

# MINING CAREERS



Adapted from "Career Match," created by the Women in Mining Education Foundation and "Exploring Opportunities: CAREERS in the Minerals Industry" from the Society for Mining, Metallurgy and Exploration

Today's minerals industry offers a wide range of rewarding careers that feature top salaries, travel and the chance to work with advanced technology.

This handbook provides an overview of these opportunities and could put you on the path to an exciting career in the minerals industry.

Mining is one of the highest paying industries. There are many different types of jobs in mining and they all have different requirements. Some jobs require a high school diploma or GED. Others require special skills certification and others need college degrees. Some mines provide on-the-job training and all mines provide safety training and certification

### Accountant

An accountant provides cost information for the mine site. This includes the maintenance of the general ledgers, reviewing payroll records, and much more. As an accountant you will need a bachelor's degree in accounting or business administration. You may also be required to obtain a CPA (Certified Professional Accountant) certificate. High school courses that will help prepare for this career are Math, Accounting, Bookkeeping, Computer Science, English and Speech.

### Administrative Assistant

An administrative assistant assists various departments with clerical functions, routes mail, type reports and maintain files. You will also route calls and visitors and work with various types of office machines (computers, copy machines, calculators, etc.). An administrative assistant needs a basic high school diploma or GED. Helpful high school courses are Math, English, Computer Science, Typing and Office Machines. You may wish to obtain a business certificate from an accredited business school or college.

### Assayer

An assayer determines procedures for sample preparation and performs fire assaying. In addition, you will do analysis that determines the quantity of elements in the sample through atomic absorption, perform basic assay calculations, and fill out daily reports. You will need a high school diploma or GED and at least six months experience related to fire assaying and sample preparation. You must also pass written and hands on tests for basic assay calculations, assay techniques, reagents and safety policies. Helpful high school courses include Math, English, Chemistry, and Computer Science.

## Assay Technician

Assay technicians collect samples from the mine. Samples need to be split, dried, crushed, split again and pulverized to the consistency of talcum powder. You will operate different types of pulverizers, lab-sized crushers, and a forklift. You will keep daily records of sample preparation activities. In addition, some maintenance and computer skills are necessary. You will need a high school diploma or GED and either on-the-job-training or vocational school. You will also need to be in good physical condition. Helpful high school courses include English, Math, Science, Chemistry, Computer Science, and Physical Education.

## Blaster

As a blaster, you will learn how to safely handle explosives, load and tie in blast patterns, calculate the tons of rock broken and quantities of explosives used. You will also gain an understanding of the basics of blasting, be able to fill out all required reports, and be able to communicate effectively both verbally and in writing. To be a blaster you will need a high school diploma or GED and a minimum of one to two years experience working as a laborer on a powder crew. You will also be expected to attend any required blasting schools and may be required to obtain a State Certified Blasting License. Helpful high school courses are Math, English, Computer Science, and Speech.



Photo courtesy of Mining Engineering Magazine

Equipment maintenance is important for safety.

## Crusher Operator/ Mechanic

You will operate and maintain all equipment associated with the crushing system. This includes all support equipment (trucks, loaders, dozers, forklifts and bobcats). You will also be required to perform physical work in an effort to keep the crushing system operational. You will need to be able to make decisions concerning the timeliness of repairs to lessen downtime. You will need a high school diploma or GED and will receive on-the-job-training or vocational schooling. You will need to be good physical condition, have a background in mechanics, and have good verbal and written skills. Helpful high school courses are Math, English, Computer Science, Shop, and Physical Education.

## Driller

A driller is required to operate equipment safely and efficiently. You will have to perform all pre-shift inspections, drill holes to designated depths, collect cutting samples to the proper specifications, change bits and hammers on the drill to keep it operational, and fill out all required reports. You will also need to be able to communicate effectively. You will need a high school diploma or GED and a minimum of one to two years mining experience. You may also wish to have some blasting and or lab experience to help you understand the results of the job. Helpful high school courses are Math, English, Science, and Auto Shop.

## Electrician

An electrician works on electrical construction, instrumentation, and all electrical repairs on mine equipment. You will also be required to use electrical hand and power tools, plus electrical test equipment. In addition, you must have a working knowledge of Alternating Current (AC) and Direct Current (DC), electrical theory, and be able to work from schematics and blueprints. You must be willing to train on programmable controllers and computers. You will also be required to pass a written test. You will need a high school diploma or GED and experience in maintenance, electrical construction, instrumentation, or other associated electrical fields. Helpful high school courses: Math, Physics, Drafting, Auto Shop, Computer Science, and any other opportunities that provide a background in electronics. Trade schools and the U.S. Military branches provide excellent technical training for this field.

## Environmental Manager

An environmental manager is responsible for water, soil, and air monitoring procedures, and filling out the required reports, implementing environmental programs that include reclamation and water management. In addition, you will guide on-site environmental tours and inspections. You will need a college degree in Environmental Science, Engineering, Geohydrology, Metallurgy, Geology, Chemistry, or Resource Management. In addition, you may need one to two years experience in the mining industry. Helpful high school courses are English, Chemistry, Earth and Biological Science, Computer Science, and Math.

## Environmental Technician

An environmental technician conducts water, soil, and air monitoring activities. You will be responsible for computer data entry and the proper documentation of your activities. You will interact with all kinds of people on the mine site, as well as State and Federal regulatory personnel. This is an entry-level position that may advance to Environmental Specialist or Engineer or Environmental Manager. You will need a high school diploma or equivalent with one to two years experience in the mining industry. You will need to be in good physical condition, and have good verbal and written communication skills. In order to advance you will need a college degree in Environmental Science, Environmental Engineering, Geology, Biology, Chemistry, or Resource Management. Helpful high school courses are Math, English, Chemistry, Biology, Physics, Earth Science, Computer Science, and Typing.



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Environmental technicians  
monitoring water.

## Equipment Operator

Equipment Operators learn how to safely operate one or more of the large pieces of equipment used on a mine site. Dozers, loaders, graders, shovels, and off-road haul trucks are some examples. In addition to the safe operation of the equipment, you will be required to perform the safety and mechanical inspections of the equipment you operate. You will need to be able to remain alert during a shift, climb a 10-foot ladder to get on the equipment, and communicate effectively both verbally and in writing. Equipment operators receive training either on-the-job or from a heavy equipment trade school. You will need a high school diploma or GED and a minimum of one year mining experience before being considered for training. Helpful high school courses: Math, English, Computer Science, and Auto Shop.



Photo courtesy of Mining Engineering Magazine

Operating a two-story haul truck requires special training.

## Geologist

A geologist studies the relationship of geology (faults, rock types, structure, etc.) to the formation of ore deposits. You will learn how to find and map ore deposits, and how to monitor ore grade during mining. Your time will be split between the office and working in the field. While in the office you will enter data into the computer, create maps, model ore deposits, and provide information to the engineers. You will need a college degree in Geology. Helpful high school courses are Earth Science, Chemistry, Physics, Biology, Computer Science, Math, Drafting, and English.

## Human Resources

A human resource manager works to make sure all company policies are followed consistently, that all Federal and State Labor laws are correctly followed, and work to have a positive company image in the community and business climate. In addition, you will assist in the training and development of all employees, interview prospective employees, coordinate benefit programs, and mediate grievance cases. You will need a college degree in Psychology, Sociology, Human Resources or a related field, and six to ten years experience working in a human resource environment. Helpful high school courses are English, Speech and Computer Science.

## Hydrologist

A hydrologist studies groundwater as it applies to a mine setting and studies the relationship of geology (faults, rock types, structures, etc.) to groundwater. You will learn how to find water by drilling, and how to establish wells to de-water the ore deposit so that it can be mined. Or you can learn how to find process water to support mineral production. To be a hydrologist you will need a college degree in Geologic Engineering or Geology. Helpful high school courses are Earth Science, Chemistry, Physics, Biology, Computer Science, Math, Drafting, and English.

## Information Systems Manager

An information systems manager is responsible for the operation of all computer hardware and software on the mine site. In addition, you will provide new or updated programming via development or purchase, training and troubleshooting for personnel on hardware and software, and you will enforce company computer policy. You will need to be able to work with all types of people and be good at solving problems. You will need a college degree in Computer Science or related field. You will also need two to five years experience working with information (computer) systems. Helpful high school courses are Math, Computer Science, English, and Business Machines.



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## Maintenance Planner

A maintenance planner will be responsible for scheduling all preventative repairs for all pieces of equipment on the site, and then handling any unscheduled ones with the least amount of impact to the operation. You will need trade school or a degree in Mechanical Engineering for this position. Helpful high school courses include Math, English, Auto Shop, and Computers.

Information systems manager hard at work.

## Mechanic

A mechanic diagnoses, documents, and repairs (with technical assistance when required) all mobile equipment on the mine site. You will be trained on the operation of all mobile equipment, which includes loaders, trucks, graders, dozers, pickups, cranes, forklifts, shovels, etc. You will be knowledgeable about the proper use of tools and equipment for repair operations, and you will do some minor welding. You will need a high school diploma or GED and a minimum of two years experience in mobile equipment repairs. In addition you will need to be able to communicate both verbally and in writing. Helpful high school courses include Math, Auto Shop, Welding, Computer Science, and English. You may decide to attend a trade school for diesel equipment repair.

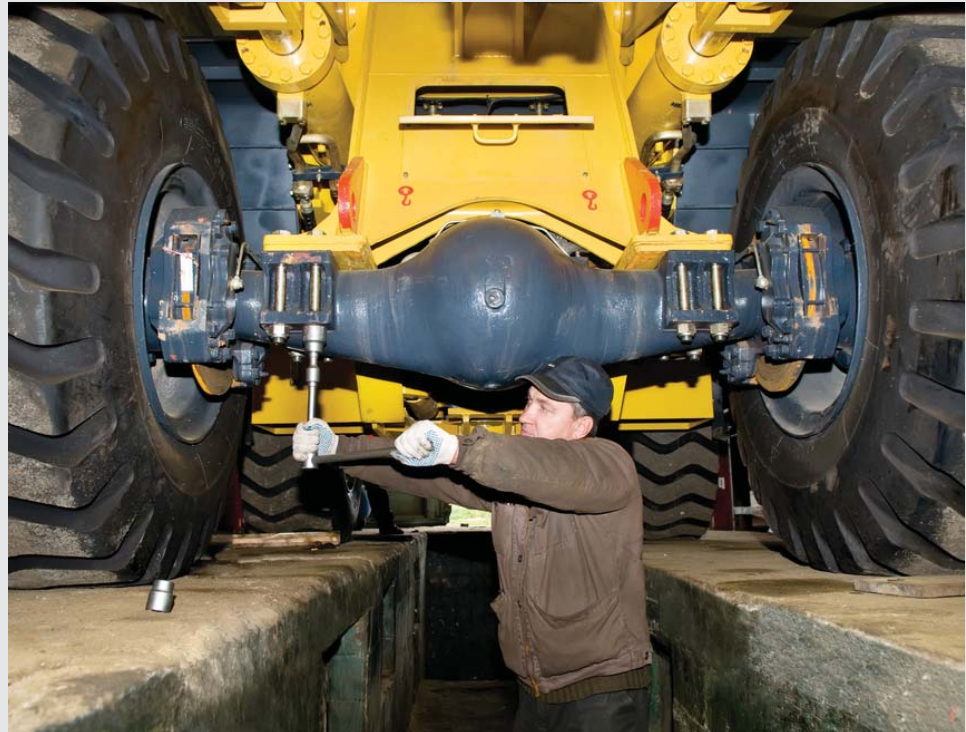


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Bulldozer gets some needed repair.

## Metallurgist

A metallurgist monitors processing to maintain or increase production while keeping costs at a minimum. You will also keep records of the production on daily, monthly, and yearly reports. You will work with the process operators and work on computers. You will receive information concerning production, and then interpret and apply the information to the process system. You might have the opportunity to test new methods of extraction to improve production. Most metallurgists in the mining industry are extractive (removes product from rock) but some may specialize in physical metallurgy (combines different minerals or elements together to make a final product, for example: steel). To be a metallurgist you will need a college degree in Metallurgical Engineering. Helpful high school courses: Math, Chemistry, Physics, English, and Computer Science.

## Metallurgy Technician

Metallurgy can be either extractive (removes product from rock) or physical (combines different minerals or elements together to make a final product). A metallurgical technician monitors the process system to optimize production while minimizing costs. You will learn to keep daily, monthly and yearly production records and reports. You will need a high school diploma or GED. You will need to be in good physical condition and have good verbal and written communication skills. To become a metallurgist you will need a college degree in Metallurgical or Chemical Engineering. Helpful high school courses include Math, English, Chemistry, Physics and Computer Science.

## Mine Engineer

As an engineer, you may learn to optimize mine operations to reduce costs. This can be achieved through mine design, mine planning, modeling, equipment selection and production reporting. Alternatively, you could supervise the construction of processing facilities, design and monitor the development of heap leach pads, design de-watering pumping systems, or design the reclamation of tailings and heap leach pads. To be an Engineer you will need a college degree in Mining, Geological, Environmental, Civil Engineering or related engineering field. Helpful high school courses include Earth Science, Chemistry, Physics, Biology, Computer Science, Math, Drafting, and English.

## Process Operator

A process operator is responsible for the safe and productive use of all process equipment including solutions and reagents. You will need to understand the production process and to respond when problems arise. You will need to be able to operate some equipment including conveyors, screens, feeders, mills, pumps, and numerous pieces of mobile equipment. You will need to update logbooks recording the production process and enter that information on a computer. You may be required to keep all systems clean and operational as well as troubleshoot any problems. You will need a high school diploma or GED and receive either on-the-job training or go through vocational training. You will need to be able to communicate clearly through written and verbal instructions and be able to train new employees. Helpful high school courses include Math, English, Computer Science, and Shop.

## Purchasing Agent

As a purchasing agent, you will be responsible for locating, purchasing, and obtaining delivery of all goods and services at a mine site. These tasks may be accomplished through the supervision of purchasing personnel and the use of computers. In addition, you will make sure that a good relationship is developed and maintained between the company and its suppliers. You must also be familiar with all the phases of the mine operation (mining, crushing and processing), as well as be aware of the vendor-supplied equipment and parts that match the company systems. To be a purchasing agent you will need a high school diploma and should have a minimum of five to ten years experience in purchasing. You will also require contract negotiation experience and be able to communicate with all types of people. Helpful high school courses include Math, English, Speech, Computer Science, Accounting, and Business.

## Refiner

A refiner is responsible for the operation of all equipment used in the refining process. You will learn how to mix fluxes, know the various methods of extracting the product, know how to operate the furnace, pour and mark the bars, and you will need to be able to tolerate extreme heat. You will be expected to troubleshoot any problems that arise and to keep accurate records of production. You will need to work with minimal supervision and be self-motivated. To become a refiner you will need a high school diploma or equivalent and receive on-the-job training. You will also need to satisfactorily complete a stringent background check. You will need to be able to communicate effectively in writing. Physical work is required so you will need to be in good physical condition. Helpful high school courses include Math, English, Chemistry, Computer Science, Physical Education, and Shop.



Photo courtesy of Shutterstock.com

Refiners can take the heat.

## Safety Coordinator

The safety coordinator conducts all aspects of safety training, performs workplace inspections, reviews material safety data sheets, and conducts industrial hygiene monitoring. You will maintain personnel records of all employees as well as reports required for State Industrial Insurance, Mine Safety and Health Administration (MSHA), State Mine Inspectors and the company. This job may lead to that of a Safety Manager position. You will need to have a high school diploma, and one year or more experience in mining. You will need to have computer knowledge, to be certified as an MSHA Instructor, be certified as a First Responder, and be willing to continue to the level of Emergency Medical Technician (EMT). A four-year degree in Occupational Health and Safety is preferred. Other helpful knowledge could be gained by becoming an emergency volunteer. Helpful high school courses include Math, Science, English, Chemistry, Psychology, and Computer Science.



Photo courtesy of Mining Engineering Magazine  
Safety coordinators train all employees in safety procedures. Here miners wear reflective vests and other safety gear in mine tunnel.

## Sample Prep Technician

A sample prep technician processes samples from the mine by splitting, drying, crushing, and pulverizing them to the consistency of talcum powder without cross contamination of samples. This requires the operation and maintenance of small crushers and pulverizers. You may also be required to do computer data entry. To assume the duties of a Sample Prep Technician you will need a high school diploma or GED and other on-the-job-training. You will also need to be in good physical condition. This is an entry-level position and advances to other positions in the Assay Lab. Helpful high school courses include Math, English, Chemistry, and Computer Science.

## Security Guard

As a security guard you will protect and safeguard mine site employees, secure any company assets against loss, and be responsible for recording the entry and departure of all individuals to the site. In addition, you will monitor activities in various locations around the mine site through electronic and visual surveillance. You will also be required to assist in life threatening situations. You will have to communicate with all areas of the mine site both verbally and in writing, and demonstrate sound judgment. You will need a high school diploma or GED, and you may have to have previous experience or training in a security position. You might take law enforcement training from a vocational school or community college. You will be required to obtain advanced first aid training as a First Responder or Emergency Medical Technician. You may also be required to obtain hazard training and emergency response training. Helpful high school courses include English, Math, Computer Science, and Physical Education.

## Surveyor

A surveyor provides all sorts of information to personnel on a mine site. The information may include the locations of ore and waste, buildings, fences, or power lines. You may be called upon to locate underground utilities, historic underground workings, drill bits stuck in drill holes, or just to survey elevations of de-watering wells or other features around the mine site. To be a Chief Surveyor you will need a degree in surveying from a college certified by the Accreditation Board for Engineering & Technology (ABET), or you may have an engineering degree with a surveying emphasis. Entry-level positions also exist on a mine survey crew but advancement is limited without a degree. Recommended high school courses are Math, Drafting, Computer Science, and English.



Photo courtesy of Shutterstock.com

Surveyors enjoy working outdoors under the clear, blue sky.

## Underground Miner

Working underground, you will cut channels to facilitate blasting, operate power drills to bore the blast holes in the walls, and operate special heavy equipment. Good physical condition is necessary; safety in all aspects of these jobs is demanded. Helpful high school courses are Math, English, and Computers. Many companies have special training programs high school graduates can apply for.

## Warehouse Person

A warehouse person stores and issues supplies, maintains supply levels, and keeps a running inventory of all supplies on a computer. In addition, you will perform inventory audits, operate light equipment, and maintain a clean work environment. Some physical work (lifting and moving) is required. You will need to be able to understand and follow both oral and written instructions. To be a warehouse employee a high school diploma or equivalent and one year experience in store keeping and inventory work is required. Helpful high school courses include Math, English, Computer Science, Accounting, Speech, Inventory Control.

## Welder

As a welder in the minerals industry, you might work on many types of equipment from light vehicles to large crushers. You will generally work in either Mobile Maintenance or Crusher Maintenance. In either department, you will be required to identify and document the majority of welding-related problems, communicate the problems through channels, and solve the problem. You must be able to perform the majority of required welding repair jobs and use all tools and equipment properly. You may have the opportunity to be task trained in operating the equipment as well. You will need a high school diploma and about one to two years experience with welding. You must be able to communicate effectively both in writing and verbally. Helpful high school courses are Math, English, Auto Shop, Welding and Computer science. You might consider a trade school to learn welding.



Photo courtesy of Shutterstock.com

Welder working in a copper mine.

# Specialties in Geology

(All specialties listed on this page require college degrees.)

**Geologist.** Geologists study the materials and processes of the Earth to explain how, when and why events occurred in the formation of the Earth's rock record. Economic geologists apply geology to explore for and develop the metal, mineral, and coal resources that are used as the foundation of our standard of living and modern society. Structural geologists analyze the Earth's forces by studying deformation, fracturing and folding of the Earth's crust.

**Geochemist.** Geochemists use physical, organic and inorganic chemistry to investigate the type and distribution of major and trace elements and organic compounds in rocks, soils, and water.

**Mineralogist.** Mineralogists study mineral formation, crystal structure, chemistry and properties to understand ore genesis, to develop process strategies for mineral liberation and beneficiation, and to develop and modify mineral-based products for industrial and consumer use.

**Geophysicist.** Geophysicists apply the principles of physics to studies of the Earth's interior and investigate Earth's magnetic, electrical and gravitational properties.

**Geophysical Engineer.** Geophysical engineers apply geophysical techniques to understand and plan for geologic conditions that affect mines.



Photo courtesy of Mining Engineering Magazine

Geologist conducts a lakeside analysis.

# Specialties in Geological Engineering

(All specialties listed on this page require college degrees.)

Many of these jobs could involve travel to different parts of the world.

**Exploration.** Geological engineers are involved in exploring and characterizing the quantity, quality, properties, and value of mineral resources. Results from these efforts form the basis for determining the feasibility for mining and reclamation/post mining site use.

**Site Characterization.** Geological engineers are involved in characterizing geologic conditions (soil, rock, groundwater, etc.) and hazards at the mine sites for the safe design, construction, operation, and closure of these facilities.

**Hydrogeology.** Geological engineers evaluate ground and surface water conditions with respect to quality, quantity, flow and volumes, and protection or remediation of these resources.

**Geotechnical.** Geological engineers assess the physical properties of soils and rocks for safe design of foundations, tunnels, excavations, pit slopes, and other facilities for all kinds of mining, construction and development practices.

**Environmental Studies.** Geological engineers will be part of a team to design and construct mine waste disposal and environmental protection facilities, e.g., tailings dams, and the development and conduct of reclamation plans at mining sites.

**Management.** Geological engineers will, after gaining experience in exploration, design, operation and leadership, move up the ladder to management positions.

# Specialties in Mining Engineering

(All specialties listed on this page require college degrees.)

**Mine Valuation.** Mine valuation is the process of determining the worth of a specific mineral deposit. This is necessary to determine the viability of extracting the mineral resource and making a return on the investment.

**Mine Design.** After a mineral resource is located and defined, the approach to mining the deposit must be engineered. The method of mining must be established, typically defined as surface or underground mining. The selection of which method to use must consider many factors, which will be specific to the site and location of the deposit.

**Materials Handling.** Mining is the process of selecting the resource material from other materials. Generally, depending on the nature of the mine, the volume of the materials that must be handled is quite large, whether the resource itself, the surrounding materials or the combination of both.

**Rock Excavation.** The most common method of extracting the resource rock is excavation. The method of excavating the rock will vary dramatically depending on the physical properties of the rock. Rock excavation may be accomplished by simple scraping or gouging practices, in the case of soft materials such as coal. Or it may require intense drilling followed by loading explosives in the drill holes and blasting.

**Ventilation.** In underground operations, special consideration must be given to the condition of the air. Emissions from underground equipment, combustion gases from blasting operations and moisture and heat from rock surfaces affect the quality of the air. If not addressed, this would result in an unsafe or unproductive work environment. Even if emissions are not a safety issue, in the case of certain mine locations, work productivity and the premature onset of fatigue would be an issue due to higher humidity and temperatures. These safety issues are of the highest priority in modern mining operations.

**Rock Mechanics.** The physical properties of resource and non-resource materials are key considerations when designing and operating a mine. How well the rock holds together, how it responds to different stresses, and how that response is affected by the moisture content of the material will greatly influence the overall mine design and the approach to mining.

# Specialties in Mineral Processing

(All specialties listed on this page require college degrees.)

**Mineral Processing Engineer.** Mineral processing engineers develop and direct the processes that separate minerals from other natural materials. These processes include crushing, grinding and treatment with chemicals, heat, water, microbes and electrolysis.

**Materials Scientist.** Materials scientists create new products for existing uses or new uses for existing products.

**Process Chemist.** Process chemists investigate or develop processes used in the production of metals or materials. Process chemists work with the process plants to reduce costs, increase production recovery, purify the metal or material, or develop new processes.

**Metallurgical Engineer.** Metallurgical engineers deal primarily with the separation of the metals or materials from the ore. This specialty includes the research metallurgist, who is involved with laboratory testing to evaluate existing or new processes or equipment; the mineral processing plant metallurgist, who oversees the separation of the product from the ore; the pyrometallurgist who employs high-temperature processes to produce metals and alloys; and the hydrometallurgist, who uses solvents and other solution to extract valuable minerals.



Photo courtesy of Shutterstock.com

Research metallurgist evaluates test results.

# Specialties in Environment

(All specialties listed on this page require college degrees.)

**Hydrologist.** Hydrologists study the properties, distribution and effects of water in the atmosphere, on the Earth's surface and in soil and rocks.

**Biologist.** Biologists study the science of living organisms and life processes, including the structure, functioning, growth, origin, evolution and distribution of living organisms.

**Environmental Engineer.** Environmental engineers are certified professionals who apply math, science and engineering principles to the design, construction and operation of economical and efficient structures, equipment and systems in the natural environment.



Photo courtesy of AngloGold Ashanti

Hydrologists and biologists study the water and life forms in Canon del Cauca, Colombia.

# Specialties in Health & Safety

(All specialties listed on this page require college degrees.)

**Industrial Hygienist.** Industrial hygienists study the science of health, prevention of disease and illness, and the conditions and practices that promote or preserve health.

**Occupational Safety and Health Specialist.** Occupational safety and health specialists, through education and experience demonstrate a thorough knowledge of safety principles, laws and regulations and apply them in the workplace.

**Safety Engineer.** Safety Engineers are certified professionals who apply math, science and engineering principles to the design of systems with inherent safety and fail-safe features.



Photo courtesy of AngloGold Ashanti

In Obuasi, Africa, safety extends beyond the mine into the community. Here waters, land and even buildings are treated for malaria control.



Photo courtesy of Mining Engineering Magazine

Suited up with safety gear, these miners head for work in an underground mine.

# Resources

AngloGold Ashanti, [www.anglogold.co.za](http://www.anglogold.co.za)

Colorado Mining Association, [www.coloradomining.org](http://www.coloradomining.org)

Mining Basics, [www.miningbasics.com](http://www.miningbasics.com)

Mineral Information Institute, SME Foundation, [www.mii.org](http://www.mii.org)

Mining Engineering Magazine, SME, [www.miningengineeringmagazine.com](http://www.miningengineeringmagazine.com)

National Mining Association, [www.nma.org](http://www.nma.org)

Newmont Mining Corporation, [www.newmont.com](http://www.newmont.com)

Society for Mining, Metallurgy and Exploration, [www.smenet.org](http://www.smenet.org)

Women in Mining Education Foundation, [www.womeninmining.org](http://www.womeninmining.org)

U.S. Department of Agriculture, [www.usda.gov](http://www.usda.gov)

U.S. Geological Survey, [www.usgs.gov](http://www.usgs.gov)

Christensen, John W. and Teri L. Christensen. Global Science: Earth/Environmental Systems Science. Kendall Hunt. Dubuque, Iowa. 7th ed. 2009