

The 31st Annual Conference of the National Association of Abandoned Mine Land Programs

Rogers, Arkansas • September 27-30, 2009

Putting the Pieces Together



For a Better Tomorrow

Hosted by
Arkansas • Kansas • Missouri • Oklahoma

Welcome to the Heartland!

From historic Route 66 to the scenic Ozark Pig Trail, all roads lead to Rogers, Arkansas where we'll be "Putting the Pieces Together...For a Better Tomorrow"! The host states of Arkansas, Kansas, Missouri, and Oklahoma have partnered to put together a program that is not only informative, but also enjoyable for all the participants. The conference schedule provides ample opportunity to renew old friendships, meet new folks, and expand networking opportunities through discussions on reclamation, the environment, funding, and partnering. On Tuesday, we're excited to show the rest of the country how our small programs with minimum budgets and limited staffs have optimized and leveraged our funding to accomplish the goals of SMCRA in today's challenging reclamation environment.



While you are here, take some time to explore the many sites, sounds, tastes, and beauty of Northwest Arkansas beyond those included in the program. Don't be afraid to venture into the neighboring states of Oklahoma, Kansas, and Missouri where many other historical, cultural, and recreational activities also exist. There is a lot to see and do within a 100-mile radius of the conference center. The conference staff will be happy to point you in the right direction.

Above all, don't be shy about letting us know what we can do to enhance your conference experience. We hope you enjoy your stay and discover why the Heartland is so dear to us.



Greetings Conference Attendees

Welcome to the annual conference of the National Association of Abandoned Mine Land Programs. This 31st annual conference, built around the theme of “Putting the Pieces Together for a Better Tomorrow,” will give all attendees the opportunity to learn new technologies, reacquaint yourselves with old friends and colleagues, and see first-hand the excellent work being undertaken by the programs of our host states of Arkansas, Kansas, Missouri and Oklahoma.

Those attendees that are visiting the region in and around Rogers, Arkansas, for the first time will undoubtedly be amazed with the natural beauty of the land, the friendliness of the people, and the uniquely high quality of life that is so evident. Those attendees that have visited this region before will reacquaint themselves with the treasures that are unique to the Ozark region and surrounding country, and once again marvel at the history and culture that makes this region so truly American.

The member states and tribes of the NAAML P are devoted to the diligent and effective implementation of all aspects of the Abandoned Mine Land law. We all work for the elimination of the critical safety and health issues that continue to confront our citizens in the mining regions of this country. We continue to develop and implement new technologies to reduce the environmental abuse, an unfortunate legacy in mined areas. Local citizens and advocate groups are empowered through the AML program to improve their own existence and livelihood. Our goals are noble, our challenges immense, and our conviction and dedication are resolute.

I have thoroughly enjoyed serving as president of NAAML P for the past year. I have gained a new appreciation for the hard work performed by our member organizations, and the work of our supporters and colleagues. The conversations, emails and anecdotes have been enlightening and thought provoking. I want to thank all of those folks from our ranks that have stepped up and made my job easier and more fulfilling. Enjoy the conference and together we can look forward to a better tomorrow.



Steve Herbert
President, NAAML P

Conference Agenda

Thursday, September 24 - Saturday, September 26

Pre-conference Tour in Northwest Arkansas

Sunday, September 27

9:00 am - 5:30 pm	Registration	Convention Center Registration
9:00 am - 5:30 pm	Exhibit Setup	Ambassador Foyer
9:30 am - 4:00 pm	Golf	Meet in North Rotunda
10:30 am - 4:00 pm	War Eagle Mill and Cavern	Meet in North Rotunda
1:00 pm - 5:00 pm	Committee Meetings	To Be Announced
1:00 pm - 9:00 pm	Speaker Ready Room	Ambassador D
6:30 pm - 8:30 pm	Welcome Reception/Deli Buffet	Ambassador A, B, C
6:30 pm - 8:30 pm	Exhibits Open	Ambassador Foyer
9:00 pm - 11:00 pm	Hospitality	Embassy Suites Room 928

Monday, September 28

7:00 am - 4:30 pm	Registration	Convention Center Registration
7:00 am - 4:30 pm	Speaker Ready Room	Ambassador D
7:00 am - 6:30 pm	Exhibits Open	Ambassador Foyer
8:00 am - 4:30 pm	Guest Tour to Eureka Springs	Meet in North Rotunda
8:30 am - 9:15 am	Opening General Session	Grand I - IV
9:15 am	Break	
9:30 am - 12:00 pm	Technical Sessions	Ambassador A, B, C
12:00 pm - 1:30 pm	Lunch on Your Own	
1:30 pm - 3:00 pm	Technical Sessions	Ambassador A, B, C
3:00 pm	Break	
3:15 pm - 4:15 pm	Technical Sessions	Ambassador A, B, C
5:30 pm - 6:30 pm	Reception, Cash Bar	North Rotunda
6:30 pm - 9:00 pm	Awards Banquet	Grand I - IV
9:00 pm - 11:00 pm	Hospitality	Embassy Suites Room 928

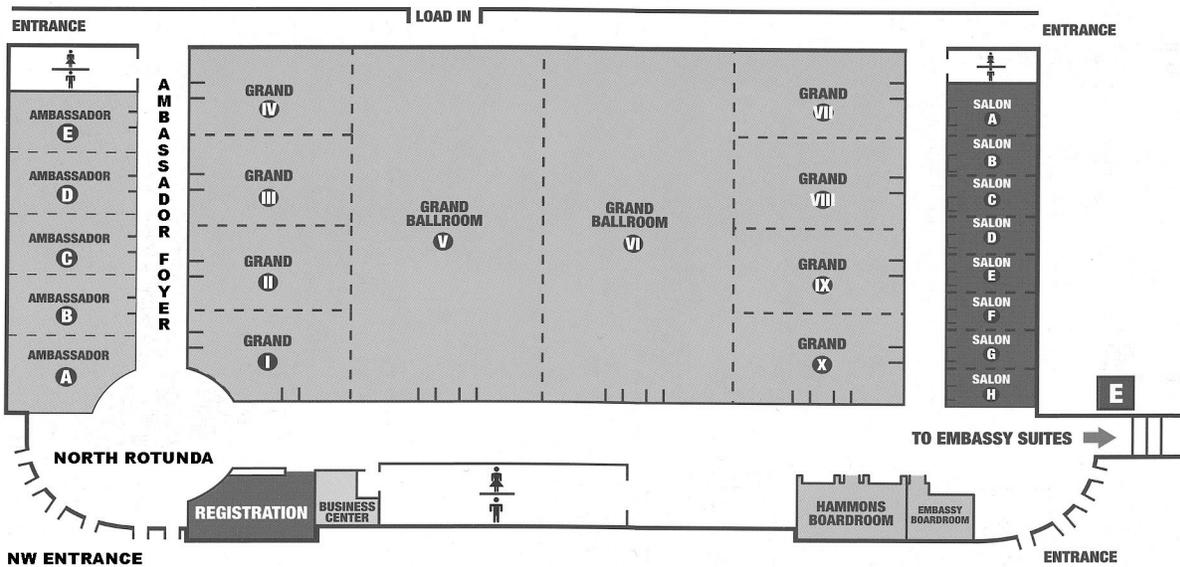
Tuesday, September 29

7:30 am - 4:30 pm	Tours	Meet in North Rotunda
5:30 pm	Buses to Bluegrass & BBQ	Meet in North Rotunda
6:00 pm - 8:30 pm	Bluegrass & BBQ	Prairie Creek Park
8:30 pm	Buses to Hotel	
9:00 pm - 11:00 pm	Hospitality	Embassy Suites Room 928

Wednesday, September 30

7:00 am - 10:00 am	Speaker Ready Room	Ambassador D
8:00 am - 12:00 pm	Registration	Convention Center Registration
8:00 am - 12:00 pm	Exhibits	Ambassador Foyer
8:00 am - 10:00 am	Technical Sessions	Ambassador A, B
8:00 am - 5:00 pm	NAAML P Business Meeting	Grand I
10:00 am	Break	
10:30 am - 12:00 pm	Technical Sessions	Ambassador A, B

Convention Center Map



Miscellaneous Information

- The number on your name badge will be used for the door prizes which may be given through out the meeting, so wear your name badge at all times.
- Door prizes can be delivered to the conference registration desk at any time prior to 3:30 p.m. on Monday.
- A message board is available at the conference registration desk for outside messages and attendees use. Don't forget to check periodically.
- Some local restaurant menus are available at the conference reference desk.
- We ask that all award winners remain after the banquet for photos. We will make it as quick as possible.
- Continental breakfast will not be served during the conference. Embassy Suites offers each paid guest a free breakfast.
- Please take time to visit the exhibits in the Ambassador Foyer.

Evening Events

Sunday, Welcome Reception

The Reception will be held in the Ambassador A, B, & C from 6:30 to 8:30 p.m. A deli buffet is being provided. Visit the exhibits to see what's new. Relax after a busy day, catch up with old friends and acquaintances, and make new ones.

Monday, Awards Banquet

The Awards Banquet will be in the Grand Ballroom I-IV. Prior to the Banquet a cash bar will be available in the Ballroom and in the North Atrium. The Office of Surface Mining (OSM) will present its annual National and Regional Awards for 2009. The objective of the awards is to provide public recognition to those responsible for the nation's most outstanding achievement in environmentally sound mined land reclamation, and to encourage exchange of successful reclamation technology. The Stan Barnard Memorial Award, recognizing exemplary service, integrity and commitment to AML, will be awarded. The Dave Bucknam Outstanding Instructor Award will be presented to an outstanding instructor in OSM's National Technical Training Program. The NAAMLPS Scholarship will be awarded to this year's winners. The scholarship is to assist in the education of students who intend to work as scientists or technicians in the field of mined land reclamation.

Tuesday, Bluegrass & BBQ

The Tuesday evening social is Bluegrass & BBQ at Prairie Creek Park on the shore of scenic Beaver Lake. The BBQ is being catered by the award-winning Whole Hog Café. The Bluegrass will be provided by the Stateline Bluegrass Band. Come and enjoy the activities. Or just relax with the fellowship and beautiful scenery.

Hospitality Suite

After these events, come and carry on the fellowship at our Hospitality Suite, Room 928 in the main tower of the hotel.

Monday Tour

Guest Tour to Eureka Springs

 Departs 8:00 am

Eureka Springs is a real Victorian Mountain Village nestled in the Ozarks. View the city's outlying sights and attractions, including the award-winning Thorncrown Chapel. Explore and shop the historic downtown district with its gift shops, antique stores, and art galleries. Lunch at the 1886 Crescent Hotel's Crystal Dining Room and tour the hotel's formal gardens. Take a narrated tram tour of the winding streets, "Painted Ladies" historical homes, elegant hotels, historic springs and gardens.

Tuesday Tours

Arkansas AML Departs 8:00 am

View the picturesque Boston Mountain region on the trip to Sebastian County, which contains numerous abandoned surface and underground mines, many of which have been, or are being, reclaimed through the AML program. Stops in the area include the completed Mine No. 6 Acid Mine Drainage passive treatment system that treats an artesian flow from a 285-foot deep air shaft, the Area C Highwall AML project that addressed a large cache of trash and two highwalls, the Huntington Town West AML project that included the reconstruction of a perennial stream channel that had been diverted through spoil ridges by the mining. Lunch will be provided at one of the local restaurants on the return trip to the hotel.

Missouri/Kansas AML Departs 7:30 am

Drive through the Missouri portion of the Tri-State Mining District. Historically the Tri-State Mining District, covering more than 2,500 square miles in southwestern Missouri, southeastern Kansas and northeastern Oklahoma, was one of the major lead and zinc mining areas in the world. The mining left behind open mine shafts, collapsed mine shafts, and subsidence. The EPA and the Tri-States are still working today to reduce or remove potential adverse impacts posed by mine wastes contaminated with lead, zinc, and other metals. Visit the Prairie State Park where a 106-acre reclamation project was completed addressing acid mine drainage, acidic mine spoil sediments, two shafts and four eroding highwalls. View a completed emergency highwall project in Mindenmines.

Enjoy the provided box lunch and tour the grounds and museum of Big Brutus, the second largest electric shovel in the world, overlooking the Mined Land Wildlife Area in southeast Kansas. Tour the Deer Creek Abandoned Mine Land Project site, which represents a typical Kansas highwall, and the Mine 19 Carbon Recovery Operation and Slurry Containment Project located in the Mined Land Wildlife Area.

Tri-State Lead and Zinc Mining District Departs 7:30 am

Tour the Everett J. Ritchie Tri-State Mineral Museum at Joplin, which displays an exceptional collection of lead and zinc ores, interprets the geology and geochemistry of the area, and illustrates mining processes and methods used from the 1870s, and displays period mining equipment. View portions of the Tar Creek Superfund Site in northeast Oklahoma, observing high chat piles, large areas of subsidence, collapsed mine shafts and abandoned mill sites. At a chat washing facility observe, using sonar and an underwater camera, the disposal of discarded chat washings into the underground mine workings. View a constructed wetland system being developed by the University of Oklahoma to treat metal-laden mine drainage. A box lunch will be provided.



Session Schedule for Monday

8:30 - 9:15	Opening General Session in Grand I-IV			Welcome by Teresa Marks, Director, Arkansas Dept. of Environmental Quality		
9:15 - 9:30	Break					
	Ambassador A		Ambassador B		Ambassador C	
9:30 - 10:00	Investigative Tools for Mining and Reclamation Projects		Digital Technology		Acid Mine Drainage, Metal Treatment	
	<i>D. Dale</i> The Use of Borehole Video Technology in Subsurface Investigations		<i>A. Amundson</i> Geophysical Evaluation of Abandoned Underground Mine Conditions In the Rapson Coal Mine, Colorado Springs, Colorado		<i>P. Behum</i> Comparison of Results From Simple Field Tests of Water Quality With Laboratory Analyses	
10:00 - 10:30	<i>M. Sharp</i> Development and Use of a Profiling Sonar Probe for Investigating Flooded Underground Mine Workings		<i>R. Palladino</i> Using Foam to Transport Tailings		<i>B. Stover</i> Underground Bulkhead Construction for Mine Discharge Control at Hardrock AML Sites	
10:30 - 11:00	<i>A. Witty</i> Two and Three Dimensional Subsurface Profiling Using DC Electrical Resistivity Imaging		<i>D. Osborne</i> Assessing the Use of High Resolution Satellite Imagery to Inventory Abandoned Mine Land Features in Virginia		<i>R. Robbins</i> Constructed Wetlands for Heavy Metals: Practical Considerations	
11:00 - 11:30	<i>N. Shaffer</i> Applications of Ground Penetrating Radar in Mining		<i>B. AmEnde</i> Hyperspectral Imaging of Skidoo, Death Valley		Partnership Development	
					<i>T. Coffelt</i> Partnership Development: How do YOU Measure Success?	
11:30 - 12:00	<i>R. Bell</i> An Improved Understanding of Subsurface Acidic Groundwater Flow Pathways through Electrical Geophysical Imaging		Reforestation Issues		<i>L. Pineda</i> Stay Out–Stay Alive	
			<i>S. Herbert</i> Reforestation of Indiana Mined Lands			
12:00 - 1:30	Lunch on your own					
1:30 - 2:00	Workshop		<i>P. Angel</i> Reforestation ACCW/ARRI - The Appalachian Regional Reforestation Initiative		Subsidence	
2:00 - 2:30	State Reclamation Plans		<i>E. Fees</i> (listed under P. Angel) Reforestation ACCW/ARRI - The Appalachian Coal County Watershed Team, OSM/VISTA, and Watershed Groups Reforestation Partnerships		<i>S. Gallagher</i> I-470 Mine Remediation	
2:30 - 3:00			<i>M. Myers</i> (listed under P. Angel) Reforestation ACCW/ARRI - Mountaintop Coal Mining Inc. Reforestation Project		<i>M. Van der Kooij</i> Spaceborne InSAR for Monitoring of Subsidence Related to Abandoned Mines Near Urbanized Areas	
3:00 - 3:15			Break			
3:15 - 3:45	Physical Hazards Remediation		<i>R. Liebe</i> (listed under P. Angel) Reforestation ACCW/ARRI - Carcassonne, Kentucky Reforestation Project		<i>W. Dodd</i> Subsidence Prevention at an Emergency Reclamation Site near Williston, North Dakota	
	<i>J. Mistchenko</i> Physical Hazard Remediations at the Historic Tesla Coal Mine, Alameda County, California					
3:45 - 4:15	Geomorphic Reclamation		<i>L. Pineda</i> Western Hardrock Watershed Team. An Office of Surface Mining/ AmeriCorps*VISTA Initiative		AML Projects Advancements	
	<i>L. Carrere</i> Riparian Buffers, Planting Models and Species Selection for Natural and Geomorphic Stream Design on Mine Lands				<i>M. Hollis</i> Reclamation of Shiloh Park, Russellville, AR – 1992 National Award Winner (Update)	

Session Schedule for Wednesday

	Ambassador A	Ambassador B	Grand I
8:00 - 8:30	OSM AML Award Presentation	Issues or Interesting Problems/Non-SMCRA	NAAMLPL Business Meeting
8:30 - 9:00	Presentations from the National, Eastern, Mid-Continent and Western Regions	<i>J. Rohrer</i> Taking on the White Hats: Interest Group Opposition to Reclamation	
9:00 - 9:30		<i>K. Awuah-Offei</i> Quantifying Variation of CO ₂ Flux on Reclaimed Mine Spoils to Prevent Accumulation in Homes	
9:30 - 10:00		<i>J. Harper</i> Overview of Critical Issues in Reclaiming Drastically Disturbed Lands	
		OSM Applied Science	
		<i>K. Vories</i> Results of the OSM Applied Science Program	
10:00 - 10:30	Break		
10:30 - 11:00	Uranium Reclamation	Wildlife/Endangered Species	
	<i>F. Jordan</i> Conducting Preliminary Site Assessments of Abandoned Uranium Mines in the Grants Uranium Mineral Belt	<i>B. Loges</i> Status of OSM/FWS Guidance on Protection of the Indiana Bat	
11:00 - 11:30	Coal Waste Reclamation	<i>D. Kampwerth</i> In or Out; Considerations for Assessment of Underground Abandoned Mines for Wildlife	
	<i>F. Foshag</i> Abatement of a Coal Waste Slurry Spill from an Abandoned Mine Site in Southeast Kansas		
11:30 - 12:00		<i>K. Vories</i> Implications of the Occurrence and Spread of the White Nose Syndrome To Protection of the Indiana Bat	
12:00 - 5:00			

Abstracts for Technical Sessions

Quick Look at Hyperspectral Imaging of Skidoo, Death Valley

AmEnde, Barbara, PhD - The Aerospace Corporation, Chantilly, VA

Around August 1, 2009, an imagery collect will be conducted over the Skidoo area of Death Valley, National Park. Sensors on-board the Twin Otter aircraft are 1) SEBASS (Spatially Enhanced Broadband Array Spectrograph System) which measures 128 bands each of the midwave and longwave infrared portions of the electromagnetic spectrum; 2) ProspecTIR-V which measures 256 bands in the visible and near infrared; 3) ProspecTIR-S which measures 254 bands in the shortwave infrared; and 4) FLIR Photon broadband longwave infrared bolometer.

The entrances to abandoned mines have been demonstrated to be identifiable using broadband thermal imaging. This imagery collect will provide data on the feasibility of using thermal imagery for reconnaissance. Additionally, this combined collect of hyperspectral data of hundreds of bands across the entire range from visible to longwave infrared is unprecedented for add-on information about mine entrances.

The California Department of Conservation has provided data on locations of mines known to them. This imagery collect will be used to validate the technique for recognizing known mines, as well as searching for unrecognized shafts and possibly adits.

Geophysical Evaluation of Abandoned Underground Mine Conditions In the Rapson Coal Mine, Colorado Springs, Colorado

Amundson, Adolph, P.E. - Colorado Division of Reclamation, Mining and Safety, Denver, CO
Hanna, Kanan - Blackhawk Geophysical, Golden, CO

The Colorado Springs neighborhood of Country Club Circle is underlain by the abandoned Rapson Coal mine, which was worked from 1900 to 1915 prior to residential development. The workings lie at shallow depths ranging from 50 to 100 feet below surface. Through the years, numerous subsidence events have repeatedly occurred, causing serious hazards or damaging structures, streets, and utilities. Considerable subsidence mitigation work has occurred during the past several years as sinkholes have breached to surface.

As a result of continuing subsidence issues, the Colorado Division of Reclamation, Mining and Safety (CDRMS) issued a request for proposals to evaluate the Country Club Circle neighborhood using geophysical methods to delineate subsurface voids, and develop a more refined understanding of the condition of the mine workings under the subdivision. Zapata Incorporated's Blackhawk Division was selected through the RFP process to perform the work using multiple advanced geophysical technologies.

Geophysical investigations began in August 2008 using a multi-channel analysis of surface waves (MASW) technique. The survey was conducted in the streets, using a land streamer array of 48 geophones spaced at one meter intervals. This was followed by reconnaissance drilling to evaluate the information and to orient the mine map, as well as to prepare for the deployment of Reverse Vertical Seismic Potential (RVSP), followed by cross-hole tomography. These methods, combined with additional drilling, provided better locations of the remaining open voids, as well as characterization of the conditions in collapsed or caved zones above the abandoned workings.

Based on the results of these studies, CDRMS initiated a foamed-sand slurry and drilling and low-mobility grouting project to stabilize the remaining voids and caved areas beneath the neighborhood. This paper describes the methodology and results of the geophysical techniques used to delineate mine voids, the correlation with the ground modification treatment, and the performance of the ground modification treatments in minimizing future subsidence.

Reclamation Issues: Reforestation ACCWT/ARRI: Spring 2009-2010 Project in Eight States

Angel, Patrick, PhD. - U.S. Dept. of the Interior, Office of Surface Mining Reclamation and Enforcement, London, KY
Fees, Elizabeth - U.S. Dept. of the Interior, Office of Surface Mining and Reclamation and Enforcement, London, KY
Myers, Michael - AmeriCorps OSM/VISTA Schuylkill Headwaters Association, Pottsville, PA
Liebe, Rueben - AmeriCorps OSM/VISTA, Whitesburg, KY

Dr. Patrick Angel of the Office of Surface Mining (OSM) and OSM/VISTA Volunteers from the Appalachian Coal Country Watershed Team (ACCWT) will examine three innovative reforestation projects that have helped to influence the way

reclamation of previously mined sites in Appalachia will progress in the future. Projects involve and rely on partnerships between: OSM/VISTA, the Appalachian Regional Reforestation Initiative (ARRI), watershed groups, the coal industry, and local community members; all involved partners work toward the goal of planting native hardwood trees on reclaimed coal mined lands to help establish forest habitat through natural succession and to encourage restoration of high quality forests in the eastern USA.

Issues examined include: improving watersheds through the reforestation of former mine sites reclaimed through a grassland reclamation approach; and increasing the survival and growth rates of planted seedlings. Projects are expected to include: Carcassone, KY; Beckley, WV; and Schuylkill, PA. Each reforestation project presented individual difficulties and successes; the authors will present three case studies examining the problem, approach, results and future of each project. Findings vary according to the specific needs and environmental nature of each site, but one thing remains clear: this collaboration is successfully enhancing reclaimed mine sites through the supplemental planting of native hardwood species to promote healthy forest habitats, an effort that is helping to influence the way reclamation progresses in the future.

Quantifying Variation of CO₂ Flux on Reclaimed Mine Spoils to Prevent Accumulation in Homes

Awuah-Offei, Kwame - Missouri University of Science & Technology, Rolla, MO

Mathiba, Moagabo - Missouri University of Science & Technology, Rolla, MO

Baldassare, Alfred - PA Department of Environmental Protection, Director's Office, Emergency Response, Pittsburgh, PA

Incidents of dangerously high accumulation of CO₂ in buildings on or adjacent to reclaimed coal mines spoils have been reported in some coal mining states. These high CO₂ concentrations (> 25%), and attendant low O₂ levels (<10%), have been attributed to reactions between acid mine drainage and mineral carbonates in mine spoil. This study investigates the feasibility of using chamber-based CO₂ flux measurement to quantify the spatial variability of CO₂ emission rates in order to plan development, with appropriate mitigation measures where necessary. CO₂ flux measurements were taken using USDA's GRACenet chamber-based trace gas measurement protocol on June 4, 5 and 10, 2009. The LI-8100 automated flux system was used to record flux measurements at 43 sample points over a reclaimed mine site in Pennsylvania hosting a home now.

High mean daily CO₂ fluxes of 5.13, 5.31 and 7.67 μmol/m²/sec were recorded on June 4, 5 and 10, respectively. High spatial variability (the range was approximately 4 times the standard deviation) was observed in the flux data on June 5 and 10. The highest fluxes were observed around the home. The fluxes on the western boundary of the property did not seem to be affected by the proximity of a stream. These preliminary results show there is great potential to apply soil flux measurement to study CO₂ migration on reclaimed mine land. This is a significant first step to predict the potential for high accumulations in homes built on such land. Further research will concentrate on detailed sampling and geostatistical analysis. This research will provide regulators with the information and tools to better regulate the use of reclaimed mine land for residential and commercial construction.

Evaluation of Mine Drainage Abatement Projects: Comparison of Results From Simple Field Tests of Water Quality With Laboratory Analyses

Behum, Paul - U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement, Alton, Illinois

Hicks, Brian - U.S. Department of the Interior, Office of Surface Mining Reclamation and Enforcement, Alton, Illinois

Acid mine drainage (AMD) from surface and underground coal mines abandoned prior to August 3, 1977, has received additional attention in recent years. In response to this interest, a number of new passive treatment systems have been constructed in the Midwestern U.S. The Mid-Continent Region of the Office of Surface Mining Reclamation and Enforcement has assisted in reconnaissance of AMD problem sites, design of treatment systems, and evaluation of constructed passive treatment systems. This paper will discuss the application and suitability of field test methods such as colorimetric analysis of key anions and cations. Field measurements will be statistically compared with data generated from conventional laboratory techniques such as inductive coupled plasma (ICP) and ion chromatography. The purpose of this paper is to demonstrate the ability of low-cost field methods to supplement conventional analytical techniques. Important applications include (1) reconnaissance sampling which can be followed by laboratory testing once field conditions are understood and (2) diagnostic tests to evaluate the performance of AMD passive treatment systems. Several field methods have been found to be comparable with laboratory tests, while others are useful only for an estimation of water quality. One test, the ferrous iron colorimetric method, is considered the standard method for this constituent and is recommended over laboratory testing.

An Improved Understanding of Subsurface Acidic Groundwater Flow Pathways through Electrical Geophysical Imaging

Bell, Ron - hydroGEOPHYSICS, Inc., Lakewood, CO

Acidic groundwater flow through waste rock piles and native geology at abandoned and active mine sites is a common concern of environmental engineers and scientists. Exploration borings, pumping or slug tests, and data sampled from a monitoring well network over a period of time is the typical approach to understanding of the hydrogeology of the site. For a number of reasons, most often resulting from the sparse placement monitoring wells, site investigators often have more questions than answers about subsurface groundwater flow. Because the electrical conductivity of the acidic groundwater is, in general, much greater than the non-mining impacted groundwater, host geology, or the unsaturated portions of rock piles, the application of electrical geophysical methods can result in a subsurface map of the spatial variation in pore water content, the location of high ionic strength groundwater, and the preferred groundwater flow pathways.

High Resolution Resistivity (HRR) imaging and residual potential mapping (RPM) were applied to the Landusky Mine site, an abandoned gold mine in north central Montana undergoing reclamation, and the characterization of a refractory ore stockpile at an active gold mine in Nevada. In both cases, the 2D resistivity imaging transects showed areas containing increased concentrations of acidic groundwater. Likewise, the results from the RPM method, where an electric current is made to flow in the subsurface through the placement of an electrode place at depth in a monitoring well and in a seep, delineated the preferential flowpaths for the acidic groundwater. The data from the geophysical investigations were used in conjunction with data from drilling and other hydrogeological testing to develop an improved understanding of the hydrogeology of each site. The site managers were then able to develop an action plan to mitigate the creation and flow of acidic groundwater.

Riparian Buffers, Planting Models and Species Selection for Natural and Geomorphic Stream Design on Mine Lands

Carrere, Leslie - RPM Ecosystems, LLC

Working together with natural, engineered and hydrological solutions, RPM Ecosystems' presentation will focus on plant based and ecosystems solutions for stream restoration and water quality improvement. RPM Ecosystems has 20 years of proven success in stream restoration design and implementation.

Choosing the right plants in designing buffers is critical to the function of the biological and ecological structure along a stream or river. We will look at patented high performance native plant resources and how plants work together with engineered solutions and alone to improve hydrology and water quality, remove pollutants, reduce erosion and the effects of acid mine drainage.

RPM Ecosystems offers a new tool in the toolbox for higher survivability, accelerated growth, earlier mast production and canopy coverage for wildlife and aquatic habitats.

We will explore innovative research based technologies and land management practices for harsh and degraded landscapes to assure earlier project success in functioning stream ecosystems both environmentally and economically.

Partnership Development: How do YOU measure success?

Coffelt, Todd - Mines and Minerals Bureau, Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship, Des Moines, IA

Over the last five years, a partnership between landowners, local partners, watershed groups, and governmental agencies has focused on protecting the Muchakinock Creek Watershed. The Muchakinock Creek, or "Mighty Little Devil" as named by the local Indians, refers to a creek that can change from a peaceful brook to a raging torrent depending on the weather. This reference parallels the group's evolution from a "just a good idea" to a successful watershed project steamrolling toward the next challenge.

When one drives through the Muchakinock Creek Watershed, you see the history of coal mining intertwined with every aspect of life. Early on, the partnership struggled to capitalize on an opportunity. Applying for and receiving EPA 319 funds was the starting point and then the group addressed the abandoned mine land priority features. These similar, but different efforts, helped tell their story and secure additional funding and increase watershed awareness. Financial tools such as making the dollars go farther, finding creative ways to leverage funds, and identifying in-kind services helped increase citizen participation. Environmental benefits such as decreasing sediment transport, improving stream

conditions, and creating wildlife habitat are also common goals shared by the watershed stakeholders. An indirect benefit has been the development of a successful model that can be used by other watershed groups and applied to their individual situation. Increased community awareness and participation have fostered the promise of continued success for years to come.

The Muchakinock Creek Watershed has benefited from engaged citizens, increased exposure in the press, and citizen participation in field days. The story of the Muchakinock Creek Watershed can be used to help other groups identify their own resource needs, focus on common goals and objectives, and measure success beyond what is completed on the ground. This presentation will tell their story of success and outline the next steps.

The Use of Borehole Video Technology in Subsurface Investigations

Dale, Deborah - U.S. Department of the Interior, Office of Surface Mining, Alton, IL

Borehole video surveys are an invaluable tool for investigating and documenting conditions in wells, shafts, mine voids, and other subsurface features. The video surveys provide continuous, permanent records of existing conditions, as well as real-time viewing. Borehole camera technology has been in use for some time, but improvements to these systems in the past decade, such as smaller cameras and improved camera capabilities, have resulted in increased application in more narrow wells and restricted subsurface openings.

The Office of Surface Mining Reclamation and Enforcement (OSM), Mid-Continent Region (MCR) maintains a borehole camera system capable of descending to depths of 1,000 feet. The system is relatively lightweight and portable allowing its use in remote areas. The system utilizes high-resolution color and black and white cameras that are fully submersible, and the operator is able to view in any direction making it extremely useful in investigating mine voids and shafts. Working in cooperation with various State programs, OSM-MCR staff has successfully used the borehole camera in investigating domestic well complaints, revealing voids under a subsiding highway in preparation for a grouting project, exploring a mine lake, and examining numerous abandoned mine shafts scheduled for closure.

Subsidence Prevention at an Emergency Reclamation Site near Williston, North Dakota

Dodd, William - Abandoned Mine Lands Division of the North Dakota Public Service Commission, Bismarck, ND

Dangerous sinkholes have been a problem for residents in and around Williston, North Dakota (population 12,500) for many years. These sinkholes have resulted from sudden collapse of abandoned underground coal mines that operated from about 1909 to 1969. Although sinkholes are an obvious hazard, undermined lands that have not yet collapsed present a much more insidious danger to people in and near Williston.

The 2008 Williston (Njos) Emergency Project was conducted to stabilize a collapsing underground mine beneath a metal crafting and landscaping business owned and operated by David Njos near Williston, North Dakota. By probing into an expansion joint between the driveway and shop floor of his building, Mr. Njos discovered a five-foot deep void directly beneath the concrete floor and driveway. This void was caused by the collapse of an abandoned underground coal mine. Mine collapse was an immediate and serious threat to Mr. Njos, his customers and business.

Reclamation work began May 22 and was completed June 25, 2008. The reclamation technique used was pressurized grout remote backfilling. In this technique, a cementitious grout was pumped under pressure through holes drilled into the mine cavities to fill them as completely as possible and reduce the likelihood of collapse. Because of the possibility that grout pumping could cause surface lifting and damage the building, pre- and post-construction structural surveys and continuous laser level elevation monitoring were conducted.

The total contract costs for this project were \$109,185.50. We believe the hazardous underground mine voids at this site have been stabilized as well as possible. No mine-related damages to the building have been reported since this project was conducted.

Abatement of a Coal Waste Slurry Spill from an Abandoned Mine Site in Southeast Kansas

Foshag, Fred C., Jr., P.E. - Kansas Department of Health and Environment, Surface Mining Section, Frontenac, KS

This PowerPoint presentation will cover the methods and materials used by the Kansas Department of Health and Environment, Surface Mining Section (SMS) to stop coal waste slurry from washing into a stream, and containment of the remaining slurry to avoid future discharges. The problem was caused when waste slurry washing out of three breached large slurry impoundments filled a lower slurry impoundment and entered the stream. Abatement included

construction of temporary dikes to immediately stop slurry from reaching the area of the overtopping, construction of a stable spillway at the site of the discharge, and closure of the three breaches in the upstream slurry holding structures using chimney drain structures to avoid creating potentially unstable waterfilled slurry impoundments. The presentation will focus on difficulties with abatement at the site and will highlight the use of various types of geotextile fabric, as well as HDPE marine mattresses, gabions, and pipe.

I-470 Mine Remediation

Gallagher, Shery, P.E. - Geotechnology, Inc., Overland Park, KS

Rathbun, Clay - Judy Company, Kansas City, KS

Orr, Richard, P.E. - Missouri Department of Transportation, Lee's Summit, MO

The project consisted of remediating an abandoned underground limestone mine to facilitate construction of a new entrance ramp to I-470 in Lees Summit, Missouri. Due to collapse of the mined areas near the project site, design included determination of the limits of remediation for the project and minimum construction requirements for mine infilling. The underground mined area within the project limits was surveyed by a local surveyor.

The Judy Company, contractor selected for the mine infilling, experimented in the laboratory with several grout mixes to determine the appropriate mix for the project. Infilling was accomplished from the ground surface and camera observation was used to monitor the barrier wall construction and infilling process. It was discovered that some of the mapped rooms were larger and some were smaller than indicated on the plan. Overall, the mine remediation portion of the project came in under budget.

Should Public Schools Receive Special AML Dispensation?

Gibson, Robert - Illinois AMLRD

At least 14 public and 1 private Illinois schools have been damaged by coal mine subsidence. In eight (8) instances the damages were so severe that the schools were condemned and subsequently razed. In the remaining seven (7) cases, damages were either of lesser magnitude and/or limited to a portion of the school building allowing continued use of unaffected areas within the building. Of these seven cases, 3 razed the damaged portions of the building and two schools built replacement additions after subsidence was complete.

Common to each school located in historic mining communities are the problems they face in siting the location of their schools to avoid underground mines or otherwise preventing subsidence. In some communities the mining is so extensive that avoiding mined out areas is not economically or politically possible. Whereas, schools damaged by coal mine subsidence face many challenging problems including programmatic obstacles such as relocating children out of damaged classrooms and incurring financial problems trying to maintain and keep the building serviceable.

Schools operate under unique building code and funding regulations that collectively impair their ability to avoid mined out areas, implement preventative measures such as backfilling and novel building design, or remediate the impacts of subsidence damages. For these reasons, OSMRE should reconsider existing AML regulations and guidelines and allow public schools special dispensation in the following areas. First, allow AML Programs the ability to provide economic assistance in preventing subsidence with mine stabilization projects when mining cannot be reasonably avoided. Allow AML Programs to defray the costs associated with razing condemned school buildings. Finally, OSMRE should implement a research program that collects detailed information on a national level with respect to subsidence characteristics and concomitant building damages as they relate to underground coal mines and the density of surface development located over mines. The goal should be to develop comprehensive risk assessment criteria that can be used by design engineers in establishing best practice techniques and building codes.

Overview of Critical Issues in Reclaiming Drastically Disturbed Lands

Harper, Jarvis, PhD. - Agronomist, FTN Associates, Ltd., Little Rock, AR

The term drastically disturbed lands is used to refer to large-scale disturbances of the landscape. Such disturbances in the central United States are typically associated with mining activities (coal, lignite, bauxite, sand, gravel, barite, etc.), drilling operations, and/or construction activities such as pipelines, road cuts, housing developments, commercial developments, etc. Prior to disturbance the next land use should be determined, where practical, and the value of removing and reusing the topsoil when carrying out any drastic disturbance of an area should be considered. Topographic reconstruction is fundamental to successful reclamation. Although reusing topsoil is advantageous in many if not most situations, subsoils, geologic strata, and certain industrial by-products can be successfully employed

as growing media where topsoils were not saved or are of low quality. Many drastically disturbed soils in the Gulf Coastal Region have the potential to become extremely acid due to the reaction of sulfide minerals with atmospheric conditions. Thus it is important to collect sufficient soil samples to accurately estimate critical chemistry components of the soil. Due to the ability of drastically disturbed soils to chelate nutrients it is almost always necessary to fertilize the soil rather than to fertilize the crop to be grown. Several methods for determining the level of acids or bases present are available including acid/base accounting and neutralization potential. The type and amount of lime to be added is a function of the soil acidity, the neutralizing potential of the liming agent, the crop to be grown, and the desired water quality. Drastically disturbed areas that have been properly prepared can benefit greatly from the use of mulches. The final plant cover should be consistent with the soil type, the ability of the soil to store and supply adequate nutrients and moisture, degree of slope, aspect, regulatory requirements, and economic considerations.

Reforestation of Indiana Mined Lands

Herbert, Steve - Abandoned Mine Land Program, Indiana Division of Reclamation, Jasonville, IN

The Indiana Restoration Program began an intensive effort to substantially increase the number of acres planted to trees on previously mined ground in 1999. The lands include both AML eligible reclamation sites as well as post-1977 SMCRA mined ground. The challenges encountered on both types of plantings shared some common characteristics, as well as each having their own unique problems. We recognized early on the need for a unique and readily available plot or ground usable for many years as a demonstration area. The Dugger Demonstration Unit has been the location for numerous plantings, applied research projects carried out through the Purdue University forestry department, and miscellaneous field days.

After 10 years of planting well over one million trees on all types of mined land, there are some outstanding successes, some obvious failures, and a lot learned. Indiana continues to carry out research directed toward improving the survivability, growth, and quality of trees planted on mine ground.

Reclamation of Shiloh Park – 1992 National Award Winner

Hollis, Mack - Russellville Recreation and Parks Department, Russellville, AR

Development at Shiloh Park – Russellville, Arkansas

Partnership between the City of Russellville, the Surface Mining and Reclamation Division of the Arkansas Department of Environmental Quality and the Corps of Engineers.

Reclaimed 75-acre abandoned strip mined area that was unsavory, unsafe and unusable.

Developed area into a family friendly area that includes:

- Four-field softball complex with all amenities
- Improved boat launch with parking
- Playground area
- Rotary pavilion, the largest of our pavilions
- Five handicapped fishing piers
- Open walk area
- Trail system
- Pond for fishing derbies
- 18-hole disc golf course
- Competition water ski area
- Radio controlled fly field and car track
- Dog training area

Future development plans include additional walking trails, picnic areas, pavilions and amenities (benches, barbeque grills, etc.)

Conducting Preliminary Site Assessments of Abandoned Uranium Mines in the Grants Uranium Mineral Belt

Jordan, Fiona, PhD., R.G. - Golder Associates Inc., Albuquerque, NM

The New Mexico Abandoned Mine Land (AML) program is revisiting abandoned uranium mines reclaimed in the 1980s to investigate whether the previously reclaimed physical hazards have degraded. Initial reconnaissance of seven abandoned uranium mines in the Poison Canyon area of the Ambrosia Lake mining district, McKinley County, New Mexico revealed these previously reclaimed mines contained TENORM material with elevated levels of ionizing radiation. The elevated levels of ionizing radiation may pose a potential risk to human health and the environment. Radiological surveys were conducted to map areas where elevated levels occur. Ionizing radiation was characterized using NaI gamma-ray scintillometers and Geographic Information Systems (GIS) mapping. Regression analyses were performed to develop empirical relationships between gamma radiation measured with the scintillometers and

laboratory-derived concentrations of gamma ray-emitting radionuclides in the soil. ²²⁶Ra concentrations in the soil ranged from 1.2 to 980 pCi/g and were well correlated to gamma ray emissions measured with the scintillometer (60-13000 count per second—cps). Uranium concentrations ranged from 1.3 to 3000 mg/kg (0.6 to 1010 pCi/g). More than 1500 measurements/survey points were made across an area of about 200 acres. Gamma radiation of TENORM material at these sites is heterogeneous, randomly and areally scattered. TENORM material with elevated gamma radiation levels (> 8000 cps) is primarily associated with thin layers of mineralized gravelly Todilto limestone—in some instances these are spread over fairly large areas. The mapping effort included: identification of sample locations, graphic displays of point gamma-ray measurement intensities and contour maps displaying soil radionuclide concentration gradients at each site. These maps will be used to delineate areas above critical radiation levels that may require mitigation.

In or Out; Considerations for Assessment of Underground Abandoned Mines for Wildlife

Kampwerth, David - U.S. Department of the Interior, US Fish and Wildlife Service, Conway, AR

As underground abandoned mine lands (AML) dot the landscape, public safety and wildlife conservation issues drive the closure program. Abandoned mines provide opportunity for future mining re-entry and wildlife habitat, and it's imperative that an accurate assessment is made prior to determining appropriate closure methods. With numerous agencies forbidding entry into underground AML workings and individuals posing valid safety concerns, it's understandable why underground AML entry has a mystique surrounding the effort. Underground entry does occur with limited safety concerns as qualified personnel are trained and follow guidance that's been developed by the Bureau of Land Management (BLM) and the US Forest Service (USFS). Considerations for entry include following established protocols, maintaining up to date training, and having a mentoring program. This paper outlines many of the considerations for entry into underground AML workings with emphasis on wildlife.

Status of OSM/FWS Guidance on Protection of the Indiana Bat

Loges, Brian - U.S. Department of the Interior, Office of Surface Mining, Alton, IL
Meier, Len - U.S. Department of the Interior, Office of Surface Mining, Alton, IL

The Range-wide Indiana Bat Protection and Enhancement Plan Guidelines were developed as a partnership between U.S. Fish and Wildlife Service (FWS), Office of Surface Mining Reclamation and Enforcement (OSM), and States with coal regulatory and abandoned mine land (AML) programs. The purpose of this document is to aid coal mining applicants and state regulatory authorities (SRAs) in understanding the options and protocols associated with assuring compliance with a 1996 Biological Opinion (BO) on implementation of the Surface Mining Control and Reclamation Act (SMCRA), and in particular, as such implementation relates to mining or reclamation that may adversely affect the endangered Indiana bat (*Myotis sodalis*). This document sets the minimum standards for development of the species-specific protective measures and provides predictability in the SMCRA permitting process relative to the preparation of a Protection and Enhancement Plan (PEP) by an applicant across all of the States where the Indiana bat is found. Although not designed to address potential issues relating to AML projects, the document provides habitat evaluation protocols and protection measures that could be applied to AML projects. This paper will address the major features of the guidance document and the initial responses of SRAs and regional FWS offices affected by the guidance.

Physical Hazard Remediations at the Historic Tesla Coal Mine, Alameda County, California

Mistchenko, Jonathan - California Department of Conservation, Abandoned Mine Lands Unit, Sacramento, CA

California is well known for its Gold Rush of 1849, but less well known is that California was a coal-producing state for several decades. Coal was discovered in Corral Hollow in 1855, but it was not until 1890 that the mining town of Tesla sprung up in Alameda County around large-scale efforts to exploit one of the few coal deposits found in California. The mine grew into the leading coal producer in 1890s California and supplied the first successful coal briquetting plant in the United States. This plant was destroyed by fire in 1905, which led to the demise of the coal mine.

The mines sat abandoned for many decades until 1998, when California State Parks Off-Highway Vehicle division bought the land with the idea of adding it onto the nearby Carnegie State Vehicular Recreation Area. Before this area could be opened to the public, the numerous remaining abandoned mines needed to be evaluated and remediated. Waste rock and minor tailings piles were evaluated and deemed to be a source of sediment to Corral Hollow Creek during high flows. The abandoned underground workings were evaluated by the Federal Office of Surface Mining and the California Abandoned Mine Lands Unit and were determined to be unsafe due to rock stability, vertical internal components, and potential bad air from fires lit by vandals and trespassers. The openings into these workings included adits, shafts, and declines ranging from open to completely collapsed in competent to very weak rock. Complicating matters were new

subsidence features opening after the construction planning was underway. Ongoing closures have addressed these problems using a combination of bat gates, culvert gates, polyurethane foam, and rock backfill. This entire site will require continuous monitoring to evaluate and address potential vandalism and stability issues.

Assessing the Use of High Resolution Satellite Imagery to Inventory Abandoned Mine Land Features in Virginia

Osborne, Dianne - U.S. Department of the Interior, OSMRE, TIPS Technology Transfer and Training Branch, Denver, CO

San Souci, Jason - NCDC Imaging & Mapping, Colorado Springs, CO

Kestner, Daniel - Virginia Division of Mined Land Reclamation, Big Stone Gap, VA

Davis, Richard - Virginia Division of Mined Land Reclamation, Big Stone Gap, VA

Britton, Kim - Virginia Division of Mined Land Reclamation, Big Stone Gap, VA

McDavid, Ann - Virginia Division of Mined Land Reclamation, Big Stone Gap, VA

The State of Virginia (VA) Division of Mined Land Reclamation (DMLR), and the Office of Surface Mining used high resolution satellite imagery along with other Geographic Information System tools to assist in the inventory of abandoned mine land (AML) sites and identification of areas for re-mining consideration in southwestern VA. AML sites identified as priority for mapping by VA DMLR were dangerous highwalls, apple cores, gob piles, spoil piles, clogged streams, clogged stream lands, portals, subsidence, dangerous slides, acid mine drainage, hazardous equipment and facilities, and areas for re-mining consideration.

Inventory and mapping of AML sites was conducted through classification of QuickBird-2 satellite imagery to identify new AML sites and more precisely locate existing AML sites. Through the use of image enhancement, feature extraction and image classification techniques, eleven of the thirteen priority AML sites were mapped from QuickBird-2 satellite imagery.

Initial image classification results demonstrate that high resolution satellite imagery can be used to inventory certain AML sites. Future work on this project will include performing additional field sampling for conducting an accuracy assessment on the final classification results.

Using Foam to Transport Tailings

Palladino, Rich - Cellular Concrete LLC, Allentown, PA

An abandoned coal mine located approximately 60 feet below the surface of a subdivision in Colorado Springs, Colorado, was required to be backfilled in order to prevent subsidence. Pre-engineered foam and waste sands were the specified backfill material. The purpose of using waste sands and foam is to reduce the cost and placement expense compared to typical fill methods.

The injection holes were drilled adjacent to the surrounding houses and some close to the roadway. If the injection hole is located adjacent to the homes and far enough from the mixer, the foamed material will be pumped using a concrete pump. If the injection hole is located near the roadway, then the material will be gravity placed. The size of the underground void will determine if this process will be used. Smaller voids, and voids that are partially collapsed, will require pressure grouting with a cement grout.

The foam will be designed to dissipate within 24 hours because of the relatively small size of the fill area. A volumetric mixer will be used to mix the foam and sand. Due to budget constraints, the state will be able to stabilize a much larger area of the abandoned mine using this new foamed technology, as compared to typical fill methods.

Stay Out–Stay Alive, Partnership Update. Educational information distributed to promote abandoned mine safety awareness; also educational information on mining, mine history and mined land reclamation.

Pineda, Loretta E. - Colorado Division of Reclamation, Mining and Safety, Denver, CO

Meilinger, Frank - Mine Safety and Health Administration, Washington, D.C.

The "Stay Out–Stay Alive" national public awareness campaign aims to warn the public about the dangers of exploring and playing on abandoned mine sites. The campaign is a partnership of more than 100 federal and state agencies, private individuals. Mine openings often appear safe to explore, but in fact they are dangerous and can contain unstable soil, unsafe roofs and ladders, deadly gases, poisonous snakes and dangerous explosives. The closures or warnings around abandoned mine hazards are in place to remind visitors to enjoy the outdoors, but play it safe by keeping out of abandoned mines. Outdoor recreation near abandoned mines requires caution. We need everyone's help to remind people to "Stay Out and Stay Alive."

Western Hardrock Watershed Team. An Office of Surface Mining/AmeriCorps*VISTA Initiative, Colorado Division of Reclamation, Mining, and Safety

Pineda, Loretta E. - Division of Reclamation, Mining and Safety, Denver, CO

Video Presentation: The Colorado Division of Reclamation, Mining, and Safety (DRMS) and the Office of Surface Mining and watershed groups are participating in the Western Hardrock Watershed Team (WHWT), a team of OSM/VISTA volunteers serving in watershed groups to build capacity in small mining communities. The OSM and DRMS are committed to providing watershed groups with opportunities to enhance watershed partnerships and provide groups with assistance to enhance funding opportunities and watershed sustainability. Each watershed participating in the program received a full-time OSM/VISTA position for up to three years. Work by the OSM/VISTA team is built around a set of five core goals: 1) assist host watershed groups with capacity building; 2) conduct watershed research and assist with project development and implementation; 3) conduct watershed outreach and education in the community; 4) support economic development related to watershed restoration, and 5) to broaden the OSM/VISTA's ability to engage with watershed and community development issues, and enhance his or her opportunities for future employment. This video presentation celebrates the work and experiences of these dedicated individuals.

Constructed Wetlands for Heavy Metals: Practical Considerations

Robbins, Rex, P.E. - FTN Associates, Ltd., Little Rock, AR

Dodds, Roger, P.E. - FTN Associates, Ltd., Little Rock, AR

Although constructed wetlands have been widely studied for the removal of heavy metals, the operating experience of full-scale systems has tended to be inconsistent. Certainly, there is still reluctance to apply the technology when significant capital costs are involved. This may be partially due to an incomplete understanding of the mechanisms at work in these systems.

Based on the full-scale experience with several industrial effluents, as well as acid mine drainage, a set of design factors has been developed that has provided predictable results. A basic understanding of the mechanisms at work in these wetland systems has evolved, primarily based on the research work of others and the accumulated evidence of several years of operation.

One of the features of this particular system design always includes the formation of sulfides. To promote the formation of sulfides, an anoxic environment must be created generally with the addition of an organic substrate. While the addition of an organic substrate is critical to this design, it can also be problematic by potentially creating other undesirable conditions. The methods and materials available for adding this organic substrate may be dependent on local factors and should be analyzed for each particular situation.

Ongoing operating experience with constructed wetlands has demonstrated the removal of heavy metals such as copper lead, zinc and even selenium. This operational experience has also created a set of learned lessons that should be useful in the application to other projects. These lessons include the resilience of certain plant types, proper operation during cold weather and the construction of liners using clay soils.

Taking on the White Hats: Interest Group Opposition to Reclamation

Rohrer, Chris - Abandoned Mine Reclamation Program, Utah Division of Oil, Gas & Mining, Salt Lake City, UT

SMCRA-based abandoned mine land programs have generally enjoyed a positive image and public support. The programs are nonregulatory and reclamation projects are public works that improve public safety, benefit the environment, and provide jobs and an economic boost to communities. In Utah, recreational user groups originally founded to promote exploration of abandoned mines have begun targeting reclamation projects in recent years. Their grassroots activist campaigns have adopted a political stance in opposition to reclamation, citing concerns for historic preservation and loss of recreational access to mines. The campaigns use a variety of tools, largely web-based, to solicit support and influence project planning. This paper examines this phenomenon. It profiles the interest groups and their methods and the Utah Abandoned Mine Reclamation Program's response to a new challenge to its mission.

Applications of Ground Penetrating Radar in Mining

Shaffer, Nelson - Indiana Geological Survey, Bloomington, IN

Ground Penetrating Radar (GPR) is a relatively new, noninvasive way of seeing into the earth using a series of radar pulses directed into the ground. A small amount of radar energy is reflected when units having different electrical

permittivities are encountered in the soil or rocks below the instrument. Times (measured in nanoseconds) between generation and return signals allow for the determination of depths to the features. In practice, the GPR instrument is moved in parallel lines separated by 0.5 to 1.5 feet. Travel times and intensities of the returned signals are then plotted against position. Most GPR instruments have a field computer that displays black and white cross sections of the radar subsurface in real time. In the office, field measurements can be further manipulated to provide enhanced color cross sections, map images at different depths, or even three-dimensional images of the subsurface. GPR can detect: 1) void spaces such as natural caves, manmade mines, and graves; 2) bedding, hard grounds, or other geologic discontinuities; 3) changes in concentrations of water or other fluids; and 4) archaeological features.

Depths of penetration range from a few feet to tens of feet depending on the radar wavelengths used, physical nature of the rock, soil type, moisture content, and electrical properties of the subsurface. GPR commonly uses radar waves in the frequency range of 50 MHz to 900 MHz. Shorter wavelengths provide greater detail, but penetrate only to shallow depths. Longer wavelengths allow for deeper penetration at the cost of greater detail. Clay-rich units, water-saturated beds, or pollutant plumes inhibit passage of radar energy and, therefore, present difficulties for GPR work. These properties also allow georadar to be used to determine water table details or other hydrologic features.

The Indiana Geological Survey has used GPR and other techniques to detect and delineate paleoliquefaction features, karst solution features, water tables, faults, facies changes, utilities, graves, archaeological structures, and other features. In Indiana, GPR has delineated solution features in several limestone quarries and caves in natural circumstances. It has also shown faults, joints, and facies changes in limestone. Coal miners are required to avoid burial grounds, even those that are unmarked or no longer used. GPR studies showed a series of probable graves that were affecting coal mining in a long-abandoned family cemetery near Petersburg. In another instance, open subsidence pits and incipient subsidence features were noted by GPR in Knightsville, Indiana, where evidence of remediation efforts was also shown.

GPR has been used by others to determine coal thickness, detect roof changes, protect continuous mining machines, and make numerous other coal-related measurements. Examples of successful projects occur in all parts of Indiana, other groups have had success in many different settings worldwide.

GPR and other noninvasive methods allow rapid visualization of important subsurface details. Improvements in equipment and software arrive frequently, thus promising faster, cheaper, and crisper determinations. We expect that future research on premined prospects, mining operations, and postmined areas will commonly include GPR and other noninvasive techniques owing to their relatively inexpensive (no drilling needed), rapid, large area, detailed revelations of the subsurface.

Development and Use of a Profiling Sonar Probe for Investigating Flooded Underground Mine Workings

Sharp, William M. - Abandoned Mine Land Program, Oklahoma Conservation Commission, Oklahoma City, OK

Sharp, Richard F. - The Charles Machine Works, Inc. (Ditch Witch), Perry, OK

The West Commerce Tar Creek AML Project reclamation plan involved disposal of mining waste known as chat into flooded underground mine workings. The selection of disposal areas within the abandoned Pb/Zn mine workings was dependent on verification of mine map data to insure that adequate void space existed. Using mine maps as a guide, six-inch diameter boreholes were drilled at potential locations. Initially, verification of these mine voids was accomplished using a sonar tool developed and operated by Workhorse Technologies of Pittsburgh, PA. The tool used a high resolution profiling sonar unit from Imagenex to measure the distance from the transducer to the target (mine wall, pillar, debris, etc.). The tool was lowered down the well bore and suspended in the mine by a nylon rope. Horizontal 360 degree scans were obtained for each 0.3 meter increment starting at the mine roof and ending at the mine floor. In order to determine the spatial orientation of the sonar data relative to the earth's surface the tool was equipped with a video camera aimed at a magnetic compass. This method of orientation proved to be unsatisfactory due to air bubbles and turbidity which resulted in the sonar data being orientated to the mine map utilizing a "best fit" approach.

Later subsurface investigations were conducted with a sonar tool similar to the Workhorse tool except a digital magnetic compass was coupled to the sonar device. This allowed for accurate spatial orientation of the sonar data plus allowed for tool drift compensation. Binary data from the sonar unit and the digital compass were conveyed to a laptop computer via a RS-485 serial interface. AutoCAD Map 3D/SurvCADD was used to display point cloud data sets that were created from the binary data files after they were processed using the MATLAB programming language. This presentation will illustrate the construction of this tool and its use in both mine void measurement and monitoring of hydraulic stowing of chat into flooded mine workings.

Underground Bulkhead Construction for Mine Discharge Control at Hardrock AML Sites

Stover, Bruce - Colorado Inactive Mine Reclamation Program, Colorado Department of Natural Resources, Denver, CO

Reclamation of abandoned or inactive hardrock mine sites on public and private land in the western United States often involves developing a strategy for dealing with acid rock drainage (ARD) discharges. At many sites, there is no remaining reclamation responsibility or viable potentially responsible parties associated with the past mining operation. With continued absence of a Good Samaritan provision to limit long term liability under the Clean Water Act, NGO watershed stakeholder groups and local and State governments are often reluctant or unable to implement ARD treatment to help clean up pollution problems they didn't create, even though they may have the funding and desire to do so.

For some sites, an alternative to traditional ARD treatment may be to institute source-controls within the hydrologic system to re-establish pre-mining groundwater pathways. This approach prevents rapid, continuous "pipe-flow" groundwater movement into and through the open, oxygenated underground workings, preventing or significantly reducing the formation of ARD. This usually involves construction of a hydrologic bulkhead seal in the underground workings at a location designed to re-establish the pre-mining water-table elevation, and eliminate direct discharge from the portal. An evaluation of the mine-groundwater system interaction is required to determine the feasibility of this strategy for a given ARD site. Attributes for bulkhead success include an understanding of the groundwater hydrogeology, reasonably good access to underground workings, sections of solid, competent rock (minimal faulting, jointing or bedding planes) preferably along cross-cut mine workings, an adequate overburden depth to hold the expected head pressure, no workings, drill-holes, or other significant natural groundwater pathways connecting to any adjacent mines, and the use of appropriate construction and grouting techniques.

This evaluation of both successful and problematic examples of recent underground bulkhead construction projects provides reclamation planners with a checklist of positive site attributes for bulkhead construction. These attributes can be used to develop a preliminary bulkhead feasibility analysis for many western hardrock mine-drainage sites, and help guide subsequent hydrogeologic investigations needed to confirm the viability of a bulkhead solution.

Spaceborne InSAR for Monitoring of Subsidence Related to Abandoned Mines near Urbanized Areas

Van der Kooij, Marc - MDA Geospatial Services Inc., Ottawa, Canada

Repeat-pass Spaceborne InSAR has been recognized as a valuable new technology for the mapping and monitoring of deformation during the last 10-15 years. This technology allows detailed spatial mapping at a sub-cm precision from an in-orbit altitude of 800 km. Application areas include underground mining, open pit mining, oil/gas field subsidence and heave monitoring as well as volcanic, seismic, aquifer and urban monitoring.

Recent improvement of resolution of new satellite sensor technology as well as the maturing of operational methodology has helped to create a competitive and compelling solution that can also be applied to the monitoring of abandoned mine sites. The paper describes the technical background, technical capabilities, strengths and limitations as well as several relevant examples that highlight the benefits.

Implications of the Occurrence and Spread of the White Nose Syndrome To Protection of the Indiana Bat

Vories, Kimery - U.S. Department of the Interior, Office of Surface Mining, Alton, IL

Protection of Threatened and Endangered species is an important component of every Abandoned Mine Land (AML) project. Protection of the Indiana bat has the potential to impact AML projects in many of the States in the Eastern and Midwestern U.S. During the winter of 2006/2007, an affliction called "White-Nose Syndrome" (WNS) began devastating colonies of hibernating bats around Albany, New York. Colonies of hibernating bats were reduced 81-97% at affected caves and mines. Since then, WNS has been detected more than 450 miles away from the original site, and has infected bats in eight surrounding states including three coal mining states. No one knows for certain how quickly or how far WNS will ultimately spread. Speculation that the spread may be influenced by human contamination by cavers has led some of the affected States to either close important hibernacula to human access or require meticulous cleaning of cavers prior to entry.

The emergence and spread of a pathogenic fungus that infects hibernating bats has the potential to undermine the basic survival strategy of more than half the bat species in the U.S. and all species of bats that occur in the higher latitudes of North America. Most species of bats that hibernate in the region are known to be affected and the Indiana bats (*Myotis sodalis*) have been hit particularly hard. The sudden and widespread mortality associated with WNS is unprecedented in hibernating bats. Bat life history adaptations include high rates of survival and low fecundity resulting

in a low potential for population growth. It is expected that populations of bats affected by WNS will not recover quickly. This paper will provide the current status on WNS and its potential to impact protection of the species related to project planning by State AML programs within the range of the Indiana bat.

Results of the OSM Applied Science Program 2005-2009

Vories, Kimery - Mid-Continent Region, U.S. Department of the Interior, Office of Surface Mining, Alton, IL

Prior to FY 2005, the Office of Surface Mining Reclamation and Enforcement (OSM) did not have specific funding for applied science projects. As a result, OSM became aware of the need to support applied science projects in order to better protect identified endangered species, improve reforestation and revegetation, protect prime farmland, improve technologies to mitigate acid mine drainage, improve methods for locating underground mines, and many other issues related to protecting the public and environment associated with surface coal mining. During FY 2005, Congress approved OSM's request to initiate a program to select and fund applied science proposals that would result in improved protection of the public and environment by advancing improved technology development and transfer related to mining and reclamation.

There have been 44 applied science projects funded through FY 2008. There have been 16 projects completed and one cancelled. The number of applied science proposals received has increased from 27 in 2007, to 44 in 2008, and to 63 in 2009. The number of projects awarded has ranged from 10-12 per year. Access to the proposals, final reports and project results are made available on the National Technology Transfer Website and distributed to the regional technology transfer teams. Two-page color FACT SHEETS have been developed to provide a verbal and visual summary of the results of each of these projects that can be made available by hard copy or over the Internet.

Two and Three Dimensional Subsurface Profiling Using DC Electrical Resistivity Imaging

Witty, Alan - Martin Marietta Materials, Carmel, IN

Electrical resistivity was first developed in the early 1900s and is measured by causing an electrical current to flow in the earth between one pair of electrodes while the voltage is measured across a second pair of electrodes (defined as potential). Using the measured current and potential, and the geometric arrangement of the electrodes, an apparent resistivity can be determined for the material beneath the electrodes.

New data collection systems developed in the 1990s; along with advancements in computer modeling has vastly improved this technique's strata resolution, depth capability, and profiling reliability. Today's systems utilize tens to hundreds of electrodes with automated switching between electrode sets and single or multiple channel transmittal capabilities. These advancements are rapidly improving the "between hole" information, identification of subsurface features, and the overall accuracy of reserve analysis.

Hospitality Sponsors

**C-ALS - SAFE AND FAST
PRECISION SCANNING
OF INACCESSIBLE
VOIDS AND CAVITIES**

MDL's Cavity Autoscanning Laser System (C-ALS) is a ruggedised 3D laser scanning system which safely measures the three-dimensional shape of the void and its surface reflectivity



C-ALS

world leading laser measurement technology

 Website: www.mdl-laser.com • Tel: (281) 646 0050

We Plug Holes!

FOAM

CONCEPTS, LLC

800.556.9641

www.foamconceptsllc.com



**Hatch Mott
MacDonald**
CONSULTING ENGINEERS

www.hatchmott.com

Hatch Mott MacDonald / Morgantown, WV
AML Contact: Tim Rice
T 304.212.4388 | F 304.212.2814
timothy.rice@hatchmott.com

General Sponsors



Our scientists, mining policy professionals, facilitators and IT experts deliver creative solutions to complex mining issues and missions that matter to us, our clients, and the world.

Kenyon Larsen • (703) 284-5051 • Kenyon_Larsen@sra.com • www.sra.com

Eric E. Coustry, P.E.

816.364.2890
816.364.2126 fax
4414 B South 40th Street
St. Joseph, MO 64503
mikon@mikoncorp.com


MIKON CORPORATION Consulting Engineers



Forrest Keeling Nursery is the world-renowned originator the the RPM (Root Production Method®) Technology. The Forrest Keeling patented RPM technology yields:

- Unsurpassed (95%+) survivability
- Rapid, vigorous plant growth
- Largest, healthiest root system
- Fewer trees required per acre
- A 100% natural solution

P.O. Box 135
Elsberry MO 63343
800-356-2401

www.forrestkeelingnursery.com

Break Sponsors

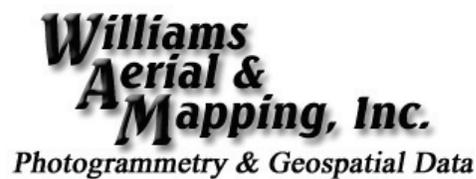
How do you integrate various mine aspects into a single, comprehensive plan? Ask Golder.

Focused on Mining. For over 45 years on six continents, Golder has developed unique expertise with complex underground and open pit projects. We deliver technical solutions that maximize value while meeting your obligations to communities, regulators and the environment.

Albuquerque Office:
505.821.3043
www.golder.com



Exhibitors



S
P
O
N
S
O
R
S
&
E
X
H
I
B
I
T
O
R
S

