DIRECT APPLICATION AND COMPOSTING

BIOSOLIDS, WOOD CHIPS
KEY TO MINELAND RECLAMATION

In 1974, the Climax Molybdenum Company, then a subsidiary of AMAX Minerals Co., closed its Urad Mine near Berthoud Pass in Clear Creek County, Colorado. Sixty years of hard rock mining had left roughly 234 acres of tailings and other disturbed areas to be reclaimed. The tailings — the waste rock residue remaining after the ore is extracted — provided a poor foundation for plant growth, especially young trees, which could be uprooted in the strong winds that frequently buffet the slopes of the Rocky Mountains. The best solution, it turned out, was to spread waste rock from a nearby mine over the tailings to provide a footing for vegetation, apply a mixture of biosolids and wood chips over the rock, then plant high-altitude grass seed and shrubs. Plant life flourished in this medium, and in seven years — half of the projected time span for the reclamation project — the Urad site was restored to a natural looking site that continues to flourish more than 25 years later.

The successful reclamation at the Urad Mine made the biosolids/wood chips revegetation approach a consideration for reclaiming the Climax Molybdenum Mine tailings near Leadville, Colorado. The Climax Mine has almost 4,000 acres of disturbed land. Like the Urad mine, the conditions are very harsh: The average growing season is six to eight weeks, the average temperature is 33°F and annual snowfall averages 270 inches.

**ANSWER TO BIOSOLIDS MANAGEMENT CRISIS**

In the late 1980s, biosolids disposal costs in Summit County, Colorado approached $1,000/dry ton and all of the local wastewater treatment facilities were exploring money-saving alternatives to landfilling. For example, biosolids were composted and stockpiled at the Summit County landfill and used, even years later, to fertilize agricultural fields, establish greens at the Copper Mountain golf course, and amend the soil at the award-winning Glenwood Canyon Interstate Highway project along Interstate 70.

Resort communities in Summit County — Breckenridge, Dillon, Copper Mountain,
capital outlays for big ticket items such as digesters, windrow turners and loaders. Even used equipment carried high price tags, and creative in-house design and building equipment like trommel screens could stretch budgets only so far. So for both practical and philosophical reasons, it made sense to forge a cooperative agreement that would enable the facilities to share resources when feasible and allow all five facilities to provide biosolids to Climax. Spearheaded by Zach Margolis of the Silverthorne/Dillon Joint Sewer Authority and Bill Smith of the Breckenridge Sanitation District, representatives of all five facilities started negotiating with Climax in earnest.

Although Climax was well aware of the success of the Urad revegetation program, the use of biosolids for reclamation had not received full internal acceptance. In 1996, Bryce Romig, Climax’s environmental manager, established plot demonstrations in order to verify the Urad solution and to determine the best application rate. He also showed the use of biosolids for reclamation would decrease reclamation costs at the site by up to two-thirds. The producers, too, wanted to benefit financially by reducing their operating costs and avoiding major capital outlays. Romig was able to demonstrate that even if the facilities transported their biosolids to the site at their own expense, they could save a significant amount per wet ton in disposal and hauling costs while paying Climax a nominal fee to support road maintenance and snow plowing efforts. In addition, the cost of chipping, transporting and storing wood at the reclamation site are well below the cost of land-filling the high-bulk material.

One of the wastewater treatment facility managers’ concerns about the project was the risk of long-term liability if Class B biosolids were applied at the site. For that reason, Silverthorne/Dillon decided to compost biosolids at the mine prior to application. The compost operation produces a Class A material that is exempt from regulation.

After two years of intense but cordial wrangling, a mutually satisfactory deal between the producers and the Climax Mine was signed in March 1997. A local independent hauler, Westvac Environmental Services (acquired by Parker Ag Services in April 2001), entered the partnership to haul the biosolids and wood chips to the mine, and conduct blending and composting services. The consortium has been operating successfully and this year, received a first place award from the U.S. Environmental Protection Agency for the operation.

Capital cost savings to the wastewater treatment plants have been significant. The Silverthorne/Dillon Joint Sewer Authority, for example, avoided the cost of a $1 million dollar digester and now saves at least

Biosolids production in Summit County is highest in winter months because of the influx of tourists during the ski season.
YOUR INVITATION TO REGISTER NOW

Nearly ten years have elapsed since the previous international scientific symposium on composting was held in the United States. Since that time, major advances in the practice and use of compost have been made throughout the world – but significant challenges still confront us. Design, operational and control issues remain key factors leading to success or failure.

GOAL OF THE 2002 INTERNATIONAL SYMPOSIUM

The 2002 International Symposium will be held May 6–8, 2002 in Columbus, Ohio at the Adam’s Mark Hotel. The objective is to fulfill the promise of composting by reporting the highest quality research on: Process Biology, Engineering and Management; Composting in Context of the Global Environment; and Compost Quality and Utilization.

EARLY REGISTRATION DISCOUNTS AVAILABLE

Please note: If you register by January 31, 2002, the registration fee is $395 — which includes attendance at all Symposium sessions as well as proceedings and poster abstracts in electronic form. Register online at www.composting2002.org. Or contact Compost Science & Utilization, 419 State Avenue, Emmaus, PA, 18049, phone 610-967-4135, fax 610-967-1345. (After January 31, 2002, registration fee is $475.) For hotel reservations at the Adam’s Mark Hotel. The objective is to fulfill the promise of composting by reporting the highest quality research on: Process Biology, Engineering and Management; Composting in Context of the Global Environment; and Compost Quality and Utilization.

CALL FOR POSTER PRESENTATION ABSTRACTS:

Poster presentations are a key element of the symposium agenda. A poster presentation is an effective way to inform others about your work and your contributions to the science of composting and compost use. Review of poster presentation abstracts will begin after November 15, 2001. Authors of poster presentations may, if they wish, submit full manuscripts for peer-review and inclusion in the symposium proceedings. The deadline for submitting manuscripts based on poster presentations is January 31.

PROGRAM HIGHLIGHTS

We received well over 150 abstract proposals for oral presentations. The review committee has selected 120 abstracts for oral presentations, based on quality and topic. We expect that an additional 80 presentations will be delivered via posters. Based on the abstracts received, we are certain that the symposium will present state-of-the-science information reported by the leading researchers and scientists from a diverse set of countries and economies.

The symposium program will have three tracks, covering the following topics:

Process Biology, Engineering And Management
- Microbial ecology of composting and compost
- New molecular tools for compost analysis
- Role of microorganisms in organic matter conversion
- Design and optimization of composting systems
- Novel systems and feedstocks
- Odor characterization and management
- Nitrogen and phosphorus dynamics
- Economic viability

Composting In Context Of The Global Environment
- Public health, fate of pathogens (including emerging pathogens)
- Effects of composting and compost use on climate change
- Bioremediation of contaminated soils, ecological engineering
- Role of composting in modern landfills
- Animal manure composting/nutrient management and sustainability
- Soil quality and productivity; erosion control

Compost Quality And Utilization
- Compost contaminants; heavy metals, xenobiotics, plastics
- Biodegradable plastics and other polymers
- Stability standards, nutrient availability
- Spectroscopic techniques for compost quality
- Plant and animal disease suppression
- Impact of compost on plant and food quality
- Organic agriculture
Tourists and residents alike – as many as 10,000 vehicles per day during the summer – travel past the mine. With the application in 2001 and growth from the previous three years, major improvements can be noticed.

$50,000 annually in energy costs from not having to operate an anaerobic digester. The Frisco Sanitation District has delayed building a $3.5 million digester complex at a congested treatment site that is near the Frisco Marina on Dillon Lake. Other cost saving are realized through avoidance of odor control at the treatment plant, equipment maintenance and personnel.

TAILINGS REVEGETATION

As a result of over ten years of operation in some form, three basic programs are conducted on the Climax Mine: Direct application of Class B biosolids to areas distant from human traffic and water courses; Application of a 1:1 mixture of Class B biosolids and wood waste to tailings areas to be revegetated; and Production of Class A compost for application to dam faces, near water courses and areas more accessible to the public.

About 1,000 dry tons annually of biosolids are transported to the mine and used in one of the three outlined methods. The split of biosolids is about even between the three options with more material used in the 1:1 blending process during the winter months in order to stage the material until the summer months. Due to the snow levels, direct application is not practiced during the winter months.

The Snake River Wastewater Treatment facility directly land applies its Class B biosolids. The Breckenridge and Frisco Sanitation Districts have their biosolids mixed evenly with the wood chips to be applied by the mine, and the Copper Mountain Metro District and Silverthorne/Dillon Joint Sewer Authority have their biosolids composted.

The tailings sites to be reclaimed, usually for range or wildlife habitat, are covered with overburden from the mining operations. Next, alkaline amendment is applied to adjust the surface pH, and biosolids and wood chips are put on at a rate of 30 dry tons/acre. Finally, the surface is broadcast seeded with a mixture of high altitude varieties of seeds, ensuring that adequate coverage is obtained.

WOOD RECOVERY AND PROCESSING

In 1997, Westvac Environmental Services began hauling wood chips to the Climax Mine for incorporation with the biosolids. The wood chips were obtained from ground wood residuals at the Henderson Mine as well as from Stan Miller, Inc., located construction and aggregate company. Because of its land clearing operations, Stan Miller had set up a wood diversion operation at its yard, but had never been able to dispose of the resulting wood chips. Until 1997, the best option was to use the wood chips to construct landscaping berms around the yard. Around 1999, as the Climax project provided a proven outlet for the ground wood material, Summit County stopped issuing open burning permits for larger land clearing projects.

By 2000, another land clearing operator, Alpine Specialty Services, bought and put into service a Bandit Beast Model 3680 and began mobile grinding operations at larger clearing operations in the county. Westvac purchased a 100 cubic yard IMCO walking floor trailer in 1999 and hauled approximately 12,000 cubic yards of ground wood to Climax for eventual composting with biosolids. The wood chips also are used to stage incoming biosolids during the frigid winter months.

The Silverthorne/Dillon facility initiated a pilot program to accept wood residuals in 1997. An associated public education effort by the staff assured the delivery of clean, acceptable wood that could be chipped on site for transport to the mine. In addition to wood from construction projects, the facility ground almost 4,000 cubic yards of Christmas trees and brush cleared from construction sites in 2000.

In 2001, almost 50,000 cubic yards of wood chips have been delivered to Climax for use in the revegetation process. The bulk have come from a large clearing operation for the Peak Seven Ski Runs expansion at the Breckenridge Ski Area conducted by Alpine Specialty Services and the diverted wood residuals from Stan Miller, Inc. The wood chips are typically ground to six-inch minus. This size provides an adequate amount of fines for the composting operation while the large chips helps maintain the pile porosity and structure.
HIGH ALTITUDE, COLD WEATHER COMPOSTING

The high altitude of the composting site, 11,200 feet above sea level, and long winter season (the site received eight-inches of snow on June 18, 2001) made outdoor composting a questionable alternative. The high technology enclosed composting systems were out of the question due to the cost and budget constraints of the generators. A series of composting experiments conducted in 1989 by the Breckenridge Sanitation District and the Silverthorne/Dillon Joint Sewer Authority helped determine the optimum mixture of biosolids and wood chips needed for such extreme conditions. After several trials, they found an effective combination of ingredients, pile size and air flow (see “High Altitude Sludge Composting,” August 1992).

Westvac Environmental Services used that experience to design and operate the composting operation on the Climax Mine site. Due to weather and below freezing temperatures, the biosolids are immediately blended upon delivery to the site during the winter. The biosolids are blended with fresh wood chips and recycled compost at a rate of 1:2:2 (one part biosolids, two parts fresh wood chips and two parts recycled compost) using a large front-end loader. Aeration hoses are laid down on a bed of the mixture and a windrow approximately ten-feet high is built. The sides are hoed into the other windrow to conserve heat. Blowers push air through the static piles 15 minutes of every hour. Most windrows reach a temperature of 150°F within five days of pile formation and can stay at this temperature range for typically 75 days when the blowers are turned off.

All feedstocks, including wood chips, are tested for nutrients and metals. Temperatures are monitored throughout the process and the compost is routinely tested for salmonella, nutrients and metals. The finished compost stays in the windrows until late summer, then is spread on the surrounding disturbances at the mine.

A large roll-off shed was purchased and placed on site to house the blowers. The temporary “building” can also house operators who get stranded on site during winter storms. It is equipped with sleeping bags, food, water, a radio and an electric heater.

The composting operation has expanded each year over the past three years. In 2001, over 1,000 tons of Class A compost will be produced. The compost, along with the blended 1:1 biosolids and wood chips, have been spread along the southern end of the Robinson Tailings Pond at Climax Mine. The tailing pond is next to Col...
orado State Highway 91, which has been designated a United States Scenic Byway. With the application in 2001 and growth from the previous three years, motorists can now see major improvements as they drive up the highway.

PUBLIC INFORMATION AND EDUCATION

Tourists and residents alike — as many as 10,000 vehicles per day during the summer — travel past the mine over Fremont Pass, with the Climax Mine at its crest. The scenic contrast is dramatic; breathtaking views are punctuated by the disturbances created by nearly a century of mining.

Informative signs were placed on a highway overlook in the late 1980s describing the mining operations and methods for extracting molybdenum from the ore. The same commitment to informing and educating the public has been applied to the revegetation project. The overlook encourages visitors to stop and observe the reclamation activities, while signs explain the process.

Climax also broadcasts a message on an AM radio frequency near the mine to inform travelers about the mine and the reclamation work. The current announcement informs listeners that biosolids are being used to revegetate the mine site. Both the signs and the announcement are updated periodically to report progress.

Educating the mine employees about biosolids utilization was a little more difficult. At first, the workers at the mine were skeptical. But their attitude did a dramatic about face when elk returned to the newly revegetated land, a welcome sight to the many avid hunters in the area — and to the mine’s work force.

The local press has been very helpful in publicizing the reclamation as it progresses. The facility managers and Westvac actively communicate with the public.

With less than 100 acres reclaimed to date, the revegetation effort will continue indefinitely. The success of the program in Summit County — and the very long-term outlook for biosolids at the reclamation site — has stimulated considerable interest among other Colorado mountain communities either participating or starting similar activities near them. As the benefits of biosolids reclamation are realized, it is believed that both the composting and reclamation activities will expand.