
UNDERWATER BLASTING

DETAILED COURSE OUTLINE

1. Introduction to Underwater Blasting
 - a. Where Underwater Blasting is Used
 - b. How Rock Breaks Underwater from Explosives
 - c. Commercial Explosives used in Underwater Blasting
 - d. Initiation Systems
 - e. Equipment Used in Underwater Blasting
 - f. Regulatory Agencies that Influence Underwater Blasting
2. Underwater Blasting Specifications
3. Underwater Blast Forms
 - a. Master Blasting Plan
 - b. Daily Preblast Plan
 - c. Drill Logs
 - d. Daily Post Blast Plan
4. Underwater Explosions – Unconfined Charge
 - a. The sequence of events in an underwater explosion
 - b. Detonation of explosives
 - c. Measurement of Underwater Pressures
 - d. Shock Wave Generation
 - e. Gas Sphere Expansion
 - f. Secondary Pressure Waves
 - g. Surface and Other Effects
5. Underwater Explosions – Confined Charges
 - a. Equations for Charges in Water Column
 - b. Pressure Waves from Confined Charges
 - c. Equations for Stemmed Charges in Blastholes
 - d. Pressure Wave Parameters
 - e. Pressure Wave Predictions

6. Underwater Blast Design
 - a. Burden
 - b. Stemming
 - c. Subdrill
 - d. Stiffness Ratio
 - e. Spacing
 - f. Timing
 - g. Blast Patterns
 - h. Examples
7. Underwater Blasting Safety
 - a. Barge Safety
 - b. Equipment Safety
 - c. Explosive Safety
 - d. Underwater Blasting Safety
8. Underwater Environmental Aspects
 - a. Underwater Impulse
 - b. Marine Life Considerations
 - c. Marine Life Blasting Safety Zones
 - d. Underwater Air Curtains
9. Surface Environmental Aspects
 - a. Ground Vibration Standards
 - b. Damage Criteria for Surface Structures
 - c. Scaled Distance and Ground Vibration

COURSE GRADING

The course will consist of online quizzes which will be taken after each major section to ensure students have reviewed the videos and have understood all the content presented. This course will then have a final course project assigned for development of a master blasting plan for a project given a sample RFP and set of specifications.

COURSE GOALS

The goal of this course is to teach mining, explosive, and civil engineers the concepts of underwater blasting and teach students who have no previous knowledge of explosives to be able to effectively design, implement, and monitor the blasting process underwater on large construction projects. This will be achieved through teaching the following points:

1. How commercial explosives are practically used in the underwater heavy civil environment (marine salvage, harbor deepening, and construction)
2. How to effectively communicate with regulatory agencies that advise, contract, and regulate underwater blasting
3. How to safely handle and use explosives underwater and perform safely in a marine construction environment
4. How underwater explosives work to create energy in the water, including unconfined and confined charges, which will set up students to understand the environmental aspects of blasting
5. How to design the borehole locations, explosive loads, and timing sequence that will create an efficient blast underwater while maximizing fragmentation for diggability and minimizing environmental aspects
6. How underwater blasts effect underwater structures and marine life
7. How to minimize underwater pressures to increase safety of marine life
8. How to identify potential damage sources for surface structures from a underwater blast
9. How to predict peak particle velocity on the surface for underwater blasts
10. How to effectively read and edit underwater specifications to bid projects without the risk of major loss of profit and to effectively rewrite underwater blasting specifications to avoid change orders and ensure compliance

COURSE INSTRUCTORS

DR. CALVIN J. KONYA

Dr. Konya is the current President of Precision Blasting Services and the Director of the Academy of Blasting and Explosive Technology. He was the first founder, first president, and first executive director of the International Society of Explosive Engineers; was a Professor at West Virginia University and the Department Chair of Mining Engineering at the Ohio State University. He has worked on dozens of underwater blasting projects including the Panama Canal, Miami Harbor, Kill van Kull (New York), Calumet Harbor, and many other underwater blasting projects.

ANTHONY KONYA

Anthony is currently a Senior Project Engineer with Precision Blasting Services and an Instructor with the Academy of Blasting and Explosive Technology. He currently also teaches Mine Health and Safety and Specialty Uses of Energetic Materials at the Missouri University of Science and Technology. Anthony has worked on numerous U.S. Army Corp of Engineers projects and has extensive research in environmental aspects of blasting.