

TECHNOLOGY TRANSFER

ASSISTANCE AND TRAINING

The Office of Surface Mining provides states, Indian tribes, federal agencies, and the coal industry with the technical information and tools they need to carry out their responsibilities under the Surface Mining Law. These activities include:

- providing direct technical assistance to address specific mining and reclamation problems;
- maintaining automated systems and databases used by others in making decisions under the Surface Mining Law; and
- transferring technical capability to others through training, consultations, forums, and conferences.

The goal is to help stakeholders develop the skills needed for solving problems on their own. In recent years, the Office of Surface Mining has been supplementing its traditional oversight presence with an increased emphasis on providing technical assistance and support to states and tribes.

While the focus of the Office of Surface Mining is to help state and tribal partners do their jobs, the ultimate goal is to improve the health, safety, and the environment for our primary customers, the people who live and work in coalfield communities. Using printed publications, website information, and videos, the Office of Surface Mining provides information to citizens to help them better understand their rights and responsibilities under the Surface Mining Law.

Technical Assistance

Computer Tools and Services

The Office of Surface Mining provides states regulators with a comprehensive set of analytical tools to aid in technical decision-making related to the Surface Mining Law. The services provided are centered on off-the-shelf scientific and engineering computer hardware and software supported by the Office of Surface Mining in partnership with the states and tribes. This technical assistance has grown from a few applications available on a single specially designed workstation, to a suite of software on each user's desktop computer. Costs are held low through shared licensing of the software via the internet.

Currently the assistance consists of Windows-based computers at state, tribal, and Office of Surface Mining offices with access to the licensed servers via the Internet and Office of Surface Mining Wide Area Network. The 26 commercially available software applications cover a wide range of regulatory and abandoned mine land subjects. During 2005, an average 134 customers use software provided by the Office of Surface Mining's Technical Innovation and Professional Services each workday. The customer base is composed of over 700 desktop computers at 96 state, tribal, and Office of Surface Mining offices throughout the country. In 2005, this service provided two software updates to each of the customer sites as part of a semiannual service to keep the software tools up to date.

Remote Sensing Technology

High resolution satellite imagery, light detection, and ranging imagery is acquired, processed, and provided to permitting and inspection staff in state and Office of Surface Mining field offices throughout the country. Aerial photography and satellite imagery are an integral part of the Office of Surface Mining geographic information system used in Western states. Satellite imagery is acquired annually and light detection and ranging imagery data is acquired biannually.

In 2005, the Office of Surface Mining provided imaging and mapping services for Alaska, Indian and federal lands mine sites in the Western United States. The inspectors routinely use this imagery to plan for field visits, during consultations with mine operators, and when preparing maps for inspection

Thermal Imaging

The Office of Surface Mining has acquired two thermal cameras (ThermaCAM™ E4) for use in locating acid materials and coal seam fires. The ThermaCAM is a hand held device that can also be used from aircraft. Thermal images and graphs are stored in the camera and downloaded to a personal computer where they can then be used as base layers in a geographic information system, or for inclusion in reports. The camera records temperatures in the range of -20°C to +250°C (-4°F to +482°F) with an accuracy of ± 2°C or ± 2% of absolute temperature in °C. In 2005, the camera was used in North Dakota,

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Illinois, and Pennsylvania to define underground coal bed fires. The camera was also used to locate and record surface temperatures of coal seam fires in North Dakota. In Illinois, it was used to search for hidden mine shafts that have been closed by unknown means, and in Pennsylvania to detect coal seam fires and pyrite oxidation areas.

Internet Mapping Services Initiative

During 2005, the Office of Surface Mining formed an Internet Mapping Services team to investigate the application of Internet mapping technology to coal mining operations. The objective of the team is to find practical methods of implementing internet mapping technology for surface mining applications, share information with others implementing this technology, provide technical support, and to identify a unified approach in delivering these services. Internet mapping uses geospatial datasets to produce maps on a server which can be delivered through the Internet to a standard browser as an image for interactive use at a remote workstation. The user can view, pan, zoom, query, select themes, download, and print the interactive map. An internal prototype map service has been established in 2005, and can be viewed by Office of Surface Mining staff. The Internet Mapping Services Initiative is a response to meet the Interior Department's E-Government Strategy, by sharing spatial information inside and outside the Department, modifying information systems to enable them to use geospatial data, and improving the capability to access geospatial information on-line.

Prior to 1977, when the Surface Mining Law was passed, it was common practice to remove the topsoil and overburden in one operation. This resulted in the loss of valuable topsoil that was essential to reestablishing productive agricultural land uses. The corn coop growing on this reclaimed Indiana mine site has consistently been above required yields and is producing better crops than the surrounding unmined area.

Partnership Projects

United States Geological Survey

Representatives from the Office of Surface Mining are negotiating a Cooperative Agreement with the U.S. Geological Survey to use strategic defense imagery from coal-mining areas of the United States to locate coal fires, and waterways containing acid mine drainage. The Office of Surface Mining provided map coordinates of known coal fires and acid mine drainage sites to the Geological Survey's Mid-Continent Mapping Center in Rolla, Missouri. The Mapping Center will determine the spectral characteristics at these coordinates and use the results to locate other potential coal fires and acid mine drainage-producing areas.

If this test is successful, the Office of Surface Mining will improve upon the hand-held thermal camera technology already in place. This new technology will enable the use of remotely-sensed thermal imaging technology to accurately detect, locate, map, and inventory coal seam and coal outcrop fires and acid mine drainage sites over large areas, and

also be able to maintain and analyze this data in a geographic information system.

United States Department of Agriculture

An Interagency Agreement was established between the Office of Surface Mining and the Agriculture Department's Agriculture Farm Services Agency. The purpose of this agreement is to provide a cost effective, administratively streamlined way to acquire high resolution aerial photography in support of regulatory and abandoned mine reclamation under the Surface Mining Law. Photography will be flown for Office of Surface Mining designated areas as part of the Agriculture Department's Forest Inventory Assessment program.

United States Forest Service

The Office of Surface Mining partnered with the U.S. Forest Service through an Interagency Agreement to share costs to test airborne thermal imaging remote sensing technology to locate and map coal seam fires. The Forest Service is using an airborne thermal imaging sensor called the Star SAFIRE III to map wildland fire area perimeters and hot



spots to assist in directing fire fighting forces on the ground. The camera is mounted on a Forest Service AH-1 Cobra Helicopter. Using the imaging sensor, the helicopter crew collects ground coordinates of fires or hot spots, mapping the exact location of these fires "on the fly". OSM initiated this partnership with the Forest Service to determine if this technology, used in wildland fire fighting efforts can be applied to mapping coal seam fires.

Mobile Computing

For the past three years, OSM staff have used global positioning systems on tablet computers to conduct reconnaissance activities for bond release and bond forfeiture design. State reclamation experts have used mobile GIS technology in Alaska, Ohio, and Pennsylvania to map mine site features. Wyoming state inspectors and western OSM inspectors verify slope angle, topsoil depth, and placement of wildlife habitat features in the field through the use of company-supplied digital maps.

In the mid-continent region, mapping efforts were initiated to aid in determining bond release areas and estimating reclamation liability of multiple-permit bond forfeiture areas. Additional efforts were conducted in Alabama and Illinois to improve the quality and accuracy of water and soil data collection. During 2004 and 2005, OSM conducted a series of workshops, assistance efforts, and hands-on training sessions with state regulatory and abandoned mine land programs to help introduce them to mobile geographic information systems and mobile computer assisted drafting technologies. In 2005, OSM and state participants in the mobile computing effort have worked together with other programs implementing the Surface Mining Law to improve the technology applications. Additional tools include the development of personal data assistance applications to mobile computing technology as a less expensive, yet effective field tool.

Hydrology Program

In 2005, the TIPS Hydrology Program successfully advanced in four areas: 1). The large watershed review team has

been reviewing potential new software to provide staff with tools to assist in the creation and evaluation of Cumulative Hydrologic Impact Assessments (CHIA) and Probable Hydrologic Consequences (PHC), general large watershed analysis, and flooding potential.

2). The surface water team is studying providing additional support for Army Corps of Engineers HEC modeling programs including HEC-RAS and HEC-HMS in response to customer requests.

3). The TIPS Hydrology Program Manager promoted the integration of Hydrology and Geospatial applications at the ESRI User Conference in San Diego in July.

4). In September the Hydrology Program provided training in Denver at the TIPS Training Center for the Geochemist's Workbench software, supporting hydrogeochemical analyses in OSM and state offices.

Slurry Impoundments

Since 1996, there have been four breakthroughs of coal slurry impoundments into underground mines. Slurry impoundments are created from the coal preparation process as coal is washed to remove impurities. A mixture of silt and sand-sized shale particles and water are pumped behind an embankment built of coarse coal waste to assure that off site water pollution will not occur.

OSM is currently completing an oversight review of the state regulatory authorities' procedures for assessing breakthrough potential. This review includes an assessment of the reasonableness of states' decisions related to breakthrough potential. OSM also has recently completed the technical review of the flowability of slurry to determine its potential to flow into underground mines if an opening develops. The study reviewed current knowledge on, or applicable to, the potential flow characteristics of impounded coal refuse. The

review explored two interrelated issues:

1. Given the occurrence of a breakthrough event that would result in a potential flow between an underground mine and an impoundment, should we expect coal refuse to flow into the mine?
2. If the refuse would flow, what would be the nature (e.g. velocity and extent) of that flow?

Underground Mine Mapping Inventory

OSM and the states have actively inventoried abandoned mine land features for years using the best available information and technologies. The inventory includes information about the location, size, and type of abandoned mine hazards and the priority for reclamation under the Surface Mining Law. For abandoned underground mines, however, more detailed information, including detailed mine maps, is necessary in order to adequately evaluate the threat posed by these mines to the public, infrastructure, and the environment.

Accurate and readily-available underground mine maps are essential for protecting the public, the environment, and infrastructure from the threats posed by unknown underground mines. The Martin County Coal Company impoundment failure in Kentucky damaged miles of stream and cost hundreds of millions of dollars to clean up. The Quecreek mine accident in Pennsylvania endangered the lives of nine trapped miners and nine others who escaped the inundation. These are just two incidents which have threatened the safety of the public and the environment and could have possibly been avoided if accurate underground mine maps were readily available.

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At this Cutler, Illinois reclamation site almost nine miles of streams were restored after being temporarily diverted during the mining. In association with the stream restoration approximately 350,000 trees were planted to provide a diverse wetland, flood plain, and wildlife habitat.

The availability of accurate underground mine maps also protects public investment in public infrastructure, homes, and businesses. For example, in Pennsylvania, millions of dollars have been spent to repair sections of Interstate 70 and other roads that have been damaged when underlying underground mines have subsided. With three interstate highways and numerous other public road projects being planned for the coalfields of West Virginia, billions of dollars of public investment may be protected by knowing how the roads should be backfilled if an underground mine map inventory is available.

In addition, thousands of homes and businesses lie over abandoned underground coal mines. These homes and businesses represent private investments of billions of dollars. In some cases, the homeowners and business owners have no way to find out where the mines are and what should be done to protect their investments or minimize the threat to their safety. According to information provided by the Commonwealth of Pennsylvania, the costs for repairs at only two developments, where homeowners were unaware of the mining and had no subsidence insurance, were nearly \$2 million.

Finally, many of these abandoned underground mines are flooded, and in some areas are hydrologically connected to one another, creating massive underground mine pools. These pools of water may contain contamination, such as alkaline or acid mine water and metals. In some cases, the volume of water is increasing to the point where the pools will soon begin discharging to the surface. The availability of maps of the



abandoned mine workings will allow more accurate calculations of the volume of water contained in these mine pools and for planning to deal with the discharges. In some cases, the water contained in these pools can be used for industrial or other purposes. Knowing the volume of the water would allow for investment based on the availability of the water supply and the potential economic redevelopment in the coal fields.

During 2005, the Office of Surface Mining began working with the states and the Mine Safety and Health Administration to develop an approach to acquire underground mine maps and to make them readily available to a variety of customers. A benchmarking forum was held in October 2003 to identify the then current activities related to underground mine mapping. The Office of Surface Mining has continued to work with the states and others on

development of further initiatives as a follow up to that meeting. The effort has focused on means to identify best practices for preserving, archiving, and distributing mine maps. A part of this effort has also been the identification of practices for georeferencing and manipulation of electronic maps using standard geospatial tools. These best practices will allow the Office of Surface Mining and the states to identify resource needs and develop a set of voluntary standards for addressing the need for underground mine maps in a cost efficient manner.

In June 2005, the Office of Surface Mining and the Interstate Mining Compact Commission co-headed the second benchmarking workshop on underground mine mapping. Over 95 attendees from federal agencies, state regulatory agencies, state abandoned mine land agencies, state geological surveys, and state and federal miners

health and safety agencies spent the two days discussing various aspects of acquiring, preserving, and making mine maps available to various customers in electronic formats. There was also discussion of liability issues and reliability of the maps and the data. The attendees heard presentations based on state and federal experiences, and looked for opportunities to develop further cooperation and a compendium of best practices to assist in acquiring the maps and making them useful for the variety of potential customers.

Congressionally-Mandated Coal Study

In the Consolidated Appropriations Act, P.L. 108-447, Congress directed OSM to engage the National Research Council of the National Academy of Sciences to carry out a 24-month study on coal research, technology, and policy matters. A formal letter of request from Senators Robert Byrd and Arlen Specter was transmitted to the National Academies on December 17, 2004.

The Senators indicated the need for involvement in the study and a review of work being done by the Office of Surface Mining, Department of Energy, U.S. Geological Survey, Mine Safety and Health Administration, National Institute for Occupational Safety and Health, Environmental Protection Agency, and other federal and state agencies. There have been significant federal expenditures over the past several decades in coal-related research. Most of this funding appears to be directed toward the use of coal in power generation, and in technology development and demonstration; and not in the mining and reclamation of coal or its use in other promising, alternative applications. There is concern that despite the large amount of funding dedicated to coal research, the United States does not appear to have an integrated and coordinated coal research and development approach for all stages of the coal life cycle.

The study will consider the following

issues:

- Review the importance of coal to the U.S. energy mix over the next 25 years, including the role coal plays in an integrated energy and environmental policy in order to develop a more comprehensive, roadmap that builds on economic growth, fuel diversity, energy security, and environmental sustainability.
- Review the coal reserve assessments based on recent trends in the coal sector and examine the current and future role of coal imports and exports.
- Evaluate the full range of local, regional, national, and global issues and challenges that lie ahead for the production and utilization of coal. Assess international coal research and development efforts, including trends in international markets in the short, medium, and long term.
- Assess the categories of coal research currently being carried out in the U.S. and investigate whether and how technology developments in other fields can be applied to the coal sector. Review how technologies are being transferred to coal mine operators and other users, recognizing differences among companies.
- Determine the priority of coal research needs, including the areas of exploration, discovery, reserve assessment (including terms of commercial feasibility for known reserves), extraction, coal preparation, delivery to market, waste disposal, reclamation, health and safety, community impact, environmental practices, education and training, and productivity.
- Evaluate the need for a broad-based, coordinated, multi-agency coal research and development program.

Review current coal-related research, examine which agencies are conducting it, and determine how much funding is currently being spent throughout the coal life cycle.

- Examine options for supporting and implementing a broad-based coal research program, including approximate costs, and the relative roles and commitments of the public and private sectors now and into the future.

The Office of Surface Mining and the National Academies entered into a cooperative agreement in July 2005 for completion of the study. The Office of Surface Mining has also established a committee made up of representatives of the federal agencies whose programs are involved in the study to help provide information to the National Research Council study committee. The National Research Council committee's report is scheduled for completion in the summer of 2007.

Bat Conservation and Mining

The Office of Surface Mining has worked to protect the populations and habitats of bats associated with mining since 1998 when a Memorandum of Understanding with Bat Conservation International. During November of 2005, the Office of Surface Mining held its third technical forum "Indiana Bat and Coal Mining" on bat conservation and mining. The forum focused on issues related to:

- Bat biology and life history
- Field techniques for biological assessment
- The consultation process
- Case studies
- Guidance development for permitting.

Information provided during the forum showed a dramatic decline in the number of Indiana bats over the last forty years nationwide. This was the basis for increasing efforts by the U.S. Fish and Wildlife Service to protect the federally endangered Indiana Bat and the need for the Office of Surface Mining to work more closely with state regulatory programs during the permitting, mining, and reclamation activities of coal mines that potentially impact Indiana Bat habitat. The Office of Surface Mining is currently publishing proceedings from this forum.



During the life of this Washington coal mine over 14 thousand acres of land will be disturbed and restored. Following mining and reclamation of the land, forests are being replanted using native species of trees. A special benefit of the reclamation is the development of diverse wildlife habitats that range from upland forests to wetlands.

provide a more reliable method of determining if reclamation has restored the productive capacity of our valuable farmlands while also returning the lands to the owner's

The Office of Surface Mining also cosponsored a forum with Bat Conservation International entitled "Management of Mines and Bats that Depend on Them." The forum focused on issues related to: mining and mining history, conservation considerations, management tools, and conservation research in action, and building a program.

The Office of Surface Mining maintains a bat conservation and mining information website in order to make technical information available to the public. See www.mcrc.osmre.gov/bats for additional information.

Prime Farmland Reclamation

The Office of Surface Mining continues to work with its partners in the agricultural regions of the nation to improve the success and efficiency of prime farmland reclamation associated with coal mining. During 2005, the Office of Surface Mining partnered with the Agricultural Department's Natural Resources Conservation Service, Illinois and Indiana Regulatory Authorities, the Illinois Coal Association, the Indiana Coal Council, and four coal mining companies in providing financial support for an applied science project being undertaken by the University of Illinois. The project proposes to develop a system to evaluate prime farmland reclamation success based on spatial soil properties. This work has the potential to provide industry and regulatory authorities with a method of determining reclamation success without impacts from the many variables that influence crop production. If successful, the technology would

control sooner than under current productivity evaluation methods.

Reforestation

The Office of Surface Mining has been involved with efforts to encourage reforestation of coal mined lands since 1998. Two interactive technical forums have been conducted with proceedings published and distributed. In 2004, the Appalachian Region established the Appalachian Region Reforestation Initiative with its state counterparts. The Initiative has grown and obtained substantial support since it began. The Initiative's accomplishments in 2005 include:

- A major signing ceremony of the Statement of Mutual Intent event on December 15, 2004 at Stonewall Jackson Lake State Park, West Virginia

- Obtaining over 100 signatories to the Statement of Mutual Intent to date, representing 69 different organizations: 26 Government Agencies (federal, state and local), 16 Environmental Groups, 14 Industry Organizations, nine Academic Institutions, and four Citizen Groups.
- Numerous tree planting events throughout the region in support of Arbor Day including events attended by the Director of the Office of Surface Mining.
- Establishment of an academic team with representatives from universities across the country to support the science behind the Initiative.
- Creating an awards program to honor operators who exemplify the provisions of the Forestry Reclamation Approach.
- Creating materials to promote the Initiative such as brochures, newsletters, a website, and posters.
- Completion of three Initiative draft training modules; one for industry and landowners, one for inspection, and one on permitting.

The Office of Surface Mining also has a team working on a primer which will explain the fundamentals of reforestation by planting high-value hardwood trees using the Forestry Reclamation Approach. Although technical in nature, the primer will also serve as a guide to local, state, and federal government agencies, tribes, the coal

Wildlife may not usually come to mind when people think of the landscape that results from surface coal mining reclamation. However, wildlife habitat is actually on of the more common postmining land uses. Many mining operations use reclamation techniques to reestablish or even improve wildlife habitats. For example, in the prairie landscape of North Dakota, wetlands provide a critical waterfowl habitat and add diversity that is important for other wildlife. This mine operator carefully designed wetland areas at this site to maximize habitat with undulating wetland edges, diverse vegetation, and creation of both shallow and deep water zones.

industry, landowners, academia, and local citizens, to demonstrate how each can benefit by creating productive forestland on reclaimed mine land. The economic benefits of reforestation are made evident not only in hardwood tree value; but, in eco-assets such as wetland restoration and carbon sequestration. Secretary Norton's 4C's management principle --Conservation through Cooperation, Communication, and Consultation-- is epitomized through this collaborative initiative.

For additional information on the Office of Surface Mining's Reforestation activities see www.osmre.gov/reforestationindex.htm

International Activities

In 2005, the Office of Surface Mining and its state partners were actively engaged in projects with the Indonesian Ministry of Energy and Mineral Resources and the Indonesian Ministry of the Environment, and occasionally with the Ministry of Forestry. The goals were technical and policy assistance in the environmental regulation of mining.

Both agencies had decentralized much of the environmental decision making to the county level, and thus needed assistance in converting themselves into central policy, training, and oversight agencies. Office of Surface Mining's relationships with its state partners and with other federal agencies, such as the Environmental Protection Agency, provided useful models for the Indonesian national ministries to form cooperative, consultative relationships among themselves and with the provincial and county governments.

The United States Agency for International Development provided all the funding for the Office of Surface Mining's activities pursuant to the Technical Assistance Agreement with Indonesia. The December tsunami, however, required the Agency for International Development to reassess its priorities for the near future. The Agency decided that it would need the money it had been providing to the Office of Surface Mining in Indonesia to help with relief for the tsunami victims. As a result,





the Office of Surface's active assistance to the Indonesian ministries, provinces, and localities ended September 30th. The project director relocated permanently back to the United States and the small staff in Jakarta was terminated.

The Office of Surface Mining and its state partners have provided training for its Indonesian partners in 2005 that included:

- Several seminars and workshops on environmental impact statements for local, provincial, and national government staff, and for the mining industry. The national, provincial, and county governments are telling the Office of Surface Mining that thanks to its seminars, the environmental impact statements are now containing solid baseline and other specific information useful to evaluating an application for a mining permit. The course has been translated into Indonesian and is now being taught by training staff of the

Indonesian ministries in an unusual display of inter-ministerial cooperation.

- The Office of Surface Mining, state partners, the Environmental Protection Agency, mining companies, and non-governmental organizations hosted a delegation from both the Ministry of Energy and Minerals and the Ministry of the Environment in the United States for a series of seminars, question-and-answer sessions, and demonstrative tours of active and abandoned mine sites. Topics ranged from the evolution of the relevant U.S. laws and policies, to the technical specifications for controlling pollution from small coal mines and from large gold mines, to the technology and expense of remediating acid mine drainage from abandoned mines. Responding to several governmental units, the Office of Surface Mining developed and presented workshops in

Coal mining at this Ohio site was a temporary use of the land. In the first step of the mining operation one foot of topsoil and two feet of subsoil were removed and stored separately. During reclamation the soil was restored, seeded with alfalfa, red clover, timothy, and orchard grass and today is used for hay production. This mine reclamation resulted in above average crop yields and very rapid return to the long-term agricultural land use.

several provinces for the small-scale gold mining "industry" and local governments. They have been successful in persuading many of the small operations to adopt cyanide vat leaching instead of using mercury amalgamation. The miners are recovering a greater percentage of gold at lower cost, and are sparing themselves and the environment from exposure to collectively hundreds of tons of mercury per year.

- At the request of the new chief of the provincial mining agency in East Kalimantan, the Office of Surface Mining developed and taught a course on environmental auditing. The goal was to improve the performance of the provincial auditors and of the mining industry so that the next round of environmental audits by the Ministry of the Environment would show substantial improvement in that province.
- OSM's assistance has been requested beyond the boundaries of mining. During the year, two landfills collapsed in West Java, killing at least 200 people. They were poorly sited and not managed properly for an area that expects monsoon rains during the year. At the request of the national government, the Office of Surface Mining prepared and presented workshops for local and provincial governments on the geologic factors affecting slope stability of landfills. The hope is that the training, plus Office of Surface Mining's technical papers and consultations, will help the officials responsible for locating and managing landfills to avoid such failures and the resulting



casualties.

- The Office of Surface Mining and its state partners have conducted several sessions of "Training for Trainers" to ministry personnel. Those courses have enabled the ministries' technical, scientific, and policy experts to become effective and efficient trainers for personnel across governmental levels, and for the industry.
- In conjunction with the Indonesian Center for Training and Geology Education, the Office of Surface Mining conducted multiple sessions of training on surface and groundwater hydrology, in support of the U.S. Agency for International Development's plan on improving human services. The course was for managers and administrators responsible for water supply, land use, and watershed management decisions. The course included ground water storage

and flow characteristics, surface water and use relationships, and factors affecting water quality.

The Office of Surface Mining consulted with the Ministry of the Environment for many years, and in October 2004, the ministry issued a decree establishing effluent standards for copper and gold mining. Effluent limitations for nickel and tin mining should be completed by the end of the year. There are also now effluent standards for coal mining operations. OSM has been encouraging the provincial and local governments to incorporate those standards into the mining permits, which would provide authority for the Ministry of the Environment to inspect the water discharged from the permitted operations. An initial draft of such a provincial regulation has been circulated. Making the effluent limitations enforceable at the mines would increase environmental protection, and also should benefit the mining industry because miners would no longer

At this Montana mine site, the operation went around this natural rock outcrop. With reclamation complete, it is once again part of the natural landscape. The reclaimed land in the foreground has been graded to match the original contour. Native grasses, forbs, shrubs, and trees were planted. Now with the coal resource removed, it has been returned to its long-term livestock grazing land use.

have to guess what level of treatment was needed to avoid polluting waterways.

In addition to the project with Indonesia, the Office of Surface Mining, its state partners, and mining firms hosted delegations of visitors from other countries interested in improving their environmental regulation of coal mining, or in reclaiming abandoned mines. In 2005, these included delegations from the Peoples Republic of China Ministry of Land and Resources, from China's Shanxi Province, and from the Republic of Korea (South Korea). OSM has also discussed possible technical assistance projects with agencies that include China's Ministry of Land and Resources and Brazil's Ministry of Science and Technology.

Systems and Databases

Applicant/Violator System

One of the underlying principles in the Surface Mining Law is that those who conduct mining are responsible for returning the land and water to productive use. Section 510(c) of the Law prohibits the issuance of new permits to applicants who own or control operations with unabated or uncorrected violations.

The Applicant/Violator System provides state regulatory authorities with a central database of application, permit, ownership and control, and violation information. Federal and state officials review Applicant/Violator System data when evaluating the applicant's eligibility for new permits. The system is also used to

determine the eligibility of potential recipients of Abandoned Mine Land reclamation contracts and for inspection

and oversight purposes.

Access to the system is available to the public, coalfield citizens, coal companies, and industry representatives through the use of customized communications software distributed free of charge. Upon request, the Office of Surface Mining provides system users with demonstrations and training, often tailored to meet the specific needs of the target audience, on how to access and interpret system information.

During 2005, the Applicant/Violator System Office responded with quality reviews for 3,766 requests for Applicant/Violator System data evaluations from state and federal regulatory authorities and state abandoned mine land program officials. The Office of Surface Mining collected or settled payments of civil penalties and reclamation fees in the amount of \$1,386,194 in part because of violation information in the system.

The Office of Surface Mining published a proposed rule in the Federal Register dealing with transfer, assignment, or sale of permit rights. The proposed rule satisfied part of a settlement agreement between the Office of Surface Mining and the National Mining Association, which sought to overturn certain aspects of the 2000 final Ownership and Control rule. The Applicant/Violator System Office concluded an outreach meeting with the states during 2005 on both the proposed 2005 Transfer, Assignment or Sale of Permit Rights rule and the proposed 2003 Ownership and Control rule.

Among other efforts, the Office of Surface Mining sponsored a workshop examining how bankruptcy impacts the Surface Mining Law. The Office of Surface Mining coordinated with the states and the Department of Justice in establishing a presence in two major coal bankruptcies.

The Applicant/Violator System Office continued efforts to improve the usability of the System. The redesign effort

involves not only the transformation of the current system to a more user-friendly, web-based system; but, also a rewrite of the business processes and change in language allowing for ease in future system enhancements and modifications.

During 2005 the Applicant/Violator System Office received a customer satisfaction rating of 97 percent. This is the sixth consecutive year that the office has received extremely high customer satisfaction ratings.

General information about the system, including access and user information can be found at www.avs.osmre.gov.

Geographic Information Systems and Geologic Modeling

The Office of Surface Mining is helping to develop a mine subsidence risk maps and reports for the Oklahoma portion of the Tri-State Lead and Zinc Mining District which encompasses multiple counties in Oklahoma, Kansas and Missouri. This work is being accomplished with a multi-agency team involving participants from the Corps of Engineers, U.S. Geological Survey, and multiple state agencies. The Office of Surface Mining is participating at the request of the Oklahoma Abandoned Mine Land Program. Presentation have shown how ArcGIS 9 software provided by the Office of Surface Mining, can be used to digitize scanned maps, integrate geologic data from drill logs, and create three-dimensional views and maps of the mine workings. The Tar Creek Team decided that ArcGIS 9 will be the primary format for the final presentation of maps and three-D products. The other work involved use of drill and log software from RockWorks, to develop stratigraphic profiles and fence diagrams for a complex mining district. The presentation showed that RockWorks can be a powerful tool for geologic data visualization and analysis. Further analysis of RockWorks will result in a recommendation regarding whether or not Rockworks should be added to the Office of Surface Mining suite of tools.

The Office of Surface Mining has just

finished a year and a half long joint pilot project with the Wyoming Department of Environmental Quality, Land Quality Division, and the Powder River Coal Company. The project applied geographical information system and global positioning system technology for tracking reclamation and bond release status of permanently reclaimed lands. The scope of this pilot project encompassed two mines, the Caballo and North Antelope/Rochelle mines. Both mines transmitted electronic geographical data to the Wyoming Division for geoprocessing into various bond release data sets. Other global positioning data (such as topsoil depth and wildlife features) was also collected by Wyoming inspectors in the field and integrated into the geographical information system database. The geographical information system data, along with ArcGIS software was then used to analyze and track reclamation and bond release activities. The final report for this work is posted on the web at www.tips.osmre.gov.

Integrated Geographic Information Systems for Regulatory Programs

A cooperative project between the Office of Surface Mining, the Pennsylvania Geographic Information Systems Consortium, and Wilkes College is projecting use of several geospatial applications for regulatory (and bonding) oversight and management at an on-going mining operation in western Pennsylvania. This project includes the integrated use of geographic information systems, carrier phase (Real-Time Kinematic) global positioning systems, and satellite imagery (e.g., Digital Globe's Quick Bird data at 2' pixel resolution) to provide geospatial and geophysical data/analysis needed for engineering mapping and operations monitoring consistent with existing management procedures of the Office of Surface Mining and the Pennsylvania Department of Environmental Protection. This geographic information system tracks and verifies mining operations, related on-site reclamation, and bond release status to test the use of geographic information systems, global positioning systems, and remote sensing technologies. The project objective is to serve as a national model to



support and enhance environmental and regulatory oversight of active mining operations and related site-reclamation efforts. Training and technology transfer to the Pennsylvania Department of Environmental Protection staff are key components of this project.

Information Technology Support

The Office of Surface Mining personnel assisted the Navajo Nation Abandoned Mined Lands Agency in linking their three offices in Window Rock, Arizona; Ship Rock, New Mexico and Tuba City, Arizona together in one Microsoft Windows Active Directory Domain. As part of this project, the Office of Surface Mining connected these offices together in a Virtual Private Network. Bringing the computer systems at these three offices under the control of one active directory will allow their one-person information technology department to more efficiently manage and administer the computers in all offices. Before this

system was installed, the information technology support person spent significant amounts of time driving the hundreds of miles between these offices to perform routine administrative duties. Another side benefit of this new system is that authorized Navajo employees can now access the Navajo Abandoned Mine Land network from anywhere on the Internet via secure client software.

Knoxville Field Office Geographic Information System

The development of the Knoxville Field Office geographic information system is a part of a continuing effort to use the best technology to implement the Surface Mining Law. In 2005, the Knoxville Field Office staff received software vendor training in implementing and managing an ArcSDE geodatabase contained within a Microsoft SQL Server Relational Database Management System. This geodatabase was developed, and available to staff through the Local Area Network,

Because surface mines are usually located in remote locations, the potential for residential postmining land uses is limited. However, at a mine in Colstrip, Montana, the company reclaimed land near the town's center to facilitate home construction. Today, this reclaimed land contains a large number of the community's single-family houses.

and is presently serving as a high speed, secure, reliable, local repository for some of the spatial datasets used by the Knoxville Field Office. During this development, the office staff adopted a modern coordinate system and datum; migrated selected datasets such as permit boundaries, critical earth fills, haul roads, sediment basins, geologic drill holes, surface water monitoring locations, ground water monitoring locations, and others to the new geodatabase; and constructed a single, seamless mosaic layer from 133 individual files of 7.5-minute U.S. Geological Survey topographic quadrangle maps of the Tennessee coal field. This geodatabase provides data for use of scientific software such as ArcGIS Desktop for direct access through the network, ArcPad for use in the field on hand held mobile geographic information system devices, and ArcIMS through standard web browsers connected to the Internet. The Knoxville Field Office will continue the migration of most of its spatial data assets to the new geodatabase in accordance with the Strategic Plan.

In 2005, Knoxville Field Office continued to manage baseline environmental data submitted in coal mining permit applications. This database now contains approximately 8,749 records representing the laboratory results of 20 years of environmental sampling at 984 unique locations in the northeast corner of the Tennessee coalfield. The estimated cost incurred by coal operators to collect and submit the data during routine development of mining plans is approximately \$875,000.00. The cost to the government to hire contractors to collect this same data in the field is estimated to be much greater than the cost to the coal operator, perhaps by a factor of two to three times.

The amount of data presently contained in this database is estimated at 20 percent of the total baseline environmental data which could be harvested from existing paper permit applications. The data has been entered by hand using student interns working under the close supervision of experienced technical personnel. The sampling data is used by mining consultants and the Office of Surface Mining technical staff to augment environmental data submitted in future permit applications, reduce additional data sampling and collection costs to the coal operator, facilitate modeling of potential environmental impacts of proposed coal mining operations, and improve the decision-making process during permit application review. The collection and management of this data in a useful digital format allows it to be distributed to the public for reuse, saving the mining industry and taxpayers money, and provides more usable data for better modeling the potential impacts of surface coal mining operations.

The Knoxville Field Office also launched a mobile geographic information system initiative to implement use of datasets on portable, hand-held devices in the field at coal mine sites. Mobile geographic information systems applies the location-finding capability of global positioning system technology to software and datasets to allow a user to view their calculated ground position on an interactive map while navigating across the ground surface. On February 23, 2005, a Mobile Geographic Information System Workshop was conducted at the Knoxville Field Office. Presentations were given and hands-on demonstrations of equipment and functionality at a local outdoor facility were provided. As a result of this workshop, Knoxville staff began to acquire suitable equipment and training for use of this technology in the field during pre-mining site visits and regulatory inspections of surface coal mining operations. General information about the system, including access and user information can be found at www.av.sosmre.gov.

Mine Pool Modeling

At the request of the Pennsylvania Department of Environmental Protection, Abandoned Mine Reclamation Division, Office of Surface Mining staff conducted an in-depth study of a massive underground flooded mine pool in Cambria County, Pennsylvania, commonly referred to as the Barnes and Tucker Mine Pool. Pennsylvania operates a pump-and-treat system, removing about 6,500 gallons per minute of mine water from a 10,000 acre underground mine complex. The treated water is discharged into the Ohio River drainage basin. Pennsylvania has a proposal to sell water from the mine-pool to an industrial customer located in the Susquehanna River watershed and have identified several water quantity and quality issues associated with the project and asked the Office of Surface Mining to perform a Hydrologic Assessment of the mine-pool complex. The principal questions that needed to be answered were as follows:

1. Can the mine-pool supply 10 million gallons per day?
2. What is the expected water quality at a new proposed treatment site? How would pumping from two locations affect mine water quality at each site?
3. What is the hydrologic and geochemical influence on the Barnes and Tucker mine-pool of flooded mines in an overlying coalbed?
4. Would the proposed pumping rate impact overlying streams by inducing or accelerating stream leakage to the mine-pool? Could ground-water wells suffer partial or complete loss of yield if the mine-pool is pumped at 10 mgd?
6. How would moving the treatment plant affect leakage from an adjacent mine-pool?
7. Is underground sludge injection possible at a new treatment plant location?
8. What is the potential quality and quantity impacts to the stream currently receiving the treated mine discharge if that water is moved to another watershed?

These objectives were analyzed by review of existing information and additional data collected for the project. Existing reports, pumping records, water quality analyses, and map sources were analyzed.

The Office of Surface Mining performed geologic modeling, ground water storage and flow calculations, geochemical modeling, and collected additional water quality samples, stream and discharge measurements, and water level data. Results of this modeling and analysis included:

The mine-pool could provide about 8 million gallons per day. Higher rates, in the long term, could partially dewater the mine-pool. Mine pool storage is much less than estimated from extraction rates. Water quality is estimated to deteriorate in the short term if a new treatment plant location is started due to a change in flow-path in the mine-pool. Long term water quality is expected to be similar to current conditions. Pyrite oxidation and cation exchange are occurring within the mine-pool.

An overlying mine-pool is hydraulically connected to Barnes and Tucker mine-pool. It increased water storage and improved water quality.

Mine pool pumping will likely have little effect on wells and streams. Moving the water treatment plant will have little effect on leakage from an adjacent mine-pool.

A sludge injection area was located and conservatively estimated to provide more than 15 years of storage capacity.

Removing the treated mine water discharge from the current receiving stream will impact water quality and quantity. Stream chemistry will be reduced from moderately to lightly buffered. Flow will be reduced.

The Pennsylvania Department of Environmental Protection is currently using the findings from this work to aid in their project planning and decision process of the mine pool. The success of the Barnes and Tucker project has prompted similar requests from Maryland and another from Pennsylvania to conduct similar studies that will continue through 2006.

The Office of Surface Mining continues monitoring the Mon River Mine Pool near Fairmont, West Virginia. The Mon River Mine Pool is a collection of interconnected underground mines that are mostly flooded. They represent a combination of active and abandoned mines. The level of the pool is critical because it is controlled by the pumping of remaining active operations. If allowed to discharge, adverse impacts to the Monongahela River would most likely occur. The Office of Surface Mining and the West Virginia Department of Environmental Protection will continue to monitor this mine pool through 2006.

Technical Library Resource Center
In 2005 the Office of Surface Mining Technical Library website (www.wrcc.osmre.gov/glas/) provided on-line access to recent acquisition lists, *Federal Register* notices, and the on-line library catalog. The library collection of books and reports, along with a growing amount of electronic media, on-line searches, research services, and interlibrary loans enabled the library staff to respond to more than 650 requests from state regulatory agencies, federal agencies, citizens, the coal industry, consultants, and academics, in addition to filling more than 323 Office of Surface Mining requests for information. The technical library plays a large

role in technology transfer by assisting with the dissemination of electronic information and publications.

Training, Forums, Workshops, and Conferences

National Technical Training Program

The Office of Surface Mining continued its emphasis on providing technical assistance to the states and tribes by enhancing the technical skills of regulatory and reclamation staff through the National Technical Training Program. In 2005, the program offered 51 sessions of 39 different courses. In addition to regularly scheduled courses, in response to specific requests, a number of special course sessions were offered. Because of the extensive experience and expertise instructors have with regard to acid-forming materials, the Office of Surface Mining was asked to hold a workshop for the staff of the Commonwealth of Pennsylvania's Departments of Natural Resources and Transportation. Subsequent to the class, Pennsylvania changed their technical requirements for bidding construction contracts and the Commonwealth anticipates that they will save millions of dollars as a consequence of the knowledge their staff gained from this workshop. Mini-sessions of the Blasting

Figure 5
Courses and Enrollment

Course Name	Sessions	Students
Acid-forming Materials: Fundamentals & Applications	1	22
Acid-forming Materials: Planning & Prevention	1	24
AML Design Workshop: Dangerous Openings	1	10
AML Design Workshop: Drilling and Grouting	1	15
AML Design Workshop: Fires	1	14
AML Design Workshop: Landslides	1	9
AML Design Workshop: Subsidence	1	10
AML Realty	1	14
AML Reclamation Projects	1	21
Applied Engineering Principles	2	39
Basic Inspection Workbook 24 Workbooks Distributed		
Blasting and Inspection	1	23
Bonding Workshop: Administrative & Legal Aspects	1	14
Bonding Workshop: Cost Estimation	1	20
Communications Course	1	14
Effective Writing	3	47
Enforcement Procedures	1	18
Enforcement Tools and Applications	1	17
Erosion and Sediment Control	2	33
Evidence Preparation and Testimony	1	14
Excess Spoil Handling	1	26
Expert Witness	1	13
Forensic Hydrologic Investigations	1	12
Historic and Archeological Resources	2	33
Historic and Archeological Resources: Refresher	1	15
Instructor Training Course	1	17
NEPA Procedures	1	16
OSM Orientation	1	31
Passive Treatment	3	59
Permit Findings Workshop	1	19
Permitting Hydrology	1	16
Principles of Inspection	1	21
Quantitative Hydrogeology	2	28
Soils and Revegetation	2	38
SMCRA and the ESA: Implementation of the 1996 Biological...	1	16
Subsidence	2	41
Surface and Groundwater Hydrology	2	41
Underground Mine Mapping	1	90
Underground Mining Technology	1	19
Wetlands Awareness	2	28
Total	51	957

course were held for the U.S. Department of Alcohol, Tobacco, and Fire Arms. A special session of the Office of Surface Mining Orientation course was held for new employees to acquaint them with the basics of surface coal mining through a field exercise and with the goals of the Department of Interior and the Office of Surface Mining. Several new courses were

added to the 2005 offerings. These include a class on Abandoned Mine Land Drilling and Grouting. The audience for the course is abandoned mine land program field staff and project managers. The course has two primary objectives: (1) to evaluate when the commitment of expenditures for drilling is the appropriate response to mine subsidence complaints, and (2) to evaluate where the commitment of expenditures for grouting is appropriate in response to mine subsidence complaints. Another recently developed course which was piloted in 2005 is Forensic Hydrologic Investigations. This course is geared for geologist, hydrologist, and mine inspectors who conduct hydrologic investigations on problems related to surface and underground mines, coal refuse disposal facilities, and other coal mining related activities. Mining related problems include dewatering or contamination of aquifers, wells, streams, springs, ponds, or lakes; problems associated with the increased amount of water from mine flooding; and hydrologic aspects of landslides associated with mining. The training program conducted two low-cost

workshops at the National Association of Abandoned Mine Programs annual conference. This workshop included the Managing Media module of the new Coalfield Communications: How To Get It Right! course. The other three modules of this new class which will be piloted in 2006 are Extending the Reach: Effective Outreach, Designing Effective Public Meetings, and Building Trust through Effective Communication. The course contains dozens of practical exercises specific to the public and private mining community. Development was completed for another new course, Geology and Geochemistry of Acid-Forming Materials. This course includes new materials plus select modules from two courses which are being phased out. Additionally, to assure that students are receiving the latest technical and programmatic information, significant revisions were made to seven classes including SMCRA and Endangered Species, Acid-Forming Materials: Fundamentals, the Permit Findings Workshop, Underground Mining Technology, Bonding: Legal

and Administrative Aspects, Soils and Revegetation, and Erosion and Sediment Control. Several units specific to Western states were added to the Soils and Revegetation and Erosion and Sediment Control courses. Modeling on the success of previous highly successful state and tribal benchmarking sessions, the training program worked with the Interstate Mining Compact Commission to offer a very well attended session on Underground Mine Mapping. The audience for this session is staff who are intensively involved in capturing and cataloging data from underground mine maps. Topics in the session included methodologies for locating and accessing mine maps, database management, geo-referencing and digitization, and data delivery. The benchmarking workshops provide the opportunity to share information about model state programs with the goal of adopting or adapting processes to more effectively delivering products and services (e.g., permitting) to customers.

All aspects of the National Technical Training program from identification of training needs through course development and presentation are cooperative efforts of state, tribal, and Office of Surface Mining offices. This joint effort exemplifies Secretary Norton's 4Cs of cooperating, communicating, consulting with local agencies for the purpose of fostering good conservation practices. In 2005, there were 180 instructors, 47 percent from 15 Office of Surface Mining offices, 43 percent from 13 states, 6 percent from the Interior Department's Solicitor's Office, and four percent from other sources. The 51 sessions, which reached 957 students, were presented in 23 locations in 14 states. State students accounted for 76 percent of students; tribal students for four percent; Office of Surface Mining students for 18 percent, and two percent for other



Before re-mining and reclamation, this Pennsylvania mine site contained abandoned spoil banks, dangerous highwalls, water-filled pits, and an abandoned underground mine, and a large illegal domestic dump. Today, it is difficult to see any traces of these hazards or the recent coal mining.

participants. The program exceeded its annual attendance goal of 900 students by training a total of 957 students. The customer satisfaction rating of 98 percent exceeded the goal of 93 percent by five percent. Training courses offered in 2005 are listed in Figure 5.

Scientific and Engineering Software Applications Training

Training of state, tribal, and Office of Surface Mining personnel in the practical application of analytical software is an integral part of the technical assistance function.

Instructor-led courses incorporate the reclamation experience of its instructors and students to provide a unique shared training experience. This training during 2005 totaled 260 participants in 25 classes, compared to 2004 levels of 456 participants in 36 instructor-led classes. Twelve courses were held at sites with critical needs for software use. The training program employed 56 instructors in 2005; 28 of these were state program experts. The Government Performance and Results Act rating for this training satisfaction for 2005 was 91 percent. The four categories making up this score breakdown as follows: class satisfaction rated at 88 percent, facility at 91 percent, lead instructor at 94 percent, and co-instructor at 91 percent. Twenty-two new one-hour geographic information system workshops were offered in addition to 22 on-line courses through a contract with the Environmental Systems Research Institute Virtual Campus for basic geographic information system training. During the year, 77 students started virtual classes.

Bonding Assistance

During 2005 the Office of Surface Mining contracted for on-site bonding technical assistance that provided assistance to Montana, North Dakota, Utah, and Wyoming. In addition the contractor provided a workshop for the State of New

Wetland habitat has a particularly rich and diverse ecology. Creation or reestablishment of wetlands on reclaimed mine land is a high priority in many areas of the country where this post-mining use is suitable. At this Alabama site, the mine operator established the wetland during the reclamation of a large sediment pond.

Mexico. The assistance included updates on the Treasury Department's Circular 570, including liquidation notice, termination notice, surety company liquidation notice, and requirements for surety company listing.

New Technologies Implementation Workshops

In 2005, seven western states attended three New Technologies Implementation Information Workshops that focused on short and long-term needs for records conversion, database design and mass storage, and implementation of geographic information systems and global positioning systems. The goal of these workshops was to assist in making informed decisions on available technologies and gain a better understanding of what is involved in implementing new technologies. The exchange of information, including successes and failures, resulted in better prepared staff, and more informed managers.

The Alaska Division of Mining Land and Water co-hosted the workshop in Anchorage, Alaska which highlighted Alaska's

geographic information system initiatives and the integration of data base systems. Geographic information system applications were demonstrated as well as engineering aspects of permit applications as they relate to electronic permitting and approximate original contour measurements.

Another workshop held in Helena, Montana was co-hosted by Montana Department of Environmental Quality's Industrial and Energy Minerals Bureau. The workshop highlighted Montana's technological advances. Of considerable interest was the development of geographic information systems for bond release and reclaimed land tracking database.

The third workshop was held in Sheridan, Wyoming, and was co-hosted by the Wyoming Department of Environmental Quality, Land Quality Division. Wyoming's geographic information system provided opportunities for technology transfer.



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Although not a common practice, this reclaimed Kentucky mountaintop mine has been developed into very desirable building lots. Located adjacent to the town of Pikeville, the reclaimed mine site provides outstanding features for this land use, including scenic views, flat buildable land in an area of steep terrain, and large lots unavailable in the surrounding area.

Two additional New Technologies Implementation Workshops are scheduled in 2006, and be held in Bismarck, North Dakota and Denver, Colorado.

Technology Transfer

During 2005, the Office of Surface Mining National Technology Transfer Team continued to coordinate Office of Surface Mining technology transfer activities. The Team, formed in 2003, serves as the clearinghouse for technology transfer activities to assure that the Office of Surface Mining and the states make the most efficient use of technical resources, including both funding and staff. Within each Office of Surface Mining region, there are sub-teams that actively solicit technology needs. When transfer activities are identified, they are reviewed to determine appropriateness for regional or multiple regional transfers. The Team has developed plans for reviewing applied science proposals and has worked closely with state mining and reclamation associations on technology transfer events. During 2005, the Team rated a list of applied science proposals and provided funding for the top ten. These proposals were submitted by universities, non-profit organizations, and regulatory authorities. Nine of the proposals submitted were funded for 2006. The areas of study are acid mine



drainage testing procedures, reforestation and soil compaction, stream ecosystem rehabilitation, mine pools, prime farmlands, western mined lands revegetation, use of coal combustion by-products, and sediment pond removal in headwater streams.

Manganese Workshop

A one day workshop, sponsored by the Office of Surface Mining's Appalachian Regional Technology Transfer Team, presented issues associated with achieving manganese (Mn) effluent limits for mining operations as required by Title 40

of the Federal Regulations. Manganese has not been shown to have adverse impacts on stream biota and it is often very costly to treat discharges to meet manganese standards. The Office of Surface Mining sought to effect change of the manganese standards through a workshop aimed at both enlightening its participants about the effects of manganese on stream biota, the subsequent treatment methods, and to seek guidance from the Environmental Protection Agency as to how to effect change in the standards. Office of Surface Mining, Environmental Protection Agency, and industry representatives provided presentations on regulatory background, manganese's effects on stream biota, case studies, and treatment costs.

Mine Water Treatment Workshop

On August 15th -18th 2005, the Office of Surface Mining hosted the 2005 Mine Water Treatment Conference in Pittsburgh, Pennsylvania. This technology transfer conference had experts from across the country and Canada providing two days of presentations on active and passive mine water treatment technologies; a full day of presentations on resource recovery; and a full day passive treatment workshop. The event was focused toward those with a technical understanding of the subject material. Putting on the "best ever" conference on mine water treatment was a collaborative effort among several organizations and agencies including the Pennsylvania Department of Environmental Protection, the Western and Eastern Pennsylvania Coalition for Abandoned Mine Reclamation, Southern Alleghenies Conservancy, and the Western Pennsylvania Watershed Program. These groups are all passionate about cleaning up acid mine drainage from streams and rivers.. This conference advanced everyone's working knowledge on the current technology of

mine drainage treatment and resource recovery. Approximately 250 participants from federal and state agencies, industry, academia, watershed associations, and environmental groups attend.

Acid Mine Drainage Workshop

The Mid-Continent Region Technology Transfer Team developed and conducted an Acid Mine Drainage Workshop in Evansville, Indiana during October, 2004. The Indiana Division of Reclamation hosted the three day workshop featuring case studies and field trips highlighting acid mine drainage treatment issues and successes. Case studies were prepared for both active and passive treatment of acid mine drainage in a variety of geologic settings. Topics included: wetlands, anoxic limestone drains; freshwater dilution systems; steel slag leach-beds for acid mine drainage treatment; practical exercises on field sampling, measurements, calculations, design principals, and construction techniques; and many others. A follow up acid mine drainage workshop is being planned for 2006

Advanced Integration of Geospatial

Technologies in Mining and Reclamation Conference

The Advanced Integration of Geospatial Technologies in Mining & Reclamation conference was held in December 2004 in Atlanta, Georgia. Approximately 175 people attended the three-day conference representing state, federal, tribal, industry, academia, and consulting interests. Fifty-seven speakers made presentations ranging from regulatory permitting to abandoned mine site assessment. Several speakers, representing state regulatory agencies, discussed their respective state-wide geographic information system efforts. Several tribal and industry consultants presented geographic information system efforts for several large western mines. Office of Surface Mining's Technical Innovation and Professional Services software vendors manned display booths and were available all week for technical assistance.

The conference was well received and requests were made to have this event become annual or biannual.

Public Outreach and Technology Transfer Events

Office of Surface Mining participated in National Engineer's Week by holding a 2-day event at the Carnegie Science Center in Pittsburgh, Pennsylvania. This event highlighted Pittsburgh's engineering community with booths and exhibits from numerous industry, government, and engineering consulting groups. Office of Surface Mining's emphasis this year was on formation of acid mine drainage, its impact on the local environment, and treatment. It included demonstrations and hands-on experiments of pH, acid formation from coal, and impacts on the aquatic environment. The program encourages young people to consider science and engineering in their future career planning. The audience was principally youth groups, e.g., Girl Scouts, school groups between the ages of eight and 14, families, and the general public. In

At this reclaimed mine site the young trees growing on the reclaimed land blend into the unmined adjacent forest. It will soon be difficult to identify the mined and reclaimed areas from the surrounding Montana landscape.



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total, over 400 children and adults participated in the activities and discussions.

Another technology exchange event occurred at the Children's Ground Water Festival held at California State University in Pennsylvania. The audience for this event was sixth graders from local Pennsylvania school districts.

At this eastern Kentucky site the mine operator created a permanent impoundment from a sedimentation pond. Throughout its 4-year function as a sedimentation pond, there were no adverse impacts on designated wild and scenic areas downstream from this mine along the Rockcastle River. As a permanent pond, the impoundment receives clear drainage from the reclaimed site and has been stocked with bass, bluegill, and catfish.

