ASCE | CONTINUING EDUCATION

Pumping Systems and Design

Purpose and Background

This seminar presents the basics of pumping systems design and specifications for civil engineers. An emphasis is placed on the application of pumping systems in municipal water and wastewater systems. Topics covered include pump and system hydraulics; centrifugal pump selection; interpretation of manufacturer's pump head-capacity curves; types of pumping stations; series and parallel operations; variable speed systems friction losses in sludge pumping; specifying of pumps; and some common pump operating problems.

This seminar will provide the hydraulic engineering design needed for successful pump station projects and for providing pumping systems with the necessary hydraulic flexibility required on water and wastewater treatment plants and pumping stations.

Seminar Instructor

David J. Hanna, P.E., M.ASCE, is a graduate of Rensselaer Polytechnic Institute with an M.S. in Environmental Engineering, and a B.S. in Marine Engineering/Mechanical from the United States Merchant Marine Academy. Mr. Hanna is a Professor at Ferris State University with faculty responsibilities in the construction management and surveying engineering programs. He worked for several consulting engineering and construction management firms for eighteen years before joining the faculty at Ferris State University in 1991.

Mr. Hanna is a professional engineer in Ohio. He has designed numerous pumping stations and pumping systems associated with water and wastewater projects. Sizes of the facilities range from 80 gallons per minute to 30 million gallons per day. His experience includes design, construction administration, construction installation and quality control, and startup of new facilities as well as evaluation and troubleshooting of existing pumping and treatment facilities.

Mr. Hanna has served as an instructor on hydraulics, pumping systems and treatment processes to the New York State Department of Environmental Conservation and the New York State Department of Health with operator training and certifications programs. He is a member of ASCE and has been an instructor with the ASCE Continuing Education Division since 1999.

- **For group training, contact John Wyrick (JWyrick@asce.org) or Stephanie Tomlinson (STomlinson@asce.org)**

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Summary Outline

Pump Types and Classification
- Classification of Pumps
- Types of Centrifugal Pumps
- Types of Rotary Pumps
- Types of Positive Displacement Pumps

Basic Hydraulics
- Liquid Characteristics
- Fluid Properties
- Pressure Relationships
- Fluid Statics
- Pumping Terms
- Energy Losses in Pumping Systems (Design Ex. #1)

System Hydraulics
- Flow Regimes
- Pipeline Friction Losses (Design Ex. #2)
- Minor Losses
- System Head Curves (Design Ex. #3)
- Fluid Rheology

Pump Selection
- Impeller Classification
- Specific Speed
- Centrifugal Pump Performance
- Pump Operating Conditions and Duty Points (Design Ex. #4)
- Manufacturer's Pump Curves

Systems Operations
- Affinity Laws of Centrifugal Pumps
- Pumping Application Considerations
- Sump Design Issues
- Net Positive Suction Head (Design Ex. #5)
- Variable Speed Pumping

Types of Stations
- Wastewater Pumping Stations
- Water Pumping Stations

Shop Drawing Review
- Pump Performance Materials
- Contract Coordination

Wastewater Pumps
- Types of Wastewater Pumps
- Selection and Comparison of Wastewater Pumps

Water Pumps
- Types of Water Pumps
- Selection and Comparison of Water Pumps

Sludge Pumping
- Sludge Design Characteristics
- Friction Headlosses (Design Ex. #6)
- Sludge Design Concepts
- Design Guidelines
- Comparison of Sludge Pumps

Station Design
- Design for Expansion
- Increasing Existing Station Capacity
- Designing for Operations
- Designing for Safety
- Design Problems
- Mechanical and Maintenance Design

Avoiding Design Blunders
- General
- Site
- Environmental
- Hydraulics
- Pumps
- Valves
- Mechanical
- Electrical
- Structural/Architectural
- Specifications
- Economics

Who Should Attend?

- Civil, Design, Mechanical and Electrical Engineers
- Consulting Engineers
- Project Managers
- Specification Writers
- Construction and Mechanical Contractors
- Plant Superintendents and Operators
- Approval Agency Plan Reviewers

Seminar Benefits

- Determine which engineering relationships apply to specific pumping situations
- Know the impact of pump machine construction on hydraulic performance
- Learn how to marry theoretical hydraulics with practical pump station and system design
- Learn the latest approaches in wet well design including the new Hydraulic Institute/ANSI Design Standards
- Learn how to design correctly for viscous sludges without using inaccurate "rules of thumb"

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ASCE seminars are available for On-Site Training. For details regarding On-Site Training and/or needs-based training opportunities, please contact:

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