



# The Art of Calculation



## Classroom Instructor

**Michael Shlyamberg, P.E.**

Mr. Shlyamberg has over forty years of engineering and management experience in the design, analysis, startup, maintenance, operation, and inspection of nuclear (BWR, PWR, CANDU, RBMK) and fossil power plants, industrial facilities, and DOE installations. Since 1993 he has been providing independent consulting services to the NRC, Utilities, and the DOE.

Mr. Shlyamberg in cooperation with other Nuenergy's associates developed this training to address recurring, industry-wide incidents, that demonstrated a lack of understanding and knowledge of calculation fundamentals and the ability to perform an adequate review, revision, and/or generation of calculations. This training reflects their combined calculation related experience includes either development or a detailed review of most types of system & component level mechanical and electrical calculations.

## Intended Audience

Design & Systems Engineering personnel, their first-line supervisors and Shift Technical Advisors.

## Duration

Two (2) days.

## Type

Classroom

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# Terminal Learning Objectives

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This training applies to all engineering disciplines.

## Goals:

1. Foster critical thinking.
2. Enhance ability to apply scientific principles towards formulation and solution of engineering problems.
3. Learn what differentiates calculation from a computation.
4. Apply knowledge of concepts gained from this training 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.

## Enabling Learning Objectives

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### Part 1

1. Define Training Scope (**What**)
  - This training addresses
    - Calculation Elements
    - Process of calculation review, revision and preparation
    - Provides details on how this work is performed
2. Define **Why** calculations are performed differently than computations
3. Define Elements of Calculation (**How**)
  - Adequacy of Calculation as a Stand-Alone Document
    - Problem Statement (Purpose / Scope / Objective) and Limits of Applicability
    - Methodology, Approach
    - Acceptance Criteria
    - Assumptions
    - Design Inputs
    - Computational Technique
    - Results & Conclusions
    - Overall Assessment
  - Effect of Calculations on Plant's Design Basis and Licensing Basis (DLB), discussion, case study – Day 2
4. Define Calculation Review Process, Case Studies. All Case Studies utilize INPO training techniques of dynamic learning activities (DLA).
  - Case Study 1, Electrical Design: Station Battery Short Circuit Evaluation
  - Case Study 2, Electrical Design: Degraded Voltage Analysis – includes 2 Exercises
  - Case Study 3, Mechanical Design: EFW Pump Analysis – includes 3 Exercises

### Part 2

5. Define Calculation Revision Process – DLA Case Study 4-A, Replacement of SW Pump
  - Determine Scope of Revision
    - Physical and Functional Boundaries
    - “You Touch It, You Own It” Rule
    - Safety Screen/Evaluation (10 CFR 50.59)
6. Define Guidelines for the Interdisciplinary Review – DLA Case Study 4-B, Replacement of SW Pump
7. Effect of Calculations on Plant's DLB – DLA Case Study 4-C, Replacement of SW Pump
8. Acquire First Hands Knowledge of Calculation Preparation Process – Dynamic Learning Activity:
  - Three (3) Case Studies
    - Case Study 5, Mechanical Design: NPSHA Calculation
    - Case Study 6, Electrical Design: EDG High Resistance Neutral Grounding System
    - Case Study 7, Mechanical Design: Component Cooling Water Heat Exchanger Testing

## Key Industry Documents

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- 10CFR50, Appendix B
- ASME BPVC, Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components
- ANSI N45.2.11-1974; NQA-1 1994 Edition
- IEEE & NFPA Standards
- INPO ACAD 98-004, Revision 4, November 2017, Guidelines for Training and Qualification of Engineering Personnel

## Other Related Information

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This training has been successfully implemented at:

- Exelon University
- Entergy Operations, Inc.

Each attendee is eligible to receive up to 2 CEUs upon a successful completion of the course

This training aids in addressing guidance of INPO ACAD 98-004, Revision 4.

In addition to a copy of a training material (~ 250 slides), each trainee will receive a Desktop Guide – The Art of Calculation Review, Revision and Preparation of Safety Related Calculations that addresses all engineering disciplines (~ 200 pages).

Contributors:

- Mr. Bowman, an electrical engineer with over 30 years of experience. He is active in IEEE: chair, officer, member. Past Chair of the ETAP Nuclear Utility Users Group.