Fall 2010

the Green Gazette

Environmental Technology | Red Rocks Community College

Welcome to the *Green Gazette*

Within this edition, we explain the Environmental Technology Program.

This is a new program that is constructed around President Barack Obama's "Green Initiative." While the environmental needs within industry expand, we as a Community College need to expand to accommodate those needs and provide options for our students. Thanks to a grant awarded to RRCC from the National Science Foundation, we are quite confident we have reached our goal to satisfy those needs.

So what is environmental technology? It is the study of our environment as a whole--the land, the biology, the air and the water. It is an area of study that

connects the dots between our climate, our Earth and the way we live. It is a path to understanding our history and our future efforts toward a clean, healthy environment while at the same time respecting our lifestyles. It is about sustainability.

RRCC and the Energy and Environmental Technology department are committed to developing a new

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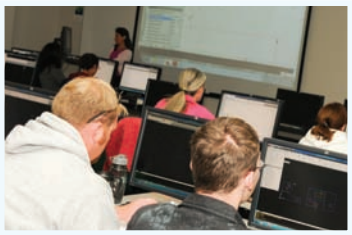
Engineering Graphics Green Technology

Could a Native American Indian teepee qualify for a LEED Platinum certification? Is sustainable building really a new idea? Come explore these questions and discover how the new "Green Economy" will affect the building industry.



The new ***Sustainable Building Systems*** class at Red Rocks Community College is intended to give students a better understanding of the rating systems, terminology, construction techniques, and intentions of the Green Building movement.

We will accomplish this by looking into the rediscovery of conscience design and investigating several case studies of successful "green" projects. Not only will students research the new products and materials that are available, they will evaluate just how sustainable they are.

Students will visit local projects that are under construction to see the nuts & bolts of these high performance buildings. These visits also give the students the opportunity to meet professionals who are implementing sustainable practices in their work every day. We will also visit the National Renewable Energy Laboratory to see how buildings of the future will be powered.

It is easy to see how every industry is affected by concerns of global warming, energy independence, health care cost, and diminishing natural resources. ***Sustainable Building Systems*** will be the starting block of a career in the new "Built Green Economy."

Delia Ochoa

Department Chair,
CAD and EGT Technology

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career path for individuals who are concerned about the world's eco system, the detrimental changes that are occurring, and the options available to reverse and control today's environmental concerns.

Consider the BP oil spill in the Gulf of Mexico this past summer. While we have a need for petroleum and its products, consequences can be expected that directly degrade our environment regardless of an accident. Are there alternatives? Could this as one example been preventable? What about the future? What will the overall toll be when you consider the sea, the biology, the air, and the industry the gulf provides for so many residents on the Gulf Coast. Our environment is our life blood. Without clean air, clean water, and solids waste management, *we* will feel the consequences. Understanding these consequences is our strategy and our vision in the classroom.

If these areas are of concern to you then this is your future. All walks of life, all ideas, and all options are a part of our planning. Together, we can make a difference. "The Blue Marble" known as Earth needs to be seen through GREEN lenses and it is our goal to show how wonderful this color can be. It is our planet, our home, and our responsibility to care for it. Join us as truly "Go Green".

Mike Smith
Program Coordinator
Environmental Technology
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Research Corner Project Bolivia Update

July 12, 2010: The Water Quality Management Department at Red Rocks Community College is about to implement the first of 24 treatment systems in Bolivia using bone char to remove high levels of fluoride from their ground water supply. During the summer, we had numerous delays with the planned departure for a variety of reasons, and once the final travel date was set in August, we learned that not enough bone had been collected by the community.

This was a tremendous disappointment for the project because the most important element to the concept—sustainability—had not been established by the local community. Although this delayed the group travel plans with the students, Mike Smith returned to Hardeman, Bolivia and met with the water cooperative staff and local community. The equipment will be stored in Hardeman, while the community acquires at least nine cubic meters of useful bones. During the past year, only a few members of the community saved their bones, and unfortunately, many of the bones were not appropriate. Cow skulls, horns, hooves, and jaws with teeth will not work correctly. Horns and hooves are not bone; skulls and jaws are far too frail to make a stable media after the charring process. A public meeting was called in Hardeman and the residents are now directly involved, so an

Female resident from Bolivia with cattle bones

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adequate volume can be collected and available for a potential December assembly internship for our students. This schedule depends upon weather conditions, as it will be their rainy season and access will not be available for travel to the remote area.

Two additional arrangements were made in August that benefit the program. The first was an agreement with a local TV station, Channel 33 "Activa," to travel with the group and record the project, which will be aired live in Santa Cruz. The other agreement was made with the University in Santa Cruz, Bolivia where the post graduate students in the master's dentistry program will conduct the health study for the other 23 communities affected by the fluoride-contaminated water supply. Using the study that was done by Mike Smith and Lidia Espinoza as a model, this information will be very useful to the impact study that will be performed following the actual implementation of the treatment systems. It will also provide the Bolivian government the data to record the benefits and affects on the national health care system.

"Although the project has seen unexpected delays with the actual implementation of the treatment system developed at Red Rocks Community College, very important additions were arranged which will add to the sustainability efforts of the project."

Although the project has seen unexpected delays with the actual implementation of the treatment system developed at Red Rocks Community College, very important additions were arranged which will add to the sustainability efforts of the project.

Our local NGO, INCADE will begin the monthly monitoring of the bone collection efforts in Hardeman and will report directly to us to aid in future scheduling.

Watch for our next newsletter as we report on the completion of this unique project and the benefits the community will receive from this water treatment system.

If you have an assessment or research project that you would like our program to assist you with, please let us know. Contact mike.smith@rrcc.edu. The WQM staff and students look forward to assisting you

Baños (Outhouses for the Communities)

Baños Ecologico is a project overseen by INCADE, an organization near San Pedro Bolivia, the same area in which we are doing water treatment projects on fluoride in the groundwater. This project is meeting the contained sanitation and waste management needs of the small rural communities in the campo (deforested farmland). By educating the locals and providing building materials at low cost, INCADE has assisted in constructing several baños, or outhouses, to communities who are in desperate need of them. The structures that these are replacing are nothing more than loosely assembled covers over a whole in the ground. The new baños are made of fiberglass fixtures, walled in by bricks made by filling old soda bottles with mud. Inside are common toilets, and in some structures, a shower room. The base of the structure allows for removal of waste material, and locals are educated on maintenance and waste disposal practices. So far this project is flourishing and continued construction is planned in many campo communities.

INCADE asked me during my last trip to Bolivia if RRCC would be interested in helping with this project. I believe they have a very well thought out program in place; one that utilizes the local workforce to keep costs down while supporting sustainability and using recycled materials. Although I'm kept informed of the process and offer my feedback when asked, I believe the best way for RRCC to assist with this project is to help in the fundraising efforts in order to keep the program running. Although it is a wonderful opportunity, it is far better off without us as *sustainability* is the goal. We would only hamper the ambitious schedule to have every home in the area updated with this system. However, without a sanitation system, the ground water we are treating for high fluoride levels would also be contaminated with fecal bacteria. So, we highly encourage this work and will maintain our assistance from a distance. We are currently establishing a way to accept donations here on campus so that we can send proceeds to INCADE periodically. This small, well-organized project, with its wise use of local support, is a great example of sustainability in development projects internationally. Funding support is by far the best form of assistance we can provide, since 100% of all donations are spent on the materials and support of the system.

Old baños structure

bricks made with mud-filled soda bottles

New baños structure

The next time you flush, think of what you have that many countries do not. It may be just a toilet, but the system behind it keeps your water safe for you and the environment. Developing communities do not have such a luxury, and human waste is a serious concern because it does come back around in other environmental arenas.

Mike Smith
Environmental Technology
Program Coordinator

Environment Technology

The Environmental Technology Degree program provides an introduction to environmental sciences with emphases in environmental control and compliance strategies. Students will leave the program prepared for entry level environmental professions in water, soil, solid waste, and air monitoring. The program is comprehensive in all areas to prepare students for a wide range of higher education and career opportunities.

The program also prepares students to apply environmental controls in industries that are affected by pollution, and efficiency issues related to operations, planning, and regulatory efforts. Specific training is provided in environmental monitoring programs, field analysis requirements, and corrective active planning. In addition, students will also explore future technologies for pollution control equipment and alternative power sources.

Information:
Mike Smith
Program Coordinator
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AAS Degree

Environmental Technology

Required Courses			**Credits**
EVT	100	Introduction to Environmental Technology	3
EVT	110	Atmospheric Environmental Application	4
EVT	120	Soil and Solids Waste Studies	4
EVT	140	Regulatory Studies	4
EVT	150	Global Environmental Awareness	4
EVT	200	Environmental Engineering	4
EVT	210	Sustainability in Environmental Technology	4
WQM	100	Introduction to Water Quality	3
WQM	121	Environmental Sampling and Volume Measurement	3
WQM	160	Source Water management	3
PRO	110	Safety, Health and Environment	3
ENY	101	Introduction to Energy Technologies	3
GIS	101	Introduction to Geographic Systems	3
Approved Substitutions			
WQM	123	Water Reuse Systems	3
WQM	165	Water Law	3
WQM	212	Drinking Water Regulations	4
CPL:OSHA HAZWOPER - 40 hour			
Total Credits			**45**
General Education Requirements			
Mat 107, Eng 131, and one 3-credit elective			9
Env 101 Introduction to Env Science with lab			4
Required Electives			
CIS 118 Introduction to PC applications			3
GIS 101 Geographic Mapping Systems			3
Total AAS Degree Credits			**64**

Certificates

Introduction to Air Compliance

ENV 100	Introduction to Environmental Technology	4
ENV 110	Atmospheric Environmental Application	3
Total Credits		**7**

Introduction to Soil Compliance

ENV 100	Introduction to Environmental Technology	4
ENV 120	Soil and Solid Waste Studies	3
Total Credits		**7**

Introduction to Water Compliance

ENV 100	Introduction to Environmental Technology	4
WQM 100	Introduction to Water Quality	3
WQM 160	Water, Life and You	3
Total Credits		**10**

Environmental Compliance Operations

ENV 140	Regulatory Studies	4
ENV 150	Global Environmental Awareness	4
Total Credits		**8**

Environmental Pre Engineering

ENV 200	Environmental Engineering	4
ENV 210	Energy Science and Technology	4
GIS 101	Introduction to Geographic Systems	3
Total Credits		**11**

Environmental Safety Systems

ENV 140	Environmental Regulations	4
PRO 110	Safety Health and Environment	3
ENY 101	Introduction to Energy Technologies	3
Total Credits		**10**

Hard Rock Mining Cleaning Up Acid Mine Drainage

One of the greatest issues faced by water quality professionals today is the pollution from hard rock mining that has been working its way into our watersheds, on a continuous basis, for the last 150 years. Hard rock mining formed the economic base for the settlement of the western United States in the mid-to-late 19th century and continued well into the 20th century. The problems associated with acid mine drainage, heavy metal contamination of streams, and polluted tailing ponds leeching into groundwater and watersheds can be seen throughout the western U.S.

Beginning in the 1840s in the U.S., the discoveries of hundreds of deposits of gold and silver ore drew thousands of prospectors to seek wealth mining minerals in the wide open American west, where it was simple to obtain prospecting claims on land that was otherwise unclaimed. Initially, these prospectors used small-scale mining methods such as panning, and even small underground mines. As the populations of these areas exploded, and the minerals became more difficult to reach through small-scale methods, large companies moved in with more destructive methods such as open pit and hydraulic strip mining, as well as deep hard rock mines, some extending for miles underground and depths of hundreds of feet. Along with these mines came piles of tailings laced with heavy metal contamination, and miles of abandoned mineshafts which, over time, would fill with groundwater that would become contaminated with acids, heavy metals, and other pollutants.

The problem is exacerbated by the fact that the overwhelming majority of these mines were abandoned, due to various circumstances. The U.S. Environmental Protection Agency's General Accounting Office estimated in 1996 that there are over 50 billion tons of mine waste, from some 200,000 abandoned mines surveyed in their report; over 14,000 of these sites require extensive work to solve potential surface water contamination, with 5,000 miles of streams directly affected by acid mine drainage.

In situations where rock is exposed to water and oxygen, minerals, especially pyrite, oxidize and react with other chemicals in the water to form Acid Mine Drainage. This drainage then seeps into groundwater and streams, polluting and lowering the pH of the water. Because these mines store millions of gallons of water, total remediation is difficult;

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the water cannot be removed and discharged without creating an even larger problem. Several remediation techniques are in use, and can be discussed in two groups: passive treatment and active treatment.

Passive treatment techniques for acid mine drainage allow chemical and biological reactions that occur naturally to affect the water in a controlled environment, such as a treatment facility, as opposed to in the environment, where these processes cannot be easily controlled. The first passive treatment technique employed the use of Sphagnum wetlands to facilitate the metabolism of acids and other pollutants in the water. The wetlands model was expanded to include Aerobic Wetland Treatment, where the influent water is aerated prior to introduction to the wetland, which speeds up the oxidation of the metals in the water into oxides and hydroxides. Compost or Anaerobic Wetland Treatment, where polluted water is passed through an organic substrate that is mixed specially to remediate specific contaminations. Each of these techniques has specific limitations and advantages; the Aerobic wetland is only effective with waters that are net-alkaline, because the oxidation of the metals will generally lower the pH of the water, but will allow better precipitation of contaminants, and will enhance oxygenation of the water. The Anaerobic wetland, on the other hand, will reduce or eliminate oxygen in the water, which in turn will reduce sulfates, and prevent oxidation of metals, which will coat the limestone present in the substrate.

Other passive treatments include Anoxic Limestone Drains, which accept subsurface discharge flows and prevent them from contacting atmospheric oxygen, and Diversion Wells, which reduce acidity by forcing the influent through a bed of crushed limestone before being discharged to stream.

Both treatments are considered an effective pretreatment for water to be discharged into Aerobic Wetland treatment.

In addition to the pollution caused by acid mine drainage, a widespread issue with pollution from mining operations comes from the use of Cyanide Leaching to extract gold from ore. The chemistry involved in this process is complex, but the technique is simple: the ore is pulverized, then placed in a carefully designed pile, or "heap." Sprayer arrays distribute a low-concentration cyanide solution over the heap, and as the solution leaches through the ore, it dissolves the gold, carrying it to the bottom of the leaching heap, where it is drained off. The solution is either passed through activated carbon, to which the gold will precipitate from the solution, or it is precipitated using zinc in what is known as the Merrill-Crowe process. A very large amount of this solution is necessary to completely strip the ore of its gold; this is where problems with environmental impact begin.

> "One of the more famous instances of widespread pollution due to cyanide leaching is the case of the Summitville Mine in southwest Colorado."

One of the more famous instances of widespread pollution due to cyanide leaching is the case of the Summitville Mine in southwest Colorado. The area was first mined in the 1870s, but in 1984, when the mine was converted to a large-scale open pit operation, cyanide leaching heaps were constructed with heap pits lined with a clay and synthetic substrate. Soon after operations began, a leak was detected, and the site owner, Summitville Consolidated Mining Corporation, announced it was abandoning the site. As an emergency response to a looming environmental disaster,

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Remediation *continued from page 7*

the EPA immediately assumed responsibility for the site, and in 1994, placed the site on the National Priorities List for Superfund sites. The main concerns at the site are heavy metal contaminants on the site, as well as acid mine drainage.

Early detection and intervention may have prevented a downstream disaster for the San Luis Valley's ground and surface drinking water supplies; in 1997, the Agency for Toxic Substances and Disease Registry reported no hazard to human health. Still, the ecological damage was great; as of today the Alamosa River system does not support aquatic life.

Cleanup of the Summitville mine site has been costly and intense. Remediation projects include the detoxification and capping of the leaching heaps, removing potentially contaminated debris from mine pits, plugging of mine entrances where runoff water could escape, and expansion of runoff retention ponds. In addition to these measures, the construction of an on-site water treatment plant is expected to begin in 2010. EPA estimates place the energy costs alone of operating the remediation project at $80,000 during the summer months; however, a small, on-site hydroelectric turbine power plant is also under construction, and expected to save up to $15,000 annually in energy costs.

It is simple to see that the impacts caused by these environmental issues were mostly unintended, and in many cases, unforeseen; at the time many of these mines began operation, very little was known about the long-term

environmental impacts that result from mining. Mines do not have to be contaminated with synthetic chemicals or cyanide to produce massive amounts of pollution; simply exposing the layers of rock causes mineral oxidation, which creates acids that precipitate heavy metals that are discharged into the watershed. Left untreated, these mines would continue to store and discharge acidic water and contaminants for as long as the oxidation of exposed minerals occurs, literally for thousands of years. Therefore the remediation of existing polluted sites is one of the most important tasks we face in the water quality field, and will continue to be so for as long as we mine the earth.

Joshua Brooks
WQM AAS Student

Important RRCC Dates

Registration Begins for Spring 2011 Semester
November 8, 2010

Fall Break
November 24–28, 2010

Fall Semester Ends
December 12, 2010

Spring 2011 Semester Begins
January 14, 2011

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