



Online Training for PROTO Series Software

Zachry Nuclear is pleased to offer online training options for the PROTO Series software packages using the Microsoft Teams platform. The courses cover both the software development theory as well as hands on model development and troubleshooting. This combination ensures that students understand the program's methodology in addition to becoming adept at using the software.

If you are interested in an unscheduled course contact us for potential scheduling with others who may have requested the same course. A minimum class of four attendees is required to schedule on a mutually agreeable date.

If there are topics of interest for additional courses please contact us.

If your company has four or more employees interested in any of the training classes, you can request to schedule a special session on mutually agreeable dates with Zachry Nuclear. These special sessions could cover previous versions of the software.

Class Details

- Each class will consist of instructor led presentation, including theory, guided example(s), and time for Q&A, followed by a hands-on exercise.
 - Approximate lengths of the instructor led presentation for each class are listed in the Course Descriptions.
 - An appointment with a link to join the class through Microsoft Teams will be provided at least 1 week prior to the scheduled class.
- Participants can either stay online while completing the exercise or complete on their own time after the class.
 - The instructor will remain online after the class to answer questions for anyone that chooses to remain online.
 - Alternatively, participants will have access to the instructor via email, telephone, or a 1-on-1 session through Microsoft Teams for up to 1 week after the class to ask questions or check the results of the exercise.
- Due to the hands-on nature of the class, it is required that each student participating be individually connected to the Teams session to allow for interaction and screen sharing as needed for questions.
- It is recommended that participants have access to an additional monitor to be able to view the software as well as the presentation.
- All classes will be conducted using the latest version of the software. Participants must have the software installed and usable prior to the class.
- Participants will also be given access to an electronic copy of the course materials that can be downloaded from a secure file transfer site.



Course Listing	Per Person
<i>Proto-Flo V5.5 Introductory Training with Modeling Best Practices</i>	\$1,200
<i>Proto-HVAC V2.0 Introductory Training with Modeling Best Practices</i>	\$900
<i>Proto-Sprinkler V2.0 Introductory Training with Modeling Best Practices</i>	\$900
<i>Proto-HX-Shell & Tube V6.1 Introductory Training with Modeling Best Practices</i>	\$600
<i>Proto-HX-Air Coil V6.0 Introductory Training with Modeling Best Practices</i>	\$600
<i>Proto-HX-Plate & Frame V6.0 Introductory Training with Modeling Best Practices</i>	\$600
<i>Proto-Flo V5.5 Modeling Best Practices</i>	\$150
<i>Proto-HVAC V2.0 Modeling Best Practices</i>	\$150
<i>Proto-Sprinkler V2.0 Modeling Best Practices</i>	\$150
<i>Proto-HX Modeling Best Practices All modules</i>	\$150
<i>Interactive Drawing Tips and Tricks for Proto-Flo, Proto-HVAC, and Proto-Sprinkler</i>	\$150
<i>Batch and Trending for Proto-Flo, Proto-HVAC, and Proto-Sprinkler</i>	\$150
<i>Pump for Proto-Flo, Proto-Sprinkler and Fans for Proto-HVAC</i>	\$150
<i>Concerns for Updating Legacy Flow Models, Junctions, Merging Models, Updating Case Alignments</i>	\$150
<i>Boundary Conditions, Pipe Break Analysis, Nozzles, Siphons and Vacuum Breakers</i>	\$150
<i>Balancing, Model Benchmarking and Uncertainty Evaluations</i>	\$150
<i>Control Valves, Check Valves, and Relief Valves</i>	\$150
<i>Cavitation, Choked Flow, Void Resistances, and Cavitating Venturi</i>	\$150
<i>Heat Exchangers in Proto-Flo</i>	\$150
<i>Proto-HVAC Advanced Topics (Thermostats, Room Pressure Balancing)</i>	\$150
<i>Creating a Heat Exchanger Test Protocol Using PROTO-HX</i>	\$150
<i>Heat Exchanger Test Performance Evaluations Using PROTO-HX</i>	\$150
<i>Tube Pugging Analysis Using Proto-HX (ST & AC)</i>	\$150



Course Descriptions

Proto-Flo V5.5 Introductory Training with Modeling Best Practices

(~two days of sessions including hands-on exercises)

PROTO-FLO is used for calculating steady-state incompressible flows, pressures and temperatures in piping systems and models pumps, valves, heat exchangers, and other components. Course Objectives are to understand PROTO-FLO well enough to be able to use it as part of a Nuclear QA Calculation. At a minimum, this includes:

- Navigate menu items
- Enter system/component geometry information (pipes, pumps, valves)
- Understand and properly model / apply boundary conditions
- Perform calculations and understand output reports
- Develop models with multiple case alignments

Hands-on exercises using provided samples as well as Tutorial lessons will be included.

This course also includes the topics covered in the Modeling Best Practices Course.

No PROTO-FLO experience is required to participate in the training. However, it is recommended that participants who take the training have some understanding of the fundamental principles of thermodynamics, heat transfer, and fluid dynamics.

Proto-HVAC V2.0 Introductory Training with Modeling Best Practices

(~1.5 days of sessions including hands-on exercises)

PROTO-HVAC calculates flows, pressures and temperatures through control dampers, fans, and duct systems for HVAC system balance and performance. Course Objectives are to understand PROTO-HVAC well enough to be able to use it as part of a Nuclear QA Calculation. At a minimum, this includes:

- Navigate menu items
- Enter system/component geometry information (ducts, fans, dampers)
- Understand and properly model / apply boundary conditions
- Perform calculations and understand output reports
- Develop models with multiple case alignments

Hands-on exercises using provided samples as well as Tutorial lessons will be included.

This course also includes the topics covered in the Modeling Best Practices Course.

No PROTO-HVAC experience is required to participate in the training. However, it is recommended that participants who take the training have some understanding of the fundamental principles of thermodynamics, heat transfer, and gas dynamics.

Proto-Sprinkler V2.0 Introductory Training with Modeling Best Practices

(~1.5 days of sessions including hands-on exercises)

PROTO-SPRINKLER models and evaluates fire sprinkler systems following the standard methodology and approach for calculations as specified in NFPA 13, “Standard for the Installation of Sprinkler Systems”, and NFPA 15, “Standard for Water Spray Fixed Systems for Fire Protection”. Course Objectives are to understand PROTO-Sprinkler well enough to be able to use it as part of a Nuclear QA Calculation. At a minimum, this includes:

- Navigate menu items
- Enter system/component geometry information (cross-mains, branches, pumps, valves, nozzles)
- Understand and properly model / apply boundary conditions
- Perform calculations and understand output reports
- Develop models with multiple case alignments, including demand flow vs available flow

Hands-on exercises using provided samples as well as Tutorial lessons will be included.

This course also includes the topics covered in the Modeling Best Practices Course.

No PROTO-SPRINKLER experience is required to participate in the training. However, it is recommended that participants who take the training have some understanding of the fundamental principles of fluid dynamics, fire protection, and NFPA codes.

Proto-HX-Shell & Tube V6.1 Introductory Training with Modeling Best Practices

(~1 day of sessions including hands-on exercises)

PROTO-HX calculates temperature and heat transfer rates in shell and tube heat exchangers and predicts system performance. Course Objectives are to understand PROTO-HX Shell & Tube well enough to be able to use it as part of a Nuclear QA Calculation. At a minimum, this includes:

- Define the heat transfer equations that are used as the basis for the solution methodology.
- Create a Shell & Tube Heat Exchanger model given all necessary input parameters.
- Benchmark the model against vendor data sheet.
- Evaluate Heat Exchanger Test Data
- Performance Extrapolations to off-design conditions

Hands-on exercises using provided samples as well as Tutorial lessons will be included.

This course also includes the topics covered in the Modeling Best Practices Course.

No PROTO-HX experience is required to participate in the training. However, it is recommended that participants who take the training have some understanding of the fundamental principles of thermodynamics and heat transfer.

Proto-HX-Air Coil V6.0 Introductory Training with Modeling Best Practices

(~1 day of sessions including hands-on exercises)

PROTO-HX calculates temperature and heat transfer rates in air cooling coil heat exchangers and predicts system performance. Course Objectives are to understand PROTO-HX Air Coil well enough to be able to use it as part of a Nuclear QA Calculation. At a minimum, this includes:

- Define the heat transfer equations that are used as the basis for the solution methodology.
- Create an Air Coil model given all necessary input parameters.
- Benchmark the model against vendor data sheet.
- Evaluate Heat Exchanger Test Data
- Performance Extrapolations to off-design conditions

Hands-on exercises using provided samples as well as Tutorial lessons will be included.

This course also includes the topics covered in the Modeling Best Practices Course.

No PROTO-HX experience is required to participate in the training. However, it is recommended that participants who take the training have some understanding of the fundamental principles of thermodynamics and heat transfer.

Proto-HX-Plate & Frame V6.0 Introductory Training with Modeling Best Practices

(~1 day of sessions including hands-on exercises)

PROTO-HX calculates temperature and heat transfer rates in plate and frame type heat exchangers and predicts system performance. Course Objectives are to understand PROTO-HX Plate & Frame well enough to be able to use it as part of a Nuclear QA Calculation. At a minimum, this includes:

- Define the heat transfer equations that are used as the basis for the solution methodology.
- Create a Plate & Frame Heat Exchanger model given all necessary input parameters.
- Benchmark the model against vendor data sheet.
- Evaluate Heat Exchanger Test Data
- Performance Extrapolations to off-design conditions

Hands-on exercises using provided samples as well as Tutorial lessons will be included.

This course also includes the topics covered in the Modeling Best Practices Course.

No PROTO-HX experience is required to participate in the training. However, it is recommended that participants who take the training have some understanding of the fundamental principles of thermodynamics and heat transfer.

Proto-Flo V5.5 Modeling Best Practices

(~ 2hr session including hands-on exercises)

Recommendations of where to start in model planning and determining the purpose and potential applications of the model will be discussed. Discussion will also include recommended modeling processes from gathering information needed for the model and what to do when you cannot fill in all the blanks.

This training is intended for individuals that have already completed the introductory training class or are already proficient working with PROTO-FLO.

Proto-HVAC V2.0 Modeling Best Practices

(~ 2hr session including hands-on exercises)

Recommendations of where to start in model planning and determining the purpose and potential applications of the model will be discussed. Discussion will also include recommended modeling processes from gathering information needed for the model and what to do when you cannot fill in all the blanks.

This training is intended for individuals that have already completed the introductory training class or are already proficient working with PROTO-HVAC.

Proto-Sprinkler V2.0 Modeling Best Practices

(~ 2hr session including hands-on exercises)

Recommendations of where to start in model planning and determining the purpose and potential applications of the model will be discussed. Discussion will also include recommended modeling processes from gathering information needed for the model and what to do when you cannot fill in all the blanks.

This training is intended for individuals that have already completed the introductory training class or are already proficient working with PROTO-Sprinkler.

Proto-HX Modeling Best Practices All modules

(~ 2hr sessions including hands-on exercises)

Recommendations of where to start in model planning and determining the purpose and potential applications of the model will be discussed. Discussion will also include recommended modeling processes from gathering information needed for the model and what to do when you cannot fill in all the blanks.

This training is intended for individuals that have already completed the introductory training class or are already proficient working with PROTO-HX.

Interactive Drawing Tips and Tricks for Proto-Flo, Proto-HVAC, and Proto-Sprinkler

(~ 2hr session including hands-on exercises)

One of the biggest improvements made to the PROTO series of software has been the drawing interface. This training will dive deeper into the drawing features to help you convey your model input and output

This training is intended for individuals that have already completed the introductory training class or are already proficient working with PROTO-FLO, PROTO-HVAC and/or PROTO-Sprinkler.

Batch and Trending for Proto-Flo, Proto-HVAC, and Proto-Sprinkler

(~ 2hr session including hands-on exercises)

Batch processing is one of the most powerful tools that our software provides. It allows the user to perform a variety of model manipulations and calculations with minimal inputs. This training will take you through performing batch calculations and how the output data can be trended in formatted reports, user defined reports and user defined graphs.

This training is intended for individuals that have already completed the introductory training class or are already proficient working with PROTO-FLO, PROTO-HVAC and/or PROTO-Sprinkler.

Pump for Proto-Flo, Proto-Sprinkler and Fans for Proto-HVAC

(~ 2hr session including hands-on exercises)

Pumps are one of the most basic components in a PROTO-FLO model. However, many system analyses revolve around various aspects of pump operation. This training will cover the basics of the pump characteristic curve and go deeper into other aspects such as pump affinity laws, NPSH analysis, degraded pump curves, in-service test analysis, and pump operation impacted by diesel droop.

This training is intended for individuals that have already completed the introductory training class or are already proficient working with PROTO-FLO, PROTO-HVAC and/or PROTO-Sprinkler.

Concerns for Updating Legacy Flow Models, Junctions, Merging Models, Updating Case Alignments

(~ 2hr session including hands-on exercises)

Many hours went into developing hydraulic system models using older versions of the PROTO series software or other software packages. This training will cover the best ways to update your old models for use with the latest versions of our software. Converting models developed using other software packages to PROTO-FLO will also be discussed.

This training is intended for individuals that have already completed the introductory training class or are already proficient working with PROTO-FLO.

Boundary Conditions, Pipe Break Analysis, Nozzles, Siphons and Vacuum Breakers

(~ 2hr sessions including hands-on exercises)

Boundary conditions are the interface of a model with systems not included in the model. There are multiple ways to model the same thing. This course will explore the different types of boundary conditions available in PROTO-FLO and some of the real world examples for pipe break analysis, siphons, and vacuum breakers.

This training is intended for individuals that have already completed the introductory training class or are already proficient working with PROTO-FLO.

Balancing, Model Benchmarking and Uncertainty Evaluations

(~ 2hr session including hands-on exercises)

It is good engineering practice to augment a model developed from reference documents with analytical/numerical tuning. This session will provide you with further insights on the functionality of your model and can uncover potential errors or bad assumptions. This training will walk through a PROTO-FLO model tuning example, showing the user how to make model adjustments based on field collected data.

This training is intended for individuals that have already completed the introductory training class or are already proficient working with PROTO-FLO.

Control Valves, Check Valves, and Relief Valves

(~ 2hr session including hands-on exercises)

Valves are more than just a way to isolate flow. This training will provide a refresher on the modeling of valves in PROTO-FLO and then expand into the various aspects of how valves can be used to support various types of analyses. This training will cover how valves can be used to control flow, pressure, and temperature and how “dummy” valves can be used to represent other types of physical phenomena.

This training will also discuss the information necessary to model relief valves and check valves and where that information can be found. The types of analyses that can be performed with properly modelled relief and check valves will be discussed.

This training is intended for individuals that have already completed the introductory training class or are already proficient working with PROTO-FLO.

Cavitation, Choked Flow, Void Resistances, and Cavitating Venturi

(~ 2hr session including hands-on exercises)

Cavitation can cause minor issues such as high noise or major issues such as component failure or pipe breaks. This training will discuss how PROTO-FLO analyzes cavitating and choked flow in orifices and valves. Modeling of cavitating venturis will be covered. Other analysis techniques such as classifying the degree of system cavitation will also be discussed. The newer features of PROTO-FLO to address flashing and vacuum breakers will be included.

This training is intended for individuals that have already completed the introductory training class or are already proficient working with PROTO-FLO.

Heat Exchangers in Proto-Flo

(~ 2hr session including hands-on exercises)

There are many ways to model heat exchangers in PROTO-FLO, from simple (fixed heat load) to detailed (PROTO-HX heat exchanger model). This training will cover all the types of heat exchangers and the types of analyses that can be performed by including heat exchangers in your model. Heat exchangers as the interface between distinct systems, such as the component cooling water heat exchanger as the link between the service water and component cooling water systems will be discussed.

This training is intended for individuals that have already completed the introductory training class or are already proficient working with PROTO-FLO and PROTO-HX.

Proto-HVAC Advanced Topics (Thermostats, Room Pressure Balancing)

(~ 2hr session including hands-on exercises)

Advanced modeling topics will be discussed including using Thermostats to control flow to maintain room temperature using Thermostats. Also discussed will be using the balancing feature to benchmark a model to flow balance test data.

This training is intended for individuals that have already completed the introductory training class or are already proficient working with PROTO-HVAC.

Creating a Heat Exchanger Test Protocol Using PROTO-HX

(~ 2hr session including hands-on exercises)

Using methods from EPRI report *Service Water Heat Exchanger Testing Guidelines* (TR-107397) and republished as 3002005340, the training discusses the process used to create a test protocol for a successful heat exchanger test.

This training is intended for individuals that have already completed the introductory training class or are already proficient working with PROTO-HX.



Heat Exchanger Test Performance Evaluations Using PROTO-HX

(~ 2hr session including hands-on exercises)

Using methods from EPRI report *Service Water Heat Exchanger Testing Guidelines* (TR-107397) and republished as 3002005340, the training discusses the process used to evaluate test data collected from heat exchanger test.

This training is intended for individuals that have already completed the introductory training class or are already proficient working with PROTO-HX.

Tube Pugging Analysis Using Proto-HX (ST & AC)

(~ 2hr session including hands-on exercises)

This training session will discuss how to use PROTO-HX to evaluate the effects of plugging heat exchanger tubes.

This training is intended for individuals that have already completed the introductory training class or are already proficient working with PROTO-HX.
