ADVANCED ENGINEERING TRAINING CATALOG

2020

"Engineering Knowledge Transfer for the 21st Century"

ADVANCED ENGINEERING TRAINING

January, 2020

INTRO.

ADVANCED ENGINEERING TRAINING

The Advanced Engineering Training (AET) initiative produced highly technical Computer Based Training modules to facilitate knowledge transfer and retention efforts at commercial nuclear facilities.

The initiative is funded and sponsored by all of the US operating commercial nuclear power plants.

The topics selected by the AET Steering Committee align to key areas of technical specialties across Engineering at the site. The focus is on areas of expertise that only a few select senior engineers may possess.

All of the CBTs produced by AET are hosted on INPO's NANTeL learning management system. A NANTeL User ID and Password are required to access the CBTs.

This catalog also lists training that is commercially available, not produced by AET.

RESTRICTED USE OF AET CBTS

Access to AET CBTs is restricted to the following:

- Employees of US commercial nuclear power plants and their corporate offices
- Contractors of US commercial nuclear power plants-specific individuals, not their company, who have been assigned a CBT for the purpose of supporting specific related work at the plant
- Employees of companies and organizations who have entered into an AET contract with Exelon PowerLabs. The current list of these companies and organizations is listed here.

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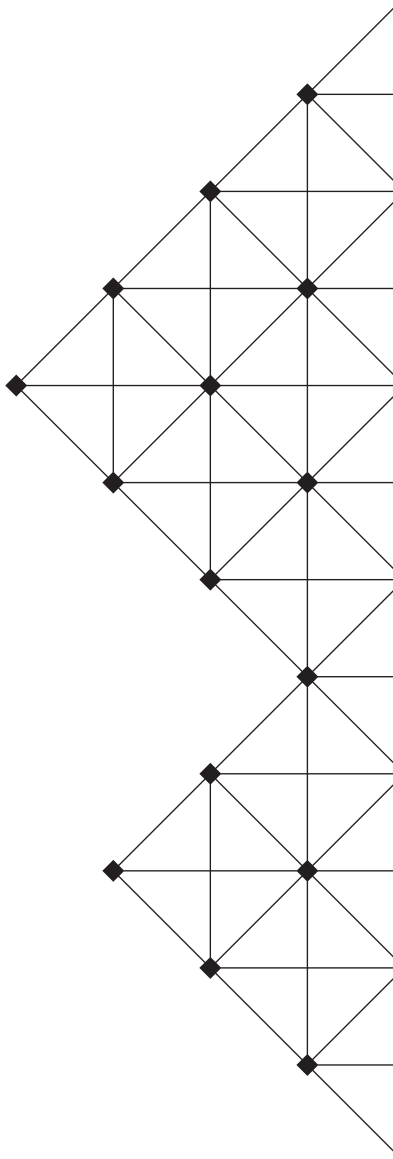

AET CBTs Available on NANTeL

Tornadoes and Hurricanes

A self-paced, comprehensive, nuclear industry generic overview of the tornado and hurricane forces on nuclear plants and structures. It includes the key terms and calculations relating to tornadoes and hurricanes (e.g., pressure differentials, missile protection, the use of TORMIS, etc). The module has undergone one round of revision to address ownership issues and feedback via NANTeL and other sources to make it more effective and seamless for the learners. The final exam was revised to add the open book resource documents link and reformat selected questions to improve clarity based on exam analysis and feedback.

Nuclear Switchyards

This CBT is a self-paced, detailed, comprehensive, nuclear industry generic overview of the layout and purpose of switchyards. This includes a variety of switchyard types, their design (grading and drainage, structures), equipment (ring buss, double ring buss), protection (grounding, lightning, relays) and operation (communication, monitoring, security) and regulatory environment (NRC, NERC, FERC). The module has undergone one round of revision to address ownership issues and feedback via NANTeL and other sources to make it more effective and seamless for the learners. The final exam was revised to add the open book resource documents link and reformat selected questions to improve clarity based on exam analysis and feedback.

High Energy Line Break

A self-paced, comprehensive, nuclear industry generic overview of HELB/MELB fundamentals for engineering evaluations and analysis. It introduces the student to the regulatory design requirements for HELB/MELB, explains the pipe rupture evaluation process and describes how to perform compartment heat-up and pressurization analysis. The module has undergone one round of revision to address ownership issues and feedback via NANTeL and other sources to make it more effective and seamless for the learners. The final exam was revised to add the open book resource documents link and reformat selected questions to improve clarity based on exam analysis and feedback.

Accident Dose

This CBT is a self-paced, detailed, comprehensive, nuclear industry generic overview of the overall purpose, terminology and objectives of Dose Consequence Assessment for postulated accidents. The course discusses key parameters (inputs, assumptions, methodology design features and acceptance criteria) for assessment of various types of hypothetical accidents for both PWR and BWR sites (e.g., rod ejection or rod drop accidents, main steam line or reactor coolant failures, fuel handling, etc.). The module has undergone one round of revision to address ownership issues and feedback via NANTeL and other sources to make it more effective and seamless for the learners. The final exam was revised to add the open book resource documents link and reformat selected questions to improve clarity based on exam analysis and feedback.

External Flooding

A self-paced, comprehensive, nuclear industry generic overview of the overall purpose, terminology and objectives of External Flooding. The training defines key flooding terminology (PMP, LIP), identifies how the information is used in flooding analysis, and discusses the impacts of drains and dams and how to evaluate protective and other hazards associated with flooding. The module has undergone one round of revision to address ownership issues and feedback via NANTeL and other sources to make it more effective and seamless for the learners. The final exam was revised to add the open book resource documents link and reformat selected questions to improve clarity based on exam analysis and feedback.

Protective Relay — Selection & Setpoint

A self-paced, comprehensive, nuclear industry generic overview of the design and licensing basis for understanding of protective relay selection and setpoint considerations. This course provides an understanding of the types and purpose of protective relays, the characteristics of the design, an understanding of both phase and ground protection and the protection requirements for different equipment. The module has undergone one round of revision to address ownership issues and feedback via NANTeL and other sources to make it more effective and seamless for the learners. The final exam was revised to add the open book resource documents link and reformat selected questions to improve clarity based on exam analysis and feedback.

Cable Aging Management & Inaccesible Cables (GL01-2007)

The CBT is a nuclear industry generic overview of the electrical cable degradation for inaccessible and difficult to access cables. The training provides a generic design and licensing basis for understanding cable material and construction and how these degrade over time and with exposure to the elements. It also focuses on identification of key attributes, walk down and evaluation criteria and proper testing criteria.

As-Built Piping Analysis

A self-paced, comprehensive, nuclear industry generic overview of the generic design and licensing basis for understanding as-built piping analysis. The course addresses key regulatory requirements, the key inputs to analysis and considerations for engineering evaluation and response to industry and regulatory guidance.

Setpoint Methodology

The CBT is a generic overview of Setpoint Methodology. It includes terminology and objectives of design and licensing basis for engineering evaluations and responses to industry and regulatory guidance. It discusses key industry and regulatory documents, margin fundamentals, unique design features and uncertainty establishing setpoints.

Molded Case Circuit Breakers/Thermal Overload Relays

The CBT on Molded Case Circuit Breakers and Thermal Overload Relays provides an understanding of the design, types and purpose of these components in the nuclear environment. It addresses the specifics of design types, their operation, maintenance and testing of the components and regulatory requirements and considerations. The engineer will have a generic design and licensing basis for performing engineering evaluations and responses to industry and regulatory issues.

Gas Management

This CBT is a comprehensive, nuclear industry generic overview of the Gas Management issues from NRC Generic Letter 2008-01. It includes design, surveillance, licensing, and operating experience related to gas management.

Anticipated Transients Without Scram (ATWS)

A comprehensive, nuclear industry generic overview of the Anticipated Transients Without Scram (ATWS) Rule. The primary learning objective of this CBT is to know about the background of the ATWS Rule, key aspects of the Transient and PRA Analysis in relation to both Pressurized Water Reactors (PWR) and Boiling Water Reactors (BWR) designs.

ECCS Suppression Pool Sump Debris Impact on Suction Strainers

The training describes the resolution to generic safety concerns with the emergency core cooling system (ECCS) suction strainers due to debris generated by a loss of coolant accident (LOCA) for both PWRs and BWRs. It provides a comprehensive overview of the safety issues and the major analysis and testing steps that are taken to resolve the issues. In addition, it gives a summary of historical and on-going regulatory requirements from the NRC on the performance of ECCS suction strainers and the actions taken by the industry to address the issues.

Fire Protection

This CBT looks at fire protection as applied to commercial nuclear power plants in the United States. Fire protection impacts design, operation, maintenance, and training at a plant. The CBT attempts to address major issues in this complex and changing fire protection landscape.

Control Room Habitability

This CBT is a comprehensive, nuclear industry generic overview of Control Room Habitability. The primary learning objective of this CBT is to describe the regulatory basis, key design features, and testing related to Control Room Habitability.

Control of Heavy loads

The CBT provides a comprehensive overview of both the background and current requirements for the Control of Heavy Loads applicable to nuclear power stations. The primary learning objective is for the trainee to become familiar with the design basis for nuclear power station Control of Heavy Loads, related major equipment such as cranes, hoists, rigging equipment, and important design documents applicable to both PWR and BWR designs.

Aux Power System Design Basis

The CBT is a comprehensive, nuclear industry generic overview of Auxiliary Power Systems Design Basis. The primary learning objective of this CBT is for the trainee to become familiar with the design basis of nuclear power station Aux Power Systems, major equipment, such as buses and circuit breakers, medium voltage equipment, key aspects of system logic, and important design documents applicable to both PWR and BWR designs. Background CBTs include Switchyard, Protective Relaying, Cable Aging Management, Molded Case Circuit Breakers, and Setpoint Methodology and Standard Design Process but are not required to be completed prior to taking this CBT.

Design and Licensing Basis

The CBT is a comprehensive, nuclear industry generic overview of Design and Licensing Basis. The primary learning objective of this CBT is for the trainee to become familiar with the technical background of and the regulatory requirements for the design and licensing basis of nuclear power stations. Information provided will be applicable to both PWR and BWR designs, will include details of key industry documents, typical documentation in place at nuclear sites and the interaction of design basis documentation with NRC commitments. The controls needed for updating the design and licensing basis for each nuclear site will also be presented.

MOV Program

This CBT is a self-paced, comprehensive, nuclear industry generic overview of the Motor Operated Valve (MOV) Program. The training will provide generic design and licensing basis for understanding MOVs. The engineer will learn the specifics of MOV design types, modes of operation, maintenance and testing of MOVs, regulatory requirements, and considerations for performing engineering evaluations.

Station Blackout (SBO)

This CBT is a detailed, comprehensive, nuclear industry generic overview of Station Blackout. The primary learning objective of this CBT is for the trainee to become familiar with the technical background of and the regulatory requirements for Station Black Out for nuclear power stations. Information provided will be applicable to both Pressurized Water Reactors (PWR) and Boiling Water Reactors (BWR) designs, include details of key industry documents, typical documentation in place at nuclear sites and the interaction of design basis documentation with NRC commitments.

AET CBTs in Development

Fukushima Operator Response

This CBT explores the decisions and actions of the plant staff at Fukushima Daiichi and Fukushima Daini. The CBT is targeted for nuclear plant key managers, and identifies key gaps in technical decision making that has its roots in eroded staff technical competency. This CBT supports the nuclear industry's Technical Competency improvement initiative.

Maintenance Rule (10 CFR 50.65)

The CBT provides a comprehensive overview of both the background and current requirements for the Maintenance Rule applicable to nuclear power stations. The primary learning objectives of the CBT are for the trainee to become familiar with the Code of Federal Regulations (10 CFR 50.65) requirements and the implementation of the Maintenance Rule at nuclear power stations via the available industry guidelines.

Heat Exchangers (GL 89-13)

This CBT is a comprehensive, nuclear industry, generic overview of the NRC Generic Letter 89-13 Service Water Problems Affecting Safety-Related Equipment. The training will provide the students with the knowledge necessary to describe each of the five actions recommended by the NRC in GL 89-13 to provide technical support of heat exchanger inspection and tests related to the GL 89-13 program, and to determine guidance for inspection and testing of Service Water heat exchangers and components.

Check Valves

The CBT provides a comprehensive overview of both the design and operation of different types of check valves in nuclear power stations, frequently encountered problems with check valves, and check valve diagnostic techniques using Non-Intrusive Testing (NIT) tools. The targeted audiences of the CBT are nuclear plant check valve engineers, check valve maintenance mechanics, IST engineers, and key Program Engineering, Maintenance, and IST Managers. The primary learning objectives are for the trainees to become familiar with check valve designs and operation, know significant Nuclear Industry Operating Experience (OE), and learn how to effectively manage check valve reliability improvement programs in both BWR and PWR Plant designs.

AET CBTs Under Consideration

- Cathodic Protection
- Human Factors (NUREG 0700)
- ASME Section XI Repairs
- AOV Program
- ISFSI, Dry Cask Storage (10 CFR 72)
- Diesel Generators Large Asset Management
- Motor Fundamentals & Large Motor Asset Management
- Erosion, Corrosion, and Flow-Accelerated Corrosion (EPRI 1010793)
- BWR Containment (Mark I & II issues, Hardened Vents, Backpressure credits)
- Power Uprate
- EQ (10 CFR 50.49)

Advanced Engineering Trainings Offered by Others

Appendix J Program (Structural Integrity)

This training is for both the new and existing qualified Program Owners. Managing a power plant's Appendix J Program requires talents from various disciplines, combined with practical ability and a good understanding of the regulatory requirements. Designed as a practical application of Appendix J regulatory requirements, the True North course blends those regulatory requirements and specific plant activities emphasizing industry best practices.

Art of Calculation (NuEnergy)

This classroom training applies to all engineering disciplines. It addresses calculation elements, process of calculation review, revision and preparation, and provides details on how this work is performed. Concepts gained from this training can be applied to maintain compliance with plant's license and to assure the integrity of its design in activities related to review, revision and preparation of calculations, irrespective of the type of software.

ASME Section XI (Structural Integrity)

This course provides an overview of the design by analysis methodology and philosophy of ASME Section VIII, which incorporates an overview of the analysis methods used, including the application of finite element analysis, to meet the requirements of the Code and how it can be applied to practical equipment design.

ASME Section XI (Inservice Engineering)

The 3-day training provides a wide spectrum of topics related to ASME Section XI and prepares the student to understand and implement the requirements of ASME Section XI. The training is intended for all level of personnel in their respective disciplines and is tailored to the experience level of the participants.

Component Classification (EPM)

EPM uses a proven, streamlined approach for determining safety classification of components in nuclear power plants. This process results in accurate classification of all components at a very low cost. EPM has applied its methodology using established criteria in the re-classification of components at multiple nuclear facilities, and our efforts have resulted in significant cost savings for our clients.

Corrosion and Corrosion Conrtol - Microbiologically Influenced and Other Raw Water Corrosion (Structural Integrity)

This classroom training focuses on raw water corrosion fundamentals and on identification, monitoring, and mitigation of cooling water system corrosion. It is a practical starting point for more-specialized courses on corrosion. The course will provide the student with practical application of corrosion theory and how to monitor and mitigate the effects of Microbiologically-influenced corrosion (MIC).

Corrosion and Corrosion Control - Light Water Reactors (Structural Integrity)

This training focuses on fundamentals, causes, and control of corrosion in light water reactors (LWRs). LWR corrosion degradation mechanisms covered include general/ uniform corrosion, galvanic corrosion, de-alloying corrosion, crevice corrosion, pitting corrosion, intergranular attack (IGA), corrosion fatigue/environmentally assisted fatigue (EAF), intergranular stress corrosion cracking (IGSCC), primary water stress corrosion cracking (PWSCC) and irradiation ssisted stress corrosion cracking (IASCC).

Design and Licensing Basis Fundamentals (NuEnergy)

The one-day training covers the interrelationship between Licensing Basis, Design Basis, and Plant Documents. It identifies commonly-used requirements in 10 CFR and discusses the potential consequences of non-compliance. This training is based on the trainer's hands-on engineering experience and participation in over one hundred of the NRC engineering inspections.

Design Review Process (NuEnergy)

This training builds on the knowledge acquired from the Design & Licensing Basis Fundamentals training, completion of which is a prerequisite requirement for this training. It is recommended that this and Design & Licensing Basis Fundamentals to be delivered as a single 2-days training session to maximize both the training and cost efficiencies. The training discusses the purpose and the top down and bottom up elements of the Design Review process. It also covers the potential consequences of non-compliance.

FAC Program (True North)

This Flow-Accelerated Corrosion or FAC training is aimed at both the new and existing qualified program owners. The training covers important technical areas including history of FAC events and industry response, key program elements, responsibilities of a FAC Program Manager, CHUG participation, CHECWORKSTM SFA Analysis, and related best practices. The training also covers other areas such as Mechanical Degradation Mechanisms (Erosion), inspection scope, FAC NDE techniques, vessels, long-term strategy, operating experiences and industry response.

Fire Protection (Jensen Hughes)

This is a three-day overview course that is the culmination of best practices from JENSEN HUGHES predecessor companies. It provides an overview of fire protection regulations and guidance, fire protection system and feature design, safe shutdown analysis, Fire PRA, fire protection programs and fire modeling. The course meets the needs of new and experienced nuclear power professionals.

Flaw Evaluations - ASME Code Case N513- (Structural Integrity)

This classroom training offers a practical application of flaw evaluation methodologies that meet NRC requirements. Students will gain an understanding of the basic flowchart for ASME Section XI flaw evaluations and will be able to describe linear-elastic, elastic-plastic, and limit load evaluation techniques. It also provides examples that illustrate management of degraded and leaking piping and how to properly implement ASME Code Case N-513 and other evaluation alternatives.

Fracture Mechanics (Structural Integrity)

This classroom training covers the fundamentals of fracture mechanics (FM) and common applications of fracture mechanics in the nuclear power industry. Topics include linear elastic and elastic plastic fracture mechanics, methods for computation of stress intensity factors, fatigue life, and stress corrosion life. Selected applications of the ASME Code and an introduction to probabilistic fracture mechanics (PFM) is also included.

Fuel Manufacturing Issues Affecting Performance (Structural Integrity)

This classroom training examines the critical processing steps in the fabrication of nuclear fuel in relation to the potential for manufacturing upsets that adversely affect in-core performance. It provides the trainee with an overview of fuel pellet, rod and assembly fabrication processes. In the training, critical stages of the manufacture of nuclear fuel where upsets could lead to reduced performance will be identified. The training will also address industry-related issues that have likely fabrication-related causal factors, and identify good practices that minimize the potential for performance loss.

Fuel Rod Performance Modeling (Structural Integrity)

This training addresses a number of topics such as burnup-induced pellet changes and increased hydrogen uptake (as a byproduct of corrosion) occurring at higher burnups, impacts both steady-state operation and licensing issues such as postulated Reactivity Initiated Accidents (RIA), Loss-Of-Coolant Accidents (LOCA), as well as spent fuel storage and transportation. It also focuses on why utilities have a need for an accurate and effective predictive fuel performance computational capability to provide guidance for both reactor operation, as well as feedback to the fuel design process.

IST Program (True North)

The classroom training is a comprehensive training with respect to In-service Testing and addresses requirements of NRC and ASME Operations and Maintenance (O&M) Standards for the in-service testing of nuclear power plant systems and components. Specific emphasis is placed on the ASME Code boundary classification process, owner's responsibilities, test and examination plans, and detailed requirements for in-service testing of pumps and valves. Several examples are used to illustrate the correct application of the technical requirements.

MOV OMN1 Appendix III Program (True North)

True North Consulting provides this classroom training for both the new MOV Program Owner and/or requalification for existing qualified Program Owners. This two-day course addresses transition to ASME Code Case OMN-1/Appendix III. It consists of an MOV operational review, discussion of generic letters (GLs) 89-10 and 96-05, and regulatory guide (RG) 1.192 relative to OMN-1/Appendix III and the associated Code requirements. Several examples will be used to illustrate the correct application of the OMN-1/Appendix III transition requirements.

Nondestructive Examination for Engineers and Managers (Structural Integrity)

In this course, NDE methods are reviewed on an industry-specific basis and a general introduction and review of the most common NDE methods is presented. A more focused review of frequently used NDE technologies and techniques is provided, including multiple hands-on technology demonstrations. Structural Health Monitoring (SHM) concepts and technologies are also reviewed. A general process for matching inspection needs with NDE methods, technologies, and techniques is also provided. Participants will learn basic quality control measures, recommended reporting requirements, planning and strategies for the effective utilization of NDE results.

Pellet Clad Interaction (Structural Integrity)

This classroom training enhances awareness of PCI-type failures and effective mitigation strategies. As such, the course addresses the PCI-type failure mechanism, including contributory local fuel and cladding phenomena. In support of the nuclear industry's initiative to eliminate fuel failures, our fuel experts worked with the Electric Power Research Institute (EPRI) to develop multiple fuel reliability guidelines for use by utility personnel and industry oversight organizations.

Plant Vibration Fundamentals and Solution Development (Structural Integrity)

This classroom training is provided in an interactive, hands-on manner, using actual case studies and live demonstrations to reinforce basic vibration principles and encourage retention of advanced concepts. This course ties in concepts of structural dynamics, stress analysis, applied mechanics/materials, and instrumentation and testing to develop a comprehensive understanding of vibration mechanisms and equip students to solve vibration problems in the field.

Section VIII High Pressure Vessel Design by Analysis (Structural Integrity)

The classroom training provides an overview of the design by analysis methodology and philosophy of ASME Section VIII, which incorporates an overview of the analysis methods used, including the application of finite element analysis, to meet the requirements of the Code and how it can be applied to practical equipment design. The focus of this course will be to emphasize the more modern and advanced analytical techniques found in ASME Section VIII Division 3 while contrasting the differences within Section VIII Division 2.

Spent Fuel Integrity Analysis in Transporting Casks (Structural Integrity)

This classroom training is meant for Licensed Senior Reactor Operators, nuclear engineering staff, fuel handling staff and individuals involved with spent fuel storage who seek better understanding of spent fuel storage integrity issues. It focuses on the evaluation of spent fuel conditions under long-term dry storage and hypothetical transportation accidents. Topics include the evaluation of fuel rods/cladding damage mechanisms and damage states during dry storage, and use of these damage states as initial conditions for detailed dynamic impact analysis and failure evaluation of cask/fuel rods under the transportation conditions.

Thermal Performance Program Advanced (True North)

The four-day training includes various workshops where the student uses tools to analyze plant problems. Interfaces with various departments are discussed along with how to integrate plant data into the decision-making process. Prerequisites and requirements are a calculator, a Heat Balance Diagram and/or Thermal Kit for your plant, a laptop with excel installed. This training and the instructors can provide Thermal Performance training for Level 3 Engineers.

Thermal Performance Program Basic (True North)

This four-day training includes various workshops where the student uses tools to analyze plant problems. Interfaces with various departments are discussed along with how to integrate plant data into the decision-making process. Prerequisites and requirements are a calculator, a Heat Balance Diagram and/or a Thermal Kit for your plant. This training and the instructors can provide Thermal Performance training for Level 1, 2, and 3 Engineers.

UPTI Program (True North)

The training covers areas including buried and underground piping and tanks, key elements of an effective UPTI program, responsibilities and interfaces for the Program Owner, procedures, instructions, and industry documents, coatings, examination and inspections tools, piping repairs and so on.

Welding and Materials (Structural Integrity)

This classroom training provides an in-depth review of welding at nuclear power plants, including welding process fundamentals, materials and metallurgy, and relevant Codes and Standards. The instructors bring many years of experience and practical applications that incorporate industry best practices to this class.

Additional Training Information Links

EPRI 2019 Nuclear Training List

Contains a list of EPRI nuclear trainings on topics such as Chemistry, Engineering, Fuel Reliability Program, Nuclear Maintenance, Materials, Welding and Repair, Nondestructive Evaluation Program, Risk and Safety Management.

EPM 2020 Brochure

Contains a list of trainings providing cost-effective solutions for safe and reliable operation of nuclear power plants. The trainings are in the categories of fire safety, risk analysis and risk management, Engineering programs and other support services, and software solution tools.

Information About NANTeL

NANTeL is a web-based learning management system owned and hosted by the Institute for Nuclear Power Operations (INPO) in Atlanta, GA. Access to NANTeL requires a NANTeL user ID and password. Every utility in the U. S. has at least one NANTeL administrator who has the rights to create new users.

Contact your training department to determine who your NANTeL Administrator is or click here.

In order to get access to any CBT on NANTeL including AET CBTs, you must first request that a NANTeL administrator assign the course to you.

ADVANCED ENGINEERING TRAINING

ABOUT AET

The Advanced Engineering Training initiative is a nuclear industry effort to develop technical computer based training modules for targeted areas of engineering expertise. The modules are being developed using the systematic approach to training and are being designed to maintain industry engineering expertise and to facilitate engineering knowledge transfer.

AET is funded and sponsored by the US nuclear utility engineering vice presidents and directors.

AET is led by the following engineers:

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