

Technology Development and Transfer

One of the purposes of the Surface Mining Law is to help states develop and carry out their own approved surface coal mining programs. OSM achieves this in part by using sound science to provide technical assistance and training to its state and tribal partners to enhance their ability to maintain effective programs.

OSM's Technology Development and Transfer program covers a range of activities that promote and popularize technological innovations that lead to better protection of the environment during mining as well as in reclaiming active and abandoned mines. The program also provides training that ensures that states, tribes, and OSM's other partners continue to administer their surface mining programs efficiently and effectively.

The principles that underlie OSM's Technology Development and Transfer program are straightforward: Increase the technical knowledge of the reclamation of active and abandoned coal mines; Develop and enhance working relationships among the bureau's partners in Federal, state, and tribal governments as well as in industry and academia, and; Leverage the funding that OSM provides through partnerships.

OSM's delivery of specialized training courses is a perfect example of these principles in action. Through the bureau's National Technical Training Program and Technical Innovation and Professional Services, OSM has acquired a reputation for offering high-quality training that helps OSM's partners administer their surface coal mining programs.

Established in 1985, NTTP is an ongoing educational program designed to increase the technical competence and professionalism of state, tribal, and OSM regulatory and reclamation staff. The program's instructors write the curriculum and then present courses in a variety of highly technical fields. They also provide practical professional development to aid in OSM's public oversight mission. OSM's technical training also provides participants with a common understanding of the regulations, advances in science and technology, and how to apply them, while also interacting with OSM's stakeholders: the public, the industry, and other governmental agencies.

Similarly, OSM's Technical Innovation and Professional Services (TIPS) provides specialized hardware, scientific software, customized software training, and technical assistance to its user community. As with the NTTP, TIPS helps strengthen the capabilities of states, tribes, and OSM staff to enforce SMCRA through high-quality technical expertise and assistance, scientific information, and training.

What follows are some of the accomplishments that OSM's Technology Development and Transfer program achieved during Fiscal Year 2009.

National Technical Training Program's Fiscal Year 2009 Program Accomplishments

In Fiscal Year 2009, the NTTP trained 1,053 students in 41 technical, legal, and programmatic subjects ranging from how to take and preserve water samples to how

to communicate better with coalfield citizens.

In addition to regularly scheduled courses, the program also conducted special in-house sessions, including an AML Reclamation course for Montana and four courses for Kentucky (Erosion and Sediment Control, Excess Spoil-Handling and Disposal, Underground Mining, and Effective Writing). All aspects of the program, from identification of needs through course development and presentation, are cooperative efforts of State, Tribal, and OSM offices. In keeping with this, 187 instructors from 43 state, tribal, and OSM offices participated in course instruction, development, and revisions to course content.

One of the most demanding tasks facing the NTTP staff is anticipating what will be needed in future years to train OSM employees in the face of changing technologies and evolving best practices, as well

as changes in policies that ensure the best reclamation. To remain on the cutting edge, NTTP staff must consider what that environment might look like 18 months to two years into the future, as the development of a class generally occurs in three phases: the emergence of an educational need, the development of curriculum and related materials, and then, the execution of classroom training.

In 2009, NTTP began developing a new and comprehensive “SMCRA Principles and Field Processes” course, which will provide OSM staff members with fewer than two years’ experience with an historical perspective on SMCRA and an understanding of why their jobs are critical to meeting SMCRA’s mission.

The two-week long course places an emphasis on the necessary skills used in every OSM area of interest, including how to use maps, electronic equipment (such



Use of a borehole camera in the field. OSM's Technology Development and Transfer program has supplied this equipment to sites around the United States for a variety of uses.

as GPS applications), range finders, clinometers, and scale rules. Students also spend significant time on water sampling, the proper use of chain-of-custody techniques, measurements, site observation, photography, note-taking, and studying how to respond to complaints. Instructors also teach students field essentials such as engineering design, blasting, enforcement procedures and AML management basics.

In 2009, NTTP also partnered with the Interstate Mining Compact Commission, an organization representing states that have assumed regulatory responsibility for their surface coal mining programs, to begin developing content for a benchmark course on the use of electronic permitting. Streamlined permit applications and increased use of electronic systems to handle permits benefit the coal-mining industry, citizens, and government entities alike.

In 2009, NTTP also began developing the curriculum for a course entitled “Acid-Forming Materials: Soils and Overburden.” The advanced-level course hones the technical skills of staff members who examine sites that contain acid-forming materials. The course addresses the materials’ geology, mineralogy, and weathering, and the impact of acid-forming materials on reclamation planning, the mitigation of mine soils, and plant systems.

NTTP conducted courses in 25 locations across the Nation in Fiscal Year 2009 in an effort to maximize student exposure to mining conditions most similar to those they work with, and to minimize travel costs. Roughly proportional to the size

of SMCRA programs in OSM’s Regions, 70 percent of the students who attended NTTP courses came from the Appalachian Region; 11 percent from the Mid-Continent Region; 17 percent from the Western Region; and the remaining 2 percent from OSM Headquarters.

Overall, the NTTP program achieved an effectiveness rating of 95 percent, exceeding the Government Performance and Results Act goal by 2 percent.

Technical Innovation and Professional Services

The Technical Innovation and Professional Services (TIPS) Training Program is a collaborative effort among OSM, states, and tribes. The tools that TIPS provides to state, tribal, and Federal offices ensure that all agencies with Surface Mining Act responsibilities are using the same advanced software and hardware tools to conduct the business required by the Act. TIPS does not just offer software and hardware, however. The program also provides specialized training to use those tools in mining and reclamation. The program maintains specialized training centers in OSM’s Regional Offices: Denver, Colorado; Alton, Illinois; and Pittsburgh, Pennsylvania.

Although most of TIPS’ tools are off-the-shelf applications, TIPS training is tailored exclusively to mining and reclamation uses; this kind of training cannot be found anywhere else. As part of an ongoing effort to improve the TIPS program, program staff regularly survey students who have taken a TIPS class. In 2009, the TIPS training

program received a customer satisfaction rating of 96 percent, exceeding the annual GPRA goal by 3 percent. Forty instructor-led classes were held in 2009 with 502 students completing class sessions. Additionally, 48 students attended training courses sponsored by TIPS, bringing the 2009 total to 550 students trained.

In addition to instructor-led courses, the training program makes 122 e-learning courses available to TIPS customers through DOI Learn, a learning-management system offered by the Interior Department, and ESRI, which is the world leader in GIS modeling and mapping. E-learning provides flexibility and convenience to its users, who can use it to train at their own pace from the comfort of their offices or homes. Forty-six students registered for e-learning courses during 2009, with 41 students completing their course work.

The TIPS program also works in cooperation with OSM's NTTP, complementing training the NTTP provides in SMCRA fundamentals and scientific principles with the training necessary for the use of TIPS technology.

The TIPS website (www.tips.osmre.gov) provides information about TIPS and NTTP, including current training classes, descriptions of TIPS software, access to digital data files for public-domain TIPS software, and a comprehensive link to nationwide geospatial data sources.

The following examples represent some of the TIPS Program's accomplishments in 2009.

TIPS Training Partners with Minority Hiring Employment Program to Reach New Students

The TIPS Training Program continued its collaborative efforts with Southwestern Indian Polytechnic Institute (SIPI), a designated MHEP Tribal College or University, in Albuquerque, NM. SIPI provides TIPS the training facility and student seats in the class in exchange for TIPS providing instructors and course materials. The TIPS program has also initiated a collaborative relationship with MHEP Adams State College (ASC), an Hispanic Serving Institution, in Alamosa, CO. TIPS staff, along with ASC, have already begun to share their expertise in many new ventures to include shared classrooms as well as online training. This partnership has already resulted in agreement for college accreditation for TIPS courses, and a partnership to distribute TIPS courses online through Adams State College's E-learning campus.

On-site Training On Target

For the last four years, the "Introduction to GPS with Garmin eTrex Vista HCx" class has been the most requested TIPS training class with nearly 300 students successfully completing the class during this time. TIPS instructors from the Commonwealth of Pennsylvania developed a tailored Garmin class for all Pennsylvania inspectors and proceeded to deliver the course on-site throughout the state. Overall, 10 classes were delivered to over 130 inspectors in Pennsylvania. The inspectors are now required to use GPS on a daily basis to document disturbed and reclaimed acreages for full-cost bonding, and often

use them to document locations of high-walls, water samples, and complaints. These data are then imported into TIPS-provided software for map generation or GIS assimilation. The end result of their efforts is that no inspector is left behind on the GPS/GIS technology ladder.

Pennsylvania's creative leadership provided learning opportunities for State field staff to work in cooperation with industry and state management to make permitting and operational decisions and their training efforts illustrate to other states the benefit TIPS products. Opportunistically, instructors from Pennsylvania recruit new TIPS instructors through delivery of their on-site classes to further the GIS/GPS effort in the organization and give employees a local point of contact to go to for information and/or resolution of problems.

Coal Mining Geospatial Data Standards

This project is to establish American Society for Testing and Materials Coal Mining Spatial Data Standards for the regulatory and AML programs. Coal mining permit applications submitted by industry and approved by state regulatory authorities contain a large amount of data used to describe planned mining operations. Some of this data is presented on maps in a spatial context displaying the areas to be mined and reclaimed. Some features on these maps, such as the permit boundary or bonded area for example, can be digitally extracted from the maps and managed in a spatial information system to allow regulatory personnel to accurately track the progress of mining and recla-

mation status at the mine site. GIS technology supports the sharing of this data electronically for use by multiple software applications among many users. To ensure data accuracy and reliability among the various applications and users, especially when comparing data from multiple state programs, standardization in defining the features being shared is essential.

OSM's Applied Science Program: Developing and Delivering High-Quality Technical Information and Science to Partners in Reclamation

Each year, OSM's Applied Science program selects and funds applied science proposals that have the potential to improve on-the-ground reclamation and find answers to environmental concerns associated with coal mining. The Nation needs these continuing efforts to better protect identified endangered species, improve reforestation and revegetation, protect prime farmland, improve technologies to mitigate acid mine drainage, and improve methods for locating underground mines. The Applied Science program is also positioned to help find solutions to other problems that may threaten the public or the environment during and after surface coal mining.

In Fiscal Year 2009, OSM's Applied Sciences program completed nine projects (see text box on page 39) that focused on bringing better information, technology, and tools to the states and tribes, the coal-mining industry, and to non-profit watershed and community groups. The follow-

ing three projects highlight some of these on-the-ground technological advances.

Predicting Contaminant Leaching Potentials for Central Appalachian Overburden and Coal Refuse Materials

The goal was to predict and study the pattern and concentrations of the total dissolved solids (TDS), which is high-salt and/or high pH-producing material, released from common overburden and coarse/fine coal waste in central Appalachia. This is the first project that has studied the pattern of TDS that leaches from mine spoils, coal refuse and overburden and quantified them in such detail. The researchers measured each component of the TDS and how much of each element of concern (including arsenic and selenium) was to potentially drain from the mine spoils, coal refuse and/or the overburden.

Through detailed TDS and overburden analysis, the researchers were able to link the type of overburden and coal waste to the type of pH and TDS it will produce. The techniques of this study have given OSM and the state regulatory authorities a tool to better predict the pattern and concentrations of TDS coming from mine sites. They will also be able to better identify which materials are going to be TDS generating. Both federal and state offices now have better insight into which type of overburden will potentially be a problem when dealing with TDS prevention and prediction.

These tools will also be very important to successful reforestation. When reforestation is the planned post mining land use,



In an Applied Science project to predict the leaching of contaminants from overburden, researchers used a closed system to measure the amount of substances that leached through different media.

using overburden that is TDS producing will not support healthy tree growth. If the coal companies and the regulatory authorities can determine which types of overburden are high in salt/TDS producing and which ones are not, they will know which materials would be ideal for reforestation. These tools will potentially help to create a link between TDS compliance and reforestation.

This study will help to link the type of overburden found at a mine site to the pH and TDS concentrations and amounts that will be produced from that mine.

Improved Static Test Prediction of Acid Generation Potential: Using X-ray Photoelectron Spectroscopy

X-ray photoelectron spectroscopy (XPS) is a new analytical tool that can be applied in the characterization of minerals common to mining operations. Samples collected from mine sites that were analyzed with XPS indicate that this new technique holds strong potential as a complementary method to existing technology for predicting the potential for mine spoil to generate acid mine drainage. Semi-quantitative results from this technology compare favorably with more costly and time-consuming bulk results determined by traditional acid-base accounting (ABA) methods.

The identification of specific minerals that are known acid producers by this method is proving to be helpful in understanding the complex chemistry of soils and rocks associated with mining. Great importance is being placed on the application of cutting-edge characterization techniques that can assist the development of better mine plans that correctly identify and handle acid-forming materials.

The Use of Commercial Weed Fabric and Irrigation to Enhance Growth and Survival of Aspen and Serviceberry on Reclaimed Surface Mine Lands

This project was designed to determine the effectiveness of landscape fabric to control competing vegetation and improving growth and survival of aspen and serviceberry planted on reclaimed surface coal mine lands at high elevation sites in

Colorado. The method can be used to mechanically replant large areas with woody perennials and enhance survival and growth of trees and shrubs on reclaimed surface mines.

This methodology can be a useful tool to ensure survival and growth of woody perennials on reclaimed surface mine lands where regeneration of trees and shrubs has been problematic due to competition for soil moisture from natural regeneration or replanted herbs and forbs. The method can be used in any area of the country where woody perennial vegetation needs to be re-established, but where growth and survival of the vegetation is limited by competition for water.

Applied Science Projects Completed in Fiscal Year 2009

One of OSM's activities is supporting applied science projects that are designed to help state and tribes in their mission of reclaiming mining sites and mitigating the adverse effects attributed to mining. These applied science projects often involve gathering large data over long periods, and then extensive analysis of the results.

Most projects will run for several years before they reach a conclusion. In Fiscal Year 2009, OSM's Applied Sciences program completed nine projects, which began between 2005 and 2008.

In chronological order by their start date, here are the projects that OSM completed in Fiscal Year 2009:

2005 Projects

Monitoring and Exploration for Flooded Pools in the Pittsburgh Coal Basin of Northern West Virginia, Principal Investigator: Donovan, West Virginia University

2006 Projects

An Evaluation of BMP Efficiencies in Reducing TDS Loads from Active and Abandoned Mine Lands and AMD, Principal Investigator: Kern, MapTech, Inc.

Improved Static Test Prediction of Acid Generation Potential: A Surface Analysis Approach, Principal Investigator: McWhinney, Prairie View University

2007 Projects

Improving Passive Mine Treatment Through Better Understanding of Biogeochemistry and Mineralogy Associated with Mn(II) Oxidation, Principal Investigator: Burgos, Penn State University

Enhancing Mine Subsidence Prediction and Control Methodologies for Long-Term Landscape Stability, Principal Investigator: Karmis, Virginia Tech University

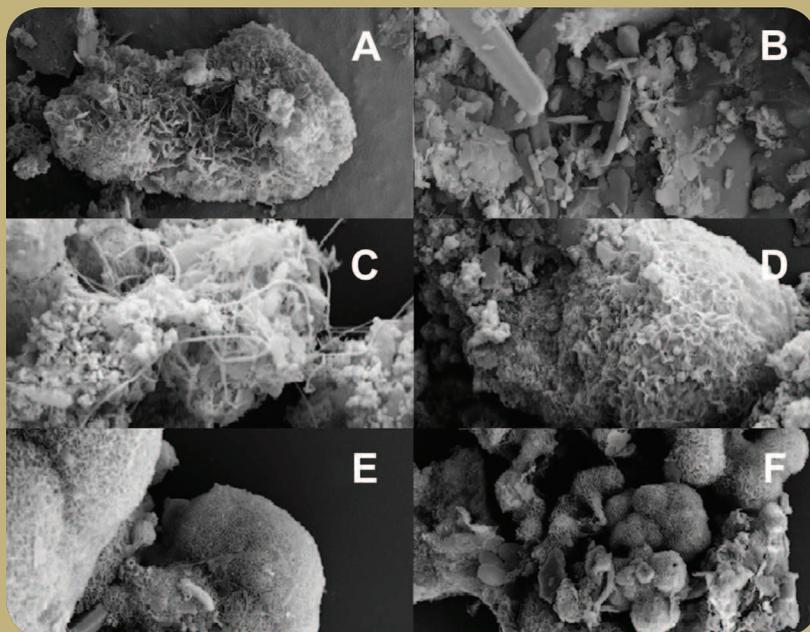
Predicting Contaminant Leaching Potentials for Central Appalachian Overburden & Coal Refuse Materials, Principal Investigator: Daniels, Virginia Tech University

In-Situ Mitigation of Iron in a Net-Alkaline Environment, Principal Investigator: Leavitt, West Virginia University

Quantifying the Functional Value of Stream and Wetland Mitigation Structures on Reclaimed Surface Mines in West Virginia, Principal Investigator: Petty, West Virginia Water Research Institute

2008 Projects

The Use of Landscape Fabric and Supplemental Irrigation to Enhance Survival and Growth of Woody Perennials Planted on Reclaimed Surface Mine Lands, Principal Investigator: Musselman, USDA Forest Service



An electron micrograph of manganese used in a 2007 study to understand the biogeochemistry and mineralogy associated with Mn(II) Oxidation.

Retirements, The Aging of the Workforce, and Opportunities to Improve: How Alabama's Surface Mining Commission Reacted to a Staffing Challenge

Loyalty and longevity are two words often used when talking about the people who work at OSM and its partner state agencies. Walk down almost any hallway in OSM or at a state office, and you will likely see where employees have placed 20 and 30-year certificates of service on their wall. That speaks eloquently to the satisfaction many people get from carrying out the work that OSM and its state government partners do.

However, it also lends itself to another reality: many of those same workers will probably retire within the next five or six years. A March 2008 Office of Personnel Management study reported that about 36 percent of the total current Federal workforce would be eligible for retirement in October 2010, but that number would balloon to nearly 61 percent by 2016. OSM has also seen a big increase in the number of retirements. From a peak of 36 retirements in FY 2005 and FY 2007, 24 OSM employees chose to leave Federal service in FY 2009, which represents nearly 5 percent of the overall workforce. There is little doubt that, as a result, every office at OSM could feel a significant loss of institutional knowledge in a very short time. Some state agencies find themselves in similar positions.

However, such turnover in the workforce presents opportunities as well. Sometimes it can lead to improvements in the regulatory arena, as the arrival of new employees offers new ways of addressing existing challenges.

In 2009, one of OSM's partner state agencies experienced such a loss when a 20-year veteran employee suddenly retired. The departure of a senior geologist/hydrogeologist meant the Alabama Surface Mining Commission (ASMC) would have to continue operations with a newly hired hydrologist with limited experience.

Facing a backlog of more than 20 permit applications, the ASMC asked OSM to lend a hand with increased technical support. In response, OSM assigned one of its hydrologists to immediately begin working closely with ASMC's new hire. OSM and the ASMC staff began the process by conducting simultaneous permit reviews. These joint reviews not only helped Alabama begin clearing its backlog of permit applications but also served as an initial training tool for the newly employed scientist.

This assistance from OSM led to a broader request from ASMC, one which produced widespread changes that took more than three years to fully implement. In addition to doing the permit reviews, OSM developed a multi-year

work plan consisting of over 25 individual tasks aimed at training the ASMC staff and enhancing Alabama's geologic and hydrogeologic permitting requirements.

For three and a half years, OSM's staff provided individual training to the ASMC on geology and hydrogeology. The courses focused on the applications of these disciplines to surface coal mining.

OSM also provided training on evaluating the potential hydrologic effects of surface coal mines to several ASMC staff members, which led to opening communications with other state and Federal programs, and promoting even better exchanges of information.

By late 2009, as a result of the changes at ASMC, the state had adopted more stringent requirements for geologic and hydrogeologic data submitted in permit applications. These new requirements will result in better probable hydrologic consequence determinations and improve the predictive analysis of potential impacts resulting in more accurate cumulative hydrologic impact assessments. There are also new requirements for overburden sampling and analysis, as well as more stringent criteria for obtaining bond release.

The work plan also prompted the state to produce and distribute plans on better preparing determinations of the Probable Hydrologic Consequences, permitting requirements for surface and ground water, geologic characterization, overburden sampling and analysis requirements, and bond release criteria.

By December 2009, OSM's staff had completed the 25-task assignment to train the ASMC staff.

In the process, both sides benefited. One new hire can make a difference. The Alabama Surface Mining Commission has a fully trained geologist/hydrogeologist, and clearly written hydrology and geology guidelines for the industry to use. For its part, OSM has developed a valuable model that may help its own transition as more Federal and state regulatory employees retire, and the next generation of professionals joins the workforce.

OSM Retirements 2003-2009

