about the different components of a TXS system, including the tasks of the function computer and the application of these tasks in I&C technology through the explanation of TXS I&C system architecture. Participants also acquire an overview of the TXS hardware components and the system properties of the digital I&C with TXS, in addition to an overview of the engineering process regarding function specification, verification and validation methods, SPACE engineering tools and possibilities of maintenance of the system platform. The theory will be supplemented with practical exercises.

The course covers the following topics in detail:
▪ Basics of the TXS system
▪ TXS function computer and system architecture
▪ Overview of the most important TXS hardware modules
▪ TXS system properties
▪ Overview of the TXS engineering process and the function specification with V&V
▪ Engineering tools (SPACE)
▪ Overview of maintenance
▪ Practical exercises and test

PREREQUISITES
General knowledge of automation technology for safety systems in nuclear power plants.
TELEPERM® XS-Fundamentals Compact

OBJECTIVES
Upon successful completion of this course, course participants will be able to:
- Explain the basic concepts of the TXS system platform
- Identify the different hardware modules of the system platform and their most important properties
- Explain the system properties of the digital I&C system and the principle of the fault tracking options
- Explain the basic principles of engineering and maintenance

CONTENT
This course gives a condensed overview of the overall concept of TELEPERM® XS. Course participants will learn about the individual components of a TXS system in general and based on specific examples. The most important hardware modules of a TXS system and the system properties as a result of the application of I&C technology will be explained, in addition to a short overview of the engineering process and the possibilities of maintenance of the TXS system platform.

The course covers the following topics in detail (classroom training only, no practical exercises):
- Basics of the TXS system
- TXS function computer and TXS system architecture
- Overview of the most important hardware modules
- TXS system properties
- Overview of the TXS engineering process and TXS maintenance

PREREQUISITES
General knowledge of automation technology for safety systems in nuclear power plants.

COURSE NUMBER
L231.3

DURATION
2 days

PARTICIPANTS
6 to 8 people

LANGUAGE
English / German

LOCATION
AREVA Training Center

TARGET GROUP
Personnel in charge of I&C system management or involved therein, as well as personnel engaged in sales/marketing of I&C equipment and licensing personnel

CONTACT
training@areva.com
www.areva-training.de
TELEPERM® XS-Hardware 2nd Generation

OBJECTIVES
Upon successful completion of this course, participants will:
▪ Have a basic knowledge of 2nd generation TXS hardware
▪ Understand the connection between the mechanical cabinet assembly and the conceptual requirements regarding the assembly of a TXS cabinet
▪ Have a basic knowledge of the structure and the function mode of cabinet modules of the power supply, circuit breaker and monitoring as well as cabinet connection techniques
▪ Have a basic knowledge of the creation of a cabinet arrangement diagram

CONTENT
This course includes an introduction and an overview of the TXS hardware of the 2nd generation. The new properties of the TXS 2nd generation hardware are presented, including the new properties of TXS modules. The course provides information about the purpose, structure and function of the new modules, including the cabinet power supply, circuit breaker and monitoring.

The connection between planning technical specifications (identification concept, standard circuitry), cabinet assembly (mechanics) and the functionality of the cabinet modules is explained in line with the creation of a cabinet arrangement diagram.

The course covers the following topics in detail:
▪ TXS basics of the hardware components
  - Cabinet structure, racks, mounting sets etc.
▪ Purpose, structure and function mode of the units for:
  - TXS cabinet power supply
  - TXS cabinet circuit breaker
  - TXS cabinet monitoring
▪ Non code-relevant analog and binary modules
▪ Code-relevant modules (computer, communication, input and output modules)
▪ Creation of a cabinet arrangement diagram with VISIO
▪ Consolidation of topics taught with theoretical and practical exercises

PREREQUISITES
Basic knowledge of I&C and of digital automation systems, TXS basic knowledge (basic course), basic knowledge of PC (VISIO) are desirable.
TELEPERM® XS-PYTHON Fundamentals

OBJECTIVES
Attendance of this course provides participants with an introduction to the concept of the interpreted, interactive and object-oriented PYTHON programming language. They will learn about the complexity and applications of this script language, and how these can be employed for this application development. For example the writing of test scripts for periodic tests and in the test bay as regards DIMAS (diagnostic and maintenance server) basics.

CONTENT
PYTHON is an imperative programming language with an object-oriented structure. Regular expressions as well as graphic user interfaces are clarified and understanding is further expanded with practical exercises.

Attendance of this course allows participants a better introduction into the handling of the PYTHON programming language.

The course discusses the following topics in detail:
- Overview, basic concept and functioning of PYTHON
- Data types: basic data types, sequential data types, dictionaries and sets
- Functions: strings, regular expressions, mathematical functions
- User interactions, standard inputs
- Modularization
- Basics of object-orientation

PREREQUISITES
Established knowledge of engineering or previous attendance of a TXS engineering course, as well as programming basics for structured and object-oriented languages.
TELEPERM® XS-PYTHON Advanced

OBJECTIVES
Attendance of this course allows participants to use PYTHON under observation of the newest code quality standards (object-orientation and graphic interfaces). They understand the concept of the PYTHON classes from a higher point of view and can thus write short and easily maintainable PYTHON code. The participants also learn about the design of graphic user interfaces with PyQt and QT Designer.

CONTENT
The modern, high-grade object-oriented programming language PYTHON allows a smooth transfer of small, simple scripts to highly complex applications according to the newest technology standards. PYTHON thereby never loses the clarity and maintainability of its code. The course focuses on the concept of the PYTHON classes and the object-oriented qualities of the language. A series of short introductions into several different special features of the language is also included, for example exception handling, as well as data and time functions.

The Qt-GUI programming is finally discussed with the aid of a window and knowledge is expanded through the connection between QT Designer and PYTHON.

The course discusses the following topics in detail:
- File access
- Exception handling
- Data and time
- Basics of the graphic user interface PyQt
- Short introduction to QT Designer
- Connection between QT Designer and PyQt

PREREQUISITES
Knowledge of TXS-PYTHON/1, basic knowledge of an operating system and a higher programming language. The knowledge from TXS-PYTHON/1 should have already been intensively used through an own script.
TELEPERM® XS-Maintenance HW2G/SMS (5 days)

OBJECTIVES
Upon successful completion of this course, course participants will be able to:
- Explain the concept and mechanisms of TXS maintenance
- Use the TXS service unit for maintenance
- Troubleshoot the TXS system and distinguish between hardware and software problems
- Monitor the TXS system, modify parameters and verify parameter changes
- Download and verify application software
- Isolate hardware failures and exchange components

CONTENT
In addition to a short introduction into the TXS basics and their plant specific applications, this course focuses on the function, application and handling of the TXS service unit used as a tool for diagnostics and troubleshooting in TXS systems. Further topics covered in this course include fault tracking in the cabinet and procedure and handling in case of module exchange. The course is based on the 2nd Generation TXS hardware and the TXS Core Software Version 3.3.x with SMS and GSM as diagnostic tools.

The course covers the following topics in detail:
- TXS basics
  Function computer and system architectures, 2nd generation hardware and system properties
- TXS maintenance
  Basic annunciation and monitoring concept
  Monitoring computer, types of errors and error messages
  SPACE database (properties and function diagram editor)
  Navigation within a project database (practical exercises)
- TXS diagnostics with the service unit (SMS)
  Use of the service unit for troubleshooting
  Service Monitor Server (SMS), functionality and Online Error Messages
- TXS diagnostic with the service unit (GSM)
  Diagnostic with the Graphic Service Monitor (GSM)
  Introduction in SM-Scripts
  Change of operating modes and parameterization
  Practical exercises
- TXS diagnostics at the cabinet
  Fault tracking and repair
  Demonstration of module exchange and hardware parameterization
  Software loading with practical exercise

PREREQUISITES
Basic knowledge of I&C and experience in digital automation systems are desirable, TXS basic knowledge is an advantage, however, not requisite. General basic knowledge of PC.
TELEPERM® XS-Maintenance HW2G/DIMAS (5 days)

OBJECTIVES
Upon successful completion of this course, course participants will be able to:
▪ Explain the TXS basics, architecture and system properties
▪ Explain the concept and mechanism of TXS maintenance
▪ Use the different DIMAS clients on the SU for TXS diagnostics and maintenance
▪ Monitor the TXS system, modify parameters and verify parameter changes
▪ Explain module exchange procedure and module settings
▪ Download application software and verify it

CONTENT
This course has essentially the same concept as course L531.1 Maintenance of the 2nd Generation (TXS-MAINT/SMS). The course is based on the TXS hardware of the 2nd Generation and the 2nd Generation of TXS Core Software with DIMAS clients as diagnostics tools. In addition to a short introduction into the TXS basics and their plant specific applications, this course focuses on the function, application and handling of the TXS service unit, used as a tool for diagnostics and troubleshooting in TXS systems. Further topics covered in this course, include fault tracking in the cabinet and procedure and handling in case of module exchange. The course will be complemented by practical exercises.

The course covers the following topics in detail:
▪ TXS-Basics
  - System architecture
  - Hardware 2nd Generation
  - System properties
  - SPACE function diagram edition (FDE)
  - Navigation in a project database (practical exercise)
▪ TXS-Diagnostic with the Service Unit (basics)
  - Annunciation and monitoring concept
  - Service unit and DIMAS introduction
  - DIMAS clients (TXSStatus, FDView, Eventlog)
  - Operating modes & parameterization
  - Practical exercises on some topics
▪ TXS-Diagnostics at the cabinet
  - Location and interpretation of indicators at the cabinet for troubleshooting
  - Module exchange and settings
  - Software loading
  - Practical exercises on some topics

PREREQUISITES
Basic knowledge of I&C and experience in digital automation systems are desirable. TXS basic knowledge is an advantage, however, not requisite. General basic knowledge of PC.
TELEPERM® XS-Maintenance HW2G/DIMAS (10 days)

OBJECTIVES
Upon successful completion of this course, course participants will be able to:
- Explain the TXS basics, architecture and system properties
- Explain the concept and mechanism of TXS maintenance
- Explain the DIMAS functionality on the SU
- Use the different DIMAS clients for TXS diagnostics
- Use the TXS service unit for general and periodical maintenance
- Troubleshoot the TXS system and differentiate between hardware and software problems
- Monitor the TXS system, change parameters, secure and control the modifications
- Load and verify TXS software
- Perform independent troubleshooting on the TXS system
- Identify hardware problems and change the modules according the required procedures
- Document the fault fixing (e.g. fill out the return receipt correctly)

CONTENT
This course provides a detailed explanation of all necessary aspects and maintenance possibilities, with practical exercises and hands-on training for a deeper understanding. The main target is independent troubleshooting on a real system by replacing defective modules and subsequent setting up of the system.

Troubleshooting starts as soon as an error appears (e.g. group alarm indication) and continues up to exchanging the defective module in the cabinet. The practical uses are first shown by the trainer. The participants then repeat what they have been shown under supervision and finally use what they have learnt in independent test tasks. The practical exercises aim to support what is learnt.

The course covers the following topics in detail:
- TXS-Basics
  - System architecture
  - Hardware 2nd Generation
  - System properties
  - SPACE editor
- TXS-Diagnostic with the Service Unit
  - Annunciation and monitoring concept
  - Service unit and DIMAS introduction
  - DIMAS clients (TXSStatus, FDView, Eventlog, DIMAS Shell)
  - Diagnosis with the service unit
  - Operating modes & parameterization
  - Scripts
  - Practical exercises on these topics
- TXS-Diagnostics at the cabinet
  - Location and interpretation of indicators at the cabinet for troubleshooting
  - Module exchange and adjustment
  - Software loading and PROFIBUS configuration
  - Practical exercises on these topics
- Diagnosis and maintenance at the training cabinet
  - Independent diagnostics at the service unit
  - Independent diagnostics at the training cabinet
  - Fault detection, module exchange, starting up the repaired system according to the actual TXS documentation rules.
  - Technical documentation of the problem and preparing the defective module to “the send back rules”

PREREQUISITES
Basic knowledge of I&C and experience in digital automation systems are desirable. TXS basic knowledge is an advantage, however, not requisite. Python knowledge and general basic knowledge of PC.
TELEPERM® XS-DIMAS Fundamentals

OBJECTIVES
Upon successful completion of this course, course participants will be able to:

- Explain the co-operation between DIMAS (Diagnostic Maintenance Server), online system and the DIMAS clients
- Explain the basic functionalities of a service unit
- Explain the different operating modes
- Perform parameter changes
- Explain DIMAS clients and their functionalities
- Know about and work with DIMAS-PYTHON-API
- Implement DIMAS scripts based on Python programming language
- Implement graphical-service masks with DIMASQt.

CONTENT
This course handles the DIMAS functionality, Version 3.6.x, and explains which function DIMAS and the service unit perform. Including an explanation and practical exercises for the using, handling and performing of DIMAS clients. The Python programming interface is then explained with the help of DIMAS-PYTHON-API and practical exercises.

The course covers the following topics in detail:

- Introduction to DIMAS
- Introduction to the service unit
- Principle of the TXS-service-concept (cooperation between DIMAS, Online System and DIMAS clients)
- Presentation of DIMAS-clients and their functionality (TXSStatus, FDView, EventLog and DIMAS-Shell)
- Introduction to the DIMAS-PYTHON-API (dimasUtil)
- Introduction to operating modes and parameterization
- Implementation of Python scripts
- Implementation of graphical-service masks with DimasQt.
- Practical exercises

PREREQUISITES
Python knowledge is essential (e.g. Python basic course and/or Python advanced course). Basic knowledge of I&C and experience in digital automation systems are desirable, TXS basic knowledge is an advantage, however, not requisite. General basic knowledge of PC and LINUX.
TELEPERM® XS-Python for TXS

OBJECTIVES
After attending this course, participants will be in the position to understand the basic concept, handling and the use of the object-oriented programming language PYTHON in connection with TELEPERM® XS Core Software version 3.6.x and higher. Participants will be able to implement simple scripts with Python and carry out tasks in the software-oriented fields of engineering (Detail Design and V&V), commissioning and maintenance of I&C systems with TELEPERM® XS equipped with Core Software Version 3.6.x or higher. In addition to the entry-level into the Python programming language, this course can be used as the basis and prerequisite for further courses, such as TXS-DIMAS, V&V, Test Bay and Maintenance.

CONTENT
After a basic introduction to the function and applications of the higher, interpreted and object-oriented programming language Python, the first steps for working with the different modules (DIMAS & Python-DB) and their functions are explained in the course. Furthermore, the different data types, control structures, operators, error handling and user interactions, up to basic script structure are investigated. The theoretical knowledge learned is consolidated by practical exercises. Thereby, reference is always made to the application of Python in the TELEPERM® XS system so that participants can transfer what they have learned into practice.

The course covers the following topics in detail:
- Overview, basics and operation of Python
- Data types (e.g. basis data types and dictionaries)
- Functions (e.g. strings, regular expressions, mathematical functions)
- User interactions
- Error handling
- DIMAS connection
- Basics of Python scripting
- Basics of the Python DB module
- Practical exercises

PREREQUISITES
General basic knowledge of PC and LINUX. Basics of programming for structured and object-oriented languages are desirable. Basic knowledge of engineering and/or maintenance of TELEPERM® XS I&C is useful, but not necessary.
TELEPERM® XS-Engineering Detailed Design

OBJECTIVES
Upon successful completion of this course, course participants will be able to:

▪ Explain the basic properties of TXS I&C systems with respect to system design, hardware and software
▪ Explain the most important process engineering steps and tools necessary for the engineering of TXS I&C systems
▪ List the tasks and contents of an I&C system requirements specification
▪ Independently generate application software with the SPACE engineering system and, in doing so, apply all SPACE tools requisite for the documentation, testing, verification and/or validation

CONTENT
In addition to a short introduction into the TXS basics, this course covers the most important elements of the TXS engineering process. It gives an overview of how to implement an I&C system specification, detailed engineering with software generation, verification and validation of the individual process steps and the accompanying engineering tools (SPACE tools). The validation tool SIVAT is also examined more closely.

The course covers the following topics in detail:

▪ TXS basics
  - System architectures (system-specific applications)
  - Hardware and software
  - System properties
▪ TXS engineering process (overview)
▪ Overview of I&C system specification (level 1-4)
▪ SPACE function plan editor in detail
▪ SPACE database design (coding concept)
▪ Generation of an I&C system specification
  - Hardware specification with practical exercises
  - Software specification with practical exercises
▪ Application software coding by means of all SPACE tools necessary for the software detail planning (with practical exercises)
▪ Validation of the application software via SIVAT (overview and practical exercises)

PREREQUISITES
Basic knowledge of I&C and experience in digital automation systems is desirable. TXS basic knowledge (such as the prior completion of a TXS basic course) is not mandatory.
TELEPERM® XS-Engineering Detailed Design-Compact

OBJECTIVES
Upon successful completion of this course, participants will be able to:
▪ Explain the basic functions of the TXS function computer and the design of system architectures
▪ Explain the most important processes and tools necessary for the engineering of TXS I&C systems
▪ Explain the tasks of a process engineering and I&C function specification and implement it in a TXS system specification
▪ Independently generate application software with the SPACE engineering system and, in doing so, apply all SPACE tools requisite for the documentation, testing, verification and / or validation

CONTENT
This course is a refresher course and designed for those who have already participated in the engineering course L631.1 and who want to brush up the most important characteristics of TXS engineering in condensed form. The topics covered are essentially identical, however, they are addressed in a more condensed manner.

The course covers the following topics in detail:
▪ TXS basics (refreshment of your knowledge about function computer, system architectures and system properties)
▪ TXS engineering process (concept)
▪ SPACE function plan editor
▪ Generation of an I&C system specification (hardware and software)
▪ Application software coding by means of all SPACE tools requisite for the SW detailed planning
▪ Practical exercises

PREREQUISITES
Good knowledge of the TXS system required and good skills in the field of TXS hardware and system design.
TELEPERM® XS-SIVAT-V1.8 Verification and Validation

OBJECTIVES
Upon successful completion of this course, the participants will be able to:

▪ explain the field of application of SIVAT in the engineering process and the concept and function of SIVAT
▪ generate a simulation code by using SIVAT
▪ create simulation scripts
▪ test and validate I&C functions by using the generated SIVAT code and simulation scripts

CONTENT
This course covers the function of SIVAT (Simulation based Validation Tool) and the generation of the SIVAT code. In addition, the course participants will learn how to work with SIVAT. They will learn to test and validate the engineered I&C functions in the software environment of SIVAT by using scripts.

The course covers the following topics in detail:

▪ The purpose, principle and requirements of the SIVAT simulation
▪ Generation of simulation code for an exemplary project of simulator structure
▪ Graphical user interface of SIVAT
▪ Work with simulation scripts
▪ Signal manipulations and simulation of malfunctions
▪ Practical exercises

PREREQUISITES
A basic background in I&C and in electrical engineering. Experience with digital automation systems is desirable. TXS basic knowledge (such as participation in a TXS basic course) is mandatory, prior attendance of a TXS engineering course desirable.
TELEPERM® XS-SIVAT-V3.6 Verification and Validation

OBJECTIVES
Upon successful completion of this course, course participants will be able to:
▪ Describe the purpose, principles and requirements of the SIVAT simulation
▪ Use the SIVAT user interface (3.6.x)
▪ Explain SIVAT Python API (3.6.x)
▪ Explain the cooperation between DIMAS and SIVAT objects
▪ Validate SIVAT test cases
▪ Write SIVAT Python test scripts

CONTENT
This course covers the function of SIVAT (SImulation based VAlidation Tool), release 3.6.x. Course participants will learn about the function fulfilled by SIVAT and how it is used in the engineering process. The SIVAT programming interface available in Python is subsequently explained by way of example. Based on this, the participants will validate an I&C function using the generated SIVAT code and SIVAT/Python test.

The course covers the following topics in detail:
▪ Explanation of the field of application of SIVAT in the engineering process as well as the concept and function of SIVAT
▪ Writing of Python scripts by means of the SIVAT Python API
▪ Description of the cooperation between DIMAS and SIVAT objects
▪ Testing of I&C functions by using SIVAT
▪ Simulation of malfunctions
▪ Automation of test cases
▪ Operating principles
▪ Inclusion of external models
▪ Practical exercises

PREREQUISITES
Python knowledge is essential (e.g. Python basic course and/or Python advanced course). It is also recommended to attend the DIMAS course L540.1. Basic knowledge of I&C and experience in digital automation systems are desirable, TXS basic knowledge is an advantage, however, not requisite, general basic knowledge of PC and LINUX.
TELEPERM® XS-SYSADMIN-LINUX Fundamentals

OBJECTIVES
The course emphasis lies on the tasks typically performed by system administrators, such as the tracking and repair of system problems or network administration. Upon successful completion of this course, course participants will be able to:
- Understand the basic functions of the TXS service unit and define and administer the necessary TXS hardware and software for a TXS service unit
- Independently execute and test TXS service unit software installations
- Carry out basic administrative tasks at a TXS service unit, such as the independent installation and configuration of users and printers, network configurations, administration of project databases, updating of TXS software releases.

CONTENT
This course is built around the basics of the LINUX operating system and TXS software releases, higher than 3.3. By means of the TXS system (service unit and/or engineering system) course participants will learn how to set up and administer user, printer and licenses with LINUX and TXS. Furthermore, they will learn how to install a SUSE LINUX operating system and configure TXS software packages, create TXS user and groups with YaST system administration and work with the K Desktop Environment (KDE).

The course covers the following topics in detail:
- Overview of TXS and LINUX
- Installation of SUSE LINUX
- KDE and LINUX concepts
- Installation of TXS user, groups and TXS software
- Configuration of TXS
- Installation testing
- Practical exercises

PREREQUISITES
A basic background in I&C and computer technology as well as in the system administration of the operating system LINUX are mandatory. Experience with digital automation systems is desirable. Basic knowledge of TXS (such as the attendance of a TXS basic course) is necessary and prior completion of a TXS engineering course is desirable.
OBJECTIVES
Upon successful completion of this course, course participants will be able to:
▪ Explain the concept and mechanism of QDS
▪ Handle QDS, including the connection to a TXS system
▪ Use engineering tools such as QtDesigner, QDS_Gen, QDS_HMI and QDS_SU
▪ Monitor the connected TXS system
▪ Modify the parameter
▪ Download application on QDS hardware

CONTENT
This course offers an overview of the concept and function of a TXS QDS (Qualified Display System). Course participants will learn how a QDS system is integrated in TXS, and will design a QDS application using the QDS tools QDS_GEN, qtDesigner, QDS_HMI and QDS_SU. They will finally download their applications onto the QDS hardware which is connected to a TXS training cabinet.

The course covers the following topics in detail:
▪ Hardware architecture
▪ Software architecture
▪ QDS in SPACE
▪ Engineering tools
▪ Designing displays
▪ Connecting of signals and HMI
▪ QDS service unit
▪ Practical exercise

PREREQUISITES
Basic knowledge of I&C and experience in digital automation systems are desirable, TXS basic or TXS engineering knowledge is an advantage, however, not requisite, general basic knowledge of PC.
TELEPERM® XS-FunBase Applications

OBJECTIVES
After successful participation in this course, participants will gain a knowledge of:
- Structure, scope of functions and handling of the FunBase
- Connections of the functions with the production of the documentation
- Installation procedures and settings
- Handling of FunTools for function specifications with the user interface
- Design of flow charts
- Handling of FunQueries for specification of enhanced user data

CONTENT
This newly developed course provides an introduction and overview of the engineering tool ‘FunBase’ (functional specification database). Participants gain a knowledge of the structure, functionality and handling of the tool and the connections between process engineering and instrumentation and control function engineering, which are generated in this new, own developed documentation form. Knowledge is expanded through practical exercises with the different project and documentation steps.

The course discusses the following individual topics:
- Structure and scope of functions of the FunBase
- Scope of application
- Program installation and settings
- Explanation of flow chart symbols (overview)
- Definition of basic functions
- Functions for the production of level 3 - documentation
- Functions for the production of level 4 - documentation
- Functions for the production of documentation for modules and submodules
- Navigation in the documentation
- Practical exercises

PREREQUISITES
Basic knowledge of instrumentation and control technology and digital automation systems. Basic knowledge of TELEPERM® XS (basic course) is desirable. General PC knowledge.
TELEPERM® XS-Test Bay and ERBUS

OBJECTIVES
Upon successful completion of this course, course participants will be able to:
▪ Carry out the Test Bay (concept and setup, test programs and test procedures)
▪ Determine the general ERBUS (Test System) concept and setup
▪ Explain the function and performance of the ERBUS - Simulation Control Unit (SCU), the Test Machine (TM) and the TEC (Test Equipment Controller)
▪ Introduce the ERBUS software tools for system tests
▪ Operate tests with ERBUS and DIMAS-PYTHON-API
▪ Implement I&C functionality test with ERBUS scripts based on Python programming language

CONTENT
The training course contains topics on the Test Bay, platform, resources required, test plan and procedure, test executions and conditions, expected results and how to perform the test itself. One of the main course key topics is the ERBUS Test system (Simulation Control Unit and TM), which is the main test system in the Test Bay. The trainee will learn the function and performance of the ERBUS and how to use the ERBUS system to simulate and record I/O signals and data for a TELEPERM® XS I&C System under test (SUT). To do this, knowledge of the ERBUS hardware and software application is required, such as using the ERBUS Command Shell and the Python programming interface with the help of DIMAS-PYTHON-API as an example. I&C function test examples are discussed and carried out. The training course is based on ERBUS software version 3.6.x (SCU). The course includes theoretical and practical exercises for all the main topics in addition to the theoretical lessons.

The course covers the following topics in detail:
▪ Test Bay concept and setup
▪ Test Bay equipment
▪ Test programs, procedures and implementation
▪ ERBUS Introduction, Test Machine (TM) and Simulation Control Unit (SCU)
▪ Hardware connection
▪ ERBUS and DIMAS using the ERBUS Shell
▪ Test of Signal Connections and I&C functionality with the help of Python scripts
▪ Theoretical and practical exercises

PREREQUISITES
Python knowledge is essential (e.g. Python basic course and/or Python advanced course). Basic knowledge of I&C and experience in digital automation systems are desirable. TXS basic knowledge is an advantage, however, not requisite, general basic knowledge of PC and LINUX.
TELEPERM® XS-SPECIAL BASIC/ENG/MAINT/OPERATION

OBJECTIVES
Upon successful completion of this course, course participants will be able to:
▪ Explain the basic properties of TXS I&C systems with respect to system design, hardware and software
▪ Explain the most important process engineering steps and tools necessary for the engineering of TXS I&C systems
▪ List the tasks and contents of an I&C system requirements specification
▪ Work with the SPACE engineering tools and independently generate application software version 3.6.x
▪ Take first steps with the validation tool SIVAT
▪ Comment on the tasks of the service unit, work with the service tools (DIMAS/client applications) and carry out system diagnosis and maintenance
▪ Describe the basic characteristics of the test bay

CONTENT
This course offers a detailed insight into all fields of TELEPERM® XS and is the most comprehensive TXS course in our range of courses offered. The following core topics will be dealt with: TXS basics, engineering, validation with SIVAT and maintenance with the service unit and an overview of the test field.

The course duration is two sessions of 5 days, with a break of at least one week in between.

The course covers the following topics in detail:
Part 1 (first week)
▪ TXS basics (function computers and system architectures, 2nd generation hardware; system properties)
▪ TXS engineering process (basics)
▪ Introduction to the I&C function specification (level 1-4);
▪ Using the SPACE function diagram editor FDE
▪ SPACE project database with hardware and software coding concepts
▪ Design rules in the SPACE project database
▪ Practical exercises to the hardware and software specification in the project database
▪ Software coding by means of the SPACE tools, practical exercises

Part 2 (second week)
▪ TXS maintenance (annunciation and monitoring concept; diagnostics at the cabinet; introduction service unit and DIMAS; TXSStatus; diagnostics with the service unit; FDView, DIMAS Shell; operation and parameterization; EventLog; modul exchange and settings; software loading and verification; practical exercises)
▪ SIVAT introduction (SIVAT tasks and principles; graphical user interface; using SIVAT; visualizing and plotting results; automating a test case, practical exercises)
▪ TXS test bay (concept and setup, test programs and test procedures)

PREREQUISITES
Basic knowledge of I&C and experience in digital automation systems is desirable. TXS basic knowledge is an advantage, however, not requisite, general basic knowledge of PC and python knowledge are essential.
Supplier Expert Knowledge and Experience in Nuclear power Plant Technology

B875-1D  Know Why Pressurizer 1 day
B875-2D  Know Why Steam Generator and Main Steam Relief Train 1 day
B875-3D  Know Why Coolant Treatment System 1 day
B875-4D  Know Why Turbine Control 1 day
B875-5D  Know Why Chemical and Volume Control System 1 day
B875-6D  Know Why Transient- Accident Analysis 1 day
B875-7D  Know Why Residual Heat Removal System 1 day
B875-8D  Know Why Reactor Protection System for PWR 1 day
B875-9D  Know Why Auxiliary and Emergency Power Supply 1 day
B875-10D  Know Why Nuclear Power Plant Layout 1 day
B875-15S  Know Why BWR- Pressure Relief System 1 day
B875-16S  Know Why Overall Concept of BWR 1 day
B875-17S  Know Why Operational I & C for BWR 1 day
B875-18S  Know Why Pressurizer Safety Relief System Reactor Coolant System 1 day
B875-19S  Know Why Refueling, Core Loading Zero Power Load Tests 1 day
Supplier Expert Knowledge and Experience in Nuclear power Plant Technology

- **B875-20S** Know Why Feedwater and Steam Circuit 1 day
- **B875-21S** Know Why Reactor Protection System for BWR 1 day
- **B875-23S** Know Why Accidents Initiating Events 1 day
- **B875-25D** Know Why Reactor Physics Special Subject 1 day
- **B875-26D** Know Why Reactor Coolant Pressure Boundary System 1 day
- **B875-27D** Know Why PKL Phenomena and Instrumentation 1 day
- **B875-28D** Know Why Criticality in Spent Fuel-Pool 1 day
- **B875-30D** Know Why Lesson Learned from Emergency Power Supply and EDG 1 day
- **B875-31D** Know Why Lessons Learned Residual Heat Removal System 1 day
- **B875-32D** Lessons Learned from Fukushima 1 day
Do you have specific training requirements?
We can arrange a course for you according to your specific requirements. We are your point of contact, and offer help with questions about courses and organization.

Course offer options
It is possible to add learning performance monitoring to all offered courses. Details of the possible options are available on request.

Online offer / Registration
Information on course dates and prices can be found in our current course catalog, at

http://www.areva-training.de

Please complete the registration form, and return it to us by e-mail, fax or post.

AREVA GmbH
Training Center Germany
Seligenstädter Str. 100
63791 Karlstein am Main

E-Mail: training@areva.com

Tel.: +49 (0) 9131900 34567
Fax: +49 (0) 9131900 31868

Our website offers tips on travel and accommodation near the training location.
AREVA is a world leader in nuclear power. The group’s offer to utilities covers every stage of the nuclear fuel cycle, reactor design and construction, and operating services. Its expertise and uncompromising dedication to safety make it a leading industry player.

AREVA also invests in renewable energies to develop via partnerships, high-technology solutions.

Through the complementary nature of nuclear and renewables, AREVA’s 45,000 employees contribute to building tomorrow’s energy model: supplying the greatest number of people with energy that is safer and with less CO₂.

www.areva.com