

GEOLOGY, MINING, AND PROCESSING OF THE INDUSTRIAL MINERALS

SPRING 2018

**Sustainable Development
and Mining**

Virginia T. McLemore

SAFETY

Assignment

→ If going to SME

- Attend 2 talks on anything and report to the class
- Summarize the talks, state why you think it was a good or bad or so-so talk

→ Not going to SME

- Find a published paper of your interest
- Summarize the paper, state why you think it was a good or bad or so-so paper

**“Our greatest weakness lies
in giving up. The most
certain way to succeed is
always to try just one more
time.”**

-- Thomas Edison, inventor



What is sustainable development?

**"We do not inherit the
earth from our ancestors,
we borrow it from our
children."**

Native American Proverb

Sustainable development

- ⇒ Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
- ⇒ Sustainable development is not about sustaining the life of a mine.
- ⇒ Instead it is about sustaining the flow of materials for this and future generations and maintaining viable communities now and in the future, even after mine closure.

Sustainable development

- ⇒ Sustainable development is about ensuring a better quality of life for everyone, now and for generations to come.
- ⇒ Sustainable development is about how the company handles potential risks (financial, health, environmental, geological)



What does this
definition imply?

What does this definition imply?

- Future generations have rights to the resources
- The Current generation has a duty to include future generations' needs in its decision-making

Is this a “Freeze-frame” projection into the future? A no growth or slow growth definition? Or may the current generation assume there will be future technological advances and economic growth?

- An accounting of social and environmental impacts
 - » Who makes the call? Government, industry or the free market?

What is Mining's Role in Sustainable Development?



Sustainable development: can
the mining industry afford it?

Definitions

→ What is sustainability?

■ In simple terms, sustainable development means that we should use things in such a way that future generations can use them too, or at least enjoy the same benefits as we enjoy from use of the resource.

→ Should we use the term responsible mining?

■ What one thinks is responsible isn't to others

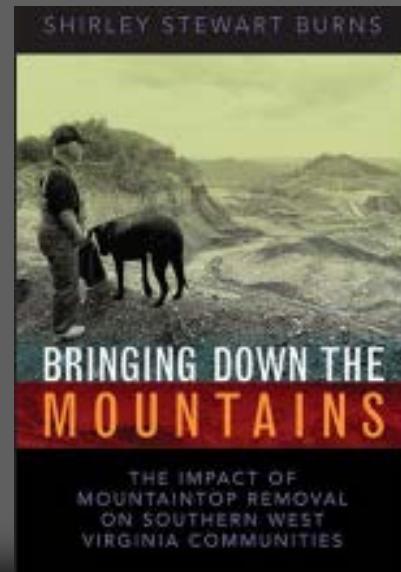
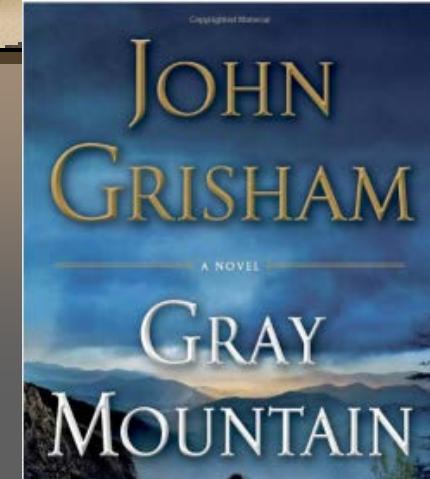
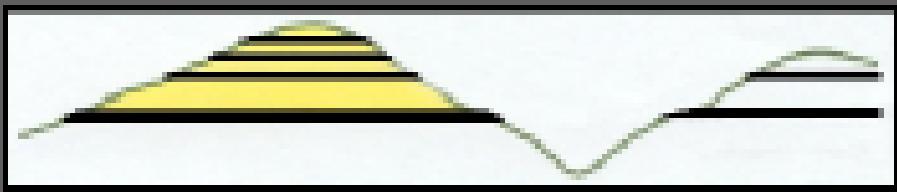
Definitions

- Should we use Corporate Social Responsibility (CSR)—“the commitment of business to contribute to sustainable economic development, working with employees, their families, the local community and society at large to improve their quality of life.”
- Should we use Social license to operate

Example

EXAMPLE—Mountaintop Surface Coal Mining

- ⇒ Example illustrating the complexity of the mining industry and sustainable development
- ⇒ Removes coal from the summit and dumps the overburden in the valleys



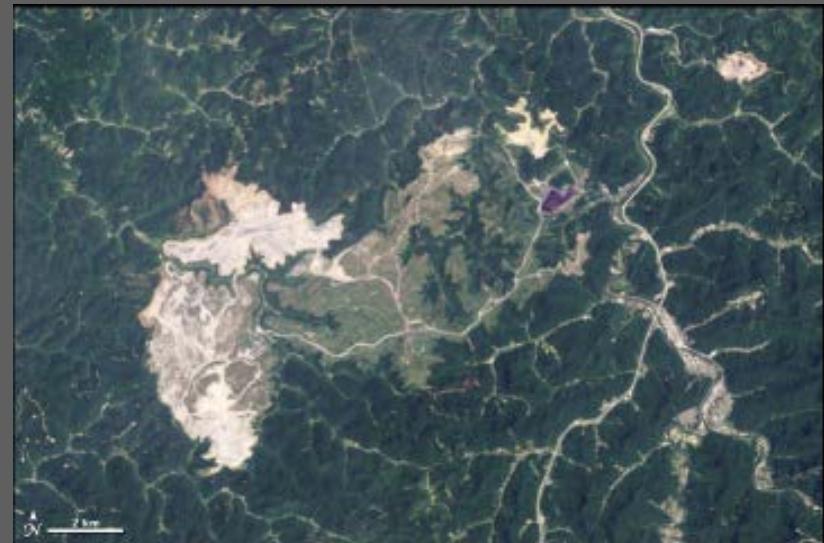
Mountaintop Surface Coal Mining

- From Ohio to Tennessee
- Since the 1960s
- In 2015 1/3 of US electricity produced from coal fired plants
- MTM approximately 5% of the coal produced
- Numerous recent studies showing health effects and negatively affecting the environment

EXAMPLE—Mountaintop Surface Coal Mining



The Hobet mine in West Virginia taken by NASA LANDSAT in 1984



The Hobet mine in West Virginia taken by NASA LANDSAT in 2009

EXAMPLE—Mountaintop Surface Coal Mining



Fill valleys



Mine the coal



Tailings



Mountaintop Surface Coal Mining

⇒ Many Environmental effects

- Water quality, flooding, increase base line flow
- Deciduous forests destroyed
- Headwaters affected

⇒ Potential Health effects

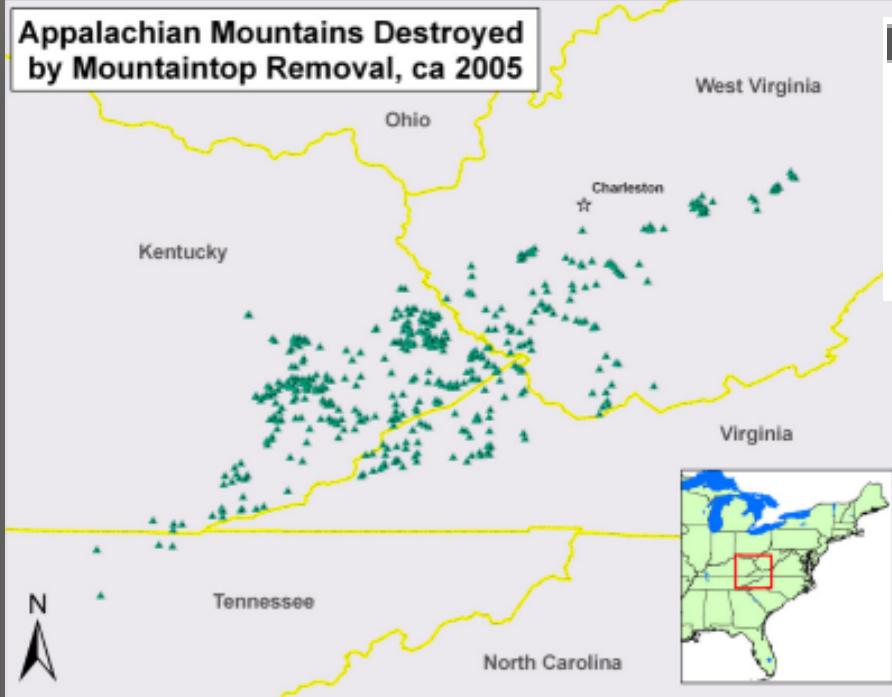
- Rates of mortality, lung cancer, as well as chronic heart, lung and kidney disease increased
- higher rates of birth defects

NOTE MAY NOT BE A CAUSE AND EFFECT
RELATIONSHIP, BUT OTHER FACTORS
INVOLVED

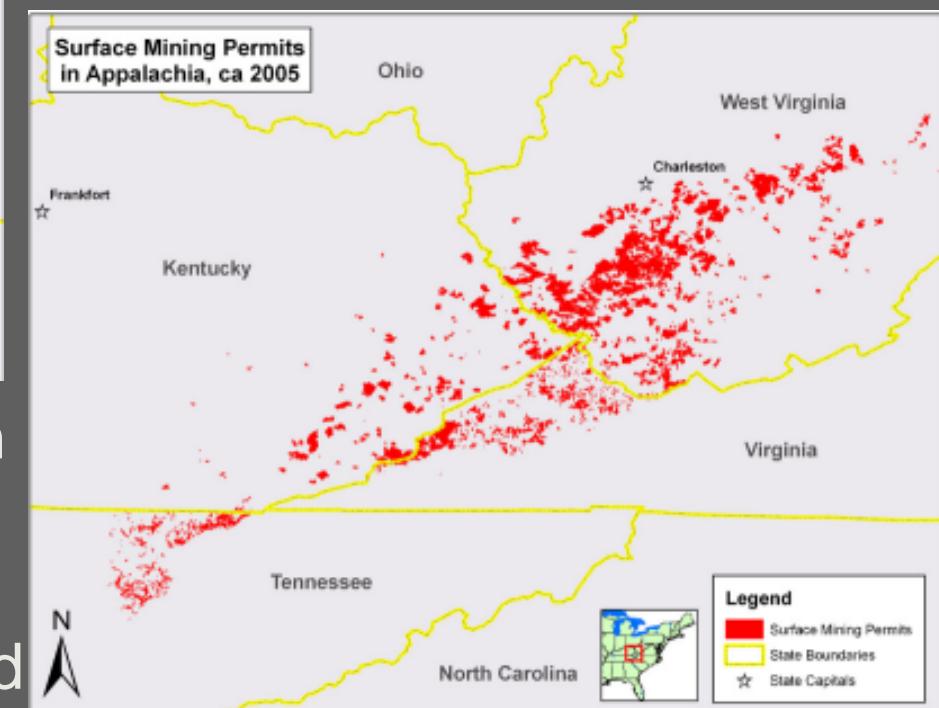


Some of the oldest soils in
North America removed

EXAMPLE—Mountaintop Surface Coal Mining



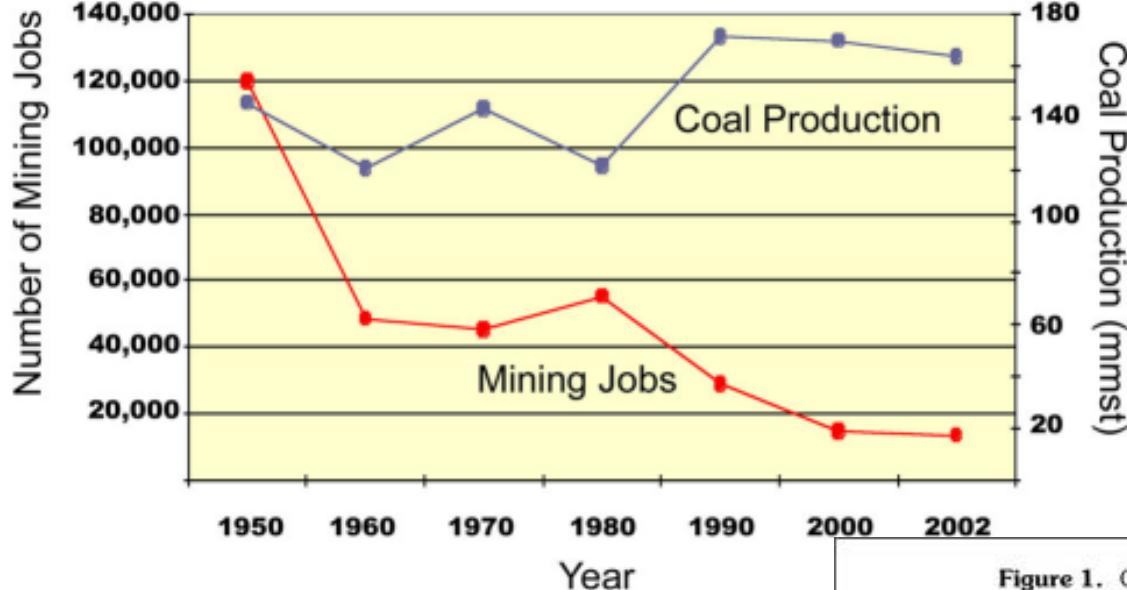
Mountaintop removal mining impact study results by state:		
Kentucky	574,000 acres	293 mountains
Tennessee	78,000 acres	6 mountains
Virginia	156,000 acres	67 mountains
West Virginia	352,000 acres	135 mountains
TOTAL	1,160,000 acres	501 mountains



450 mountains and summits in Appalachia have been destroyed by mountaintop removal coal mining (as defined by OSM in their 1985 EIS)

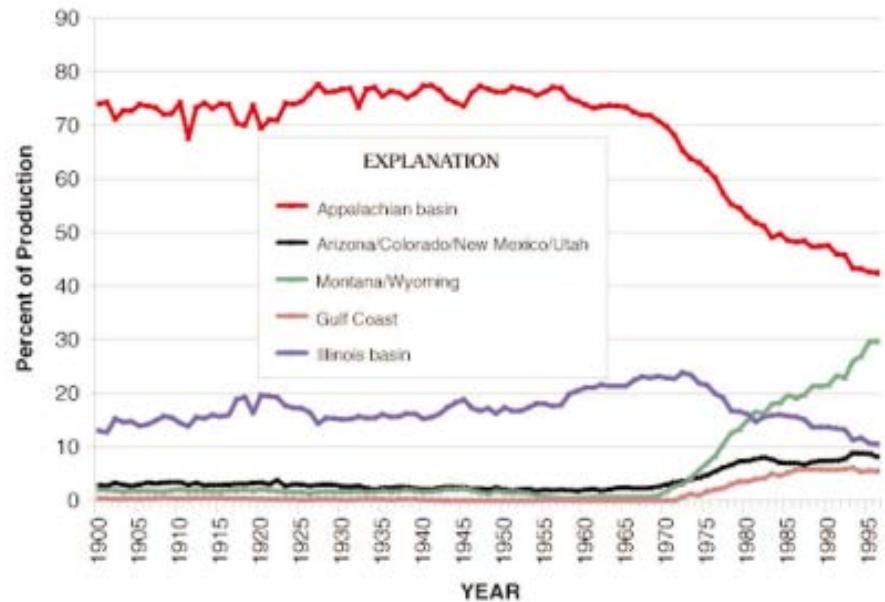
Appalachian Voices

Coal Production and Mining Employment Over Time



EXAMPLE— Mountaintop Surface Coal Mining

Figure 1. Graph showing percent of U.S. coal production by region.



EXAMPLE—Mountaintop Surface Coal Mining

- Changes in the way coal is mined, from small underground operations, to strip mines, to current mountaintop mining—cost effective, safer for workers
- Has changed the people, the communities and environment of Appalachia
- **The stark realism that mines come and go, technology changes, and no job, no place, no way of life is forever**

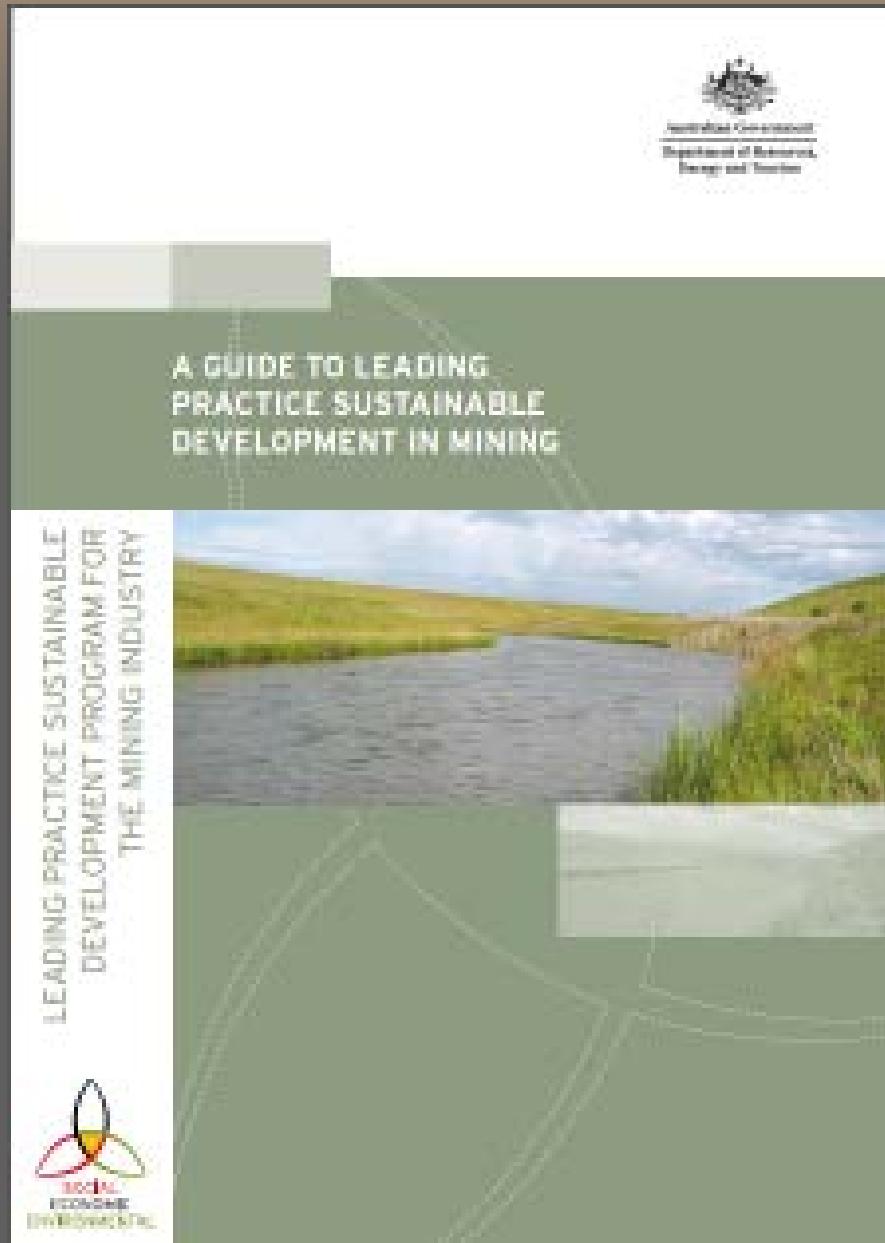
Mountaintop Removal Surface Coal Mining

- Employment is down, skill demands are up, communities have gone, and people have moved and been moved
- Decrease in jobs but the upward increase in salaries—who is better off?
- **How does a society choose between many low paying jobs in dangerous underground mines and few, well paid jobs in safe above ground operations?**

Mountaintop Coal Mining

- ➲ The failure of politicians and society to build an economy beyond mining
- ➲ Would the region be better off if no coal had been mined at all, but the equivalent amount of energy had come from nuclear power plants
- ➲ Are people better off now that Wal-Mart is one of the top five employers of the mining counties where mining employment has dropped most?

<http://www.industry.gov.au/resource/Documents/LPSDP/guideLPSD.pdf>



COAL INDUSTRY ADVISORY BOARD



INTERNATIONAL ENERGY AGENCY

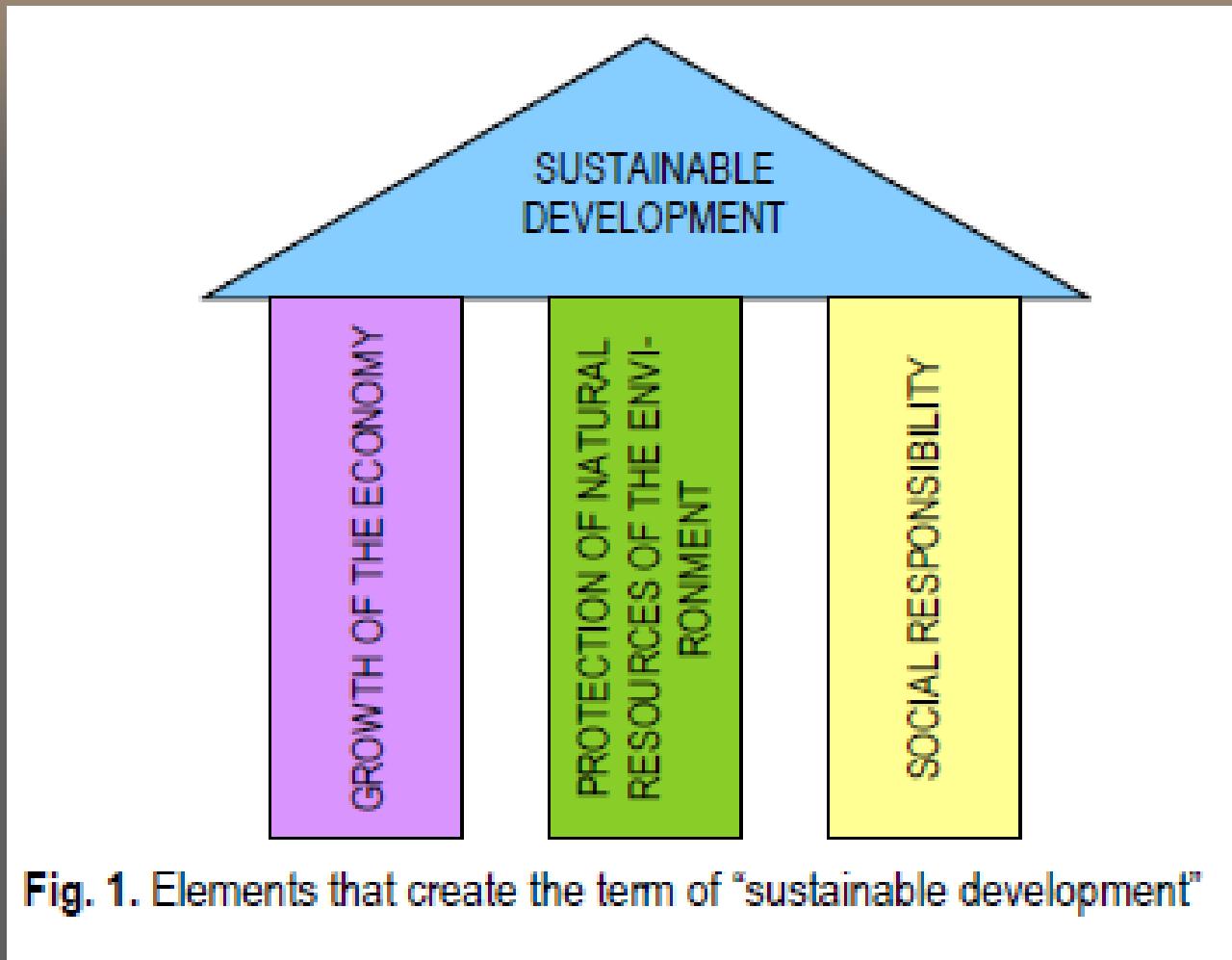


Case Studies in Sustainable Development in the Coal Industry

[http://www.iea.org/ciab/
papers/CIAB_Case_Stu
dies_2006.pdf](http://www.iea.org/ciab/papers/CIAB_Case_Studies_2006.pdf)

Mining's Role in Sustainable Development

Mining has a significant role to play in sustainable development. While it can contribute to economic growth and job creation, it must also be managed responsibly to minimize environmental impact and ensure social equity. This involves adopting sustainable mining practices, investing in renewable energy, and promoting responsible consumption and production. By doing so, mining can help to create a more sustainable future for all.



https://ac.els-cdn.com/S2300396015300446/1-s2.0-S2300396015300446-main.pdf?_tid=ee4d2222-151c-11e8-8295-0000aacb35d&acdnat=1519007652_60b3775dfb3189cc0c7e1e514866b592

Mining's Role in Sustainable Development

- Creator of New Wealth
 - Jobs, taxes and economic growth
 - Foundation for eliminating poverty
 - Make a profit -- Shareholder return
 - Enhanced standard of living
- Providing Mineral-based Products to Meet Society's Basic Material and Energy Needs and Demands
 - Building blocks of economic growth

Mining's role ... continued

- Advances in Civilization
 - All successful societies have encouraged, and will continue to encourage, mining
 - Metallurgical and technological advances have defined advances in civilization
- Mitigation of Society's Impact on the Environment
 - Mineral products make environmental protection technology possible
 - Modern mines are designed and built for closure
 - Recyclable mineral products

Mining's role ... continued

- Providing Lasting Benefits after an Orebody Is Exhausted
 - Mining's legacy to the community – a sustainable rural economy
 - Avoiding the boom/bust cycles of the past -- How do we keep the party going? Requires planning and cooperation
 - Metals are durable and continue to be used by society
- Efficient use of resources – energy, water, land and minerals
 - Technological advances promote resource conservation, efficiency, and extend mine life

Continued supply of natural resources to manufacture and produce products that society demands

- ➔ Recycling
- ➔ Re-use
- ➔ Less use
- ➔ Materials replacement
- ➔ Alternative product design
- ➔ Mining of new resources

Sustainable Development in the Context of Mineral and Energy Development

Encompasses:

- Economic Responsibility -- shareholders, employees, community, society
- Environmental Responsibility -- *society is more concerned with mining's impacts and behavior than its products*
- Resource Stewardship -- wise and efficient use
- Community Engagement -- shared objectives
- Product Stewardship
- Social License and Public Accountability— *we mine with the consent of the public*

Sustainability applied to any industry requires four general considerations (Richards, 2002):

- ◆ **Economic**
- ◆ **Environmental**
- ◆ **Social**
- ◆ **Governmental**

Sustainability applied to any industry requires four general considerations (Richards, 2002):

- ◆ Economic ◆ Environmental ◆ Social ◆ Governmental

Sustainable *does not* mean:

- renewable
- zero environmental impact
- “green”

Sustainability applied to any industry requires four general considerations (Richards, 2002):

♦Economic ♦Environmental ♦Social ♦Governmental

Sustainable *does not* mean:

- renewable
- zero environmental impact
- “green”

Note affects of renewable business on the environment:

- agriculture, farming: much greater land area, regionally much greater negative environmental impact
- golf courses: occupy surface area greater than state of Delaware - 5270 km² (herbicides, fertilizers)

Breaking New Ground

- ⇒ Report of Mining, Minerals and Sustainable Development project, 2002
- ⇒ <http://pubs.iied.org/pdfs/9084IIED.pdf>
- ⇒ MMSD+10, 10 yr report
- ⇒ <http://pubs.iied.org/pdfs/16041IIED.pdf>



It is not easy to meet society's needs without changing the landscape somewhere and affecting local communities.



Increase in population and the desire to maintain the lifestyle that we have here in America has led to an unprecedented change in the landscape locally.



The challenge is provide society with its needs, protect future resources, and alter the landscape and affect local communities as little as possible.

- Mining is compatible with environmental protection and social responsibility, and difficult challenges can and must be faced by the industry.
- Those who fail to meet this challenge are the likely losers.
- Society and the environment are also losers, and must also step up to the plate to meet the challenges.

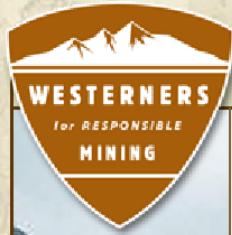
Seven Questions to Sustainability

Seven Questions to Sustainability

- ➔ How to assess the contribution of mining activities
- ➔ Maintain social license to operate

#1 - Engagement

- ⇒ Are engagement processes in place and working effectively?
- ⇒ Have community relationships been established?
- ⇒ Is there adequate feedback from the community?



BECOME A MEMBER: Your Email

STATE BY STATE IMPACTS: Select a State

Search:

Cleaning Up Mining Messes

Long gone are the days when metals like gold were mined with picks and axes. [Modern mines](#) are enormous operations that leave behind enormous messes.

Cleaning Up Mining Messes

- Abandoned Mines

Unfortunately, there is no federal program requiring all of these mining messes to be cleaned up in a way that protects communities, public health and water resources. The [1872 Mining Law](#), still governing hardrock mining today, contains no water quality or cleanup standards. Other applicable statutes and regulations, such as the Clean Water Act, either focus on pollution containment (rather than pollution prevention) or have huge holes (e.g. groundwater is not protected by federal law), or both.

But what about state-level mining regulations [especially in the West?](#)



AMIGOS BRAVOS
Friends of the Wild Rivers

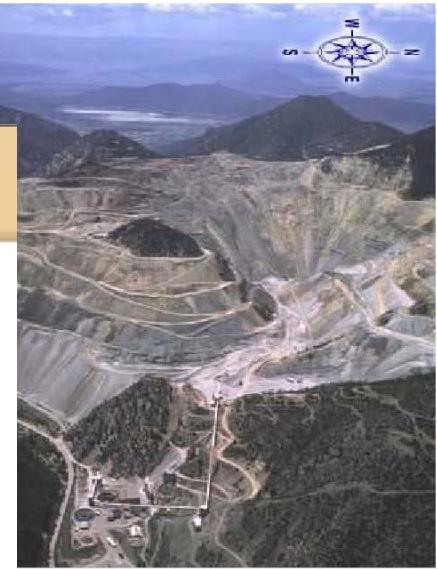
Molycorp Watch Project

Dedicated to the restoration and preservation of the Rio Grande watershed

[Molycorp Watch Menu](#)

Tour the Mine

[Open Pit](#)
[Waste Rock Dumps](#)



NEW MEXICO ENVIRONMENTAL LAW CENTER

Home
News
Issues
Cases
Awards
About Us
Join Us
Contact Us



New Mexico Environmental Law Center
1405 Luisa Street
Santa Fe, NM 87505
Email: [\(505\) 989-9022](mailto:nmelm@nmelm.org)

Hard-rock Mining Issues in New Mexico

Mining, long a major industry in New Mexico, has had a severe environmental impact on public and private lands and rural communities in the state. Modern mining involves:

- Contamination of land and water with toxic leachate elements such as cyanide and mercury
- Acid Rock Drainage, a perpetual water-pollution problem if left untreated
- Dangerous high walls and mine pits on public lands





MINERALS FOR TOMORROW'S TECHNOLOGY TODAY.

PRODUCTS

OPERATIONS

HEALTH, ENVIRONMENTAL, AND SAFETY

COMMUNITY RELATIONS

NEWS

LANTHANIDES

MOLY

//www.stcloudmining.com/

- Policies
- Programs
- Permits
- Reports
- MSDS



REPORTS - MOLYBDENUM

Molycorp is required to submit numer

st. cloud™
zeolite

Quick Links

St. Cloud Data Sheets

List of Applications

[Products](#) | [Company](#) | [Contact](#) | [Index](#) | [Home](#)



Home Page

ST. CLOUD ZEOLITE | Truth or Consequences, New Mexico USA

What is Zeolite? St. Cloud Zeolite Industries & Applications Sales About St. Cloud



st. cloud innovation through zeolite

Largest producer of natural Zeolite in the US | Limitless applications



In most businesses, you get back what you put in. With St. Cloud Zeolite, you get even more.

[Learn More](#)

St. Cloud: Innovation Through Zeolite

St. Cloud Zeolite is a safe, natural, non-toxic, and inexpensive organic material providing proven commercial benefits in a variety of applications.

Because of its unique physical and chemical characteristics, St. Cloud has become the largest and most reliable source of natural zeolite in the U.S. supplying the needs of the agriculture, horticulture, and environmental markets.

You'll find St. Cloud Zeolite in well-known animal feed supplements, in various horticultural growing media, in animal hygiene products, in water and air filtration applications and in odor control and general consumer products.

St. Cloud Zeolite is currently used in many other sophisticated industrial applications throughout the world in a wide range of processes that require cation exchange, filtering at the molecular level.

Construction, Laundry &
Industrial Grades Available
Any Quantity

... Quality & Consistency

[Construction Grade Pumice - FOB Espanola](#) | [Construction Grade Pumice -FOB San Ysidro](#) | [Laundry Grade Pumice](#)

[Products](#) | [Company](#) | [Contact](#) | [Index](#) | [Home](#)

[Material Safety Data Sheet](#) | [Credit Application](#) | [Typical Chemical Analysis](#) | [Sieve Analysis](#)

Copar Pumice Co.

PO Box 38, Espanola, NM 87532

Phone: (505) 753-2145 • Fax: (505) 753-8279

URL: <http://www.coparpumice.net> • Email: info@coparpumice.net



[For Teachers](#)

[Poster Packets](#)

[Homework Help For Students](#)

[Environment](#)

[Back to Main](#)

[Help MII](#)

*"Your materials educate
teachers as well as
entertain our students.
Free & low cost materials
are greatly appreciated."*

Michelle Mock - California

[More Teacher Comments](#)



About Mineral Information Institute

505 Violet St. - Golden CO 80401 - Ph: 303/277-9190 - Fax: 303/277-9198 - E-Mail: mii@mii.org

THE Source for FREE Teaching Materials

[Our Mission](#) | [Objectives](#) | [Programs](#)
[Support](#) | [Staffing/Directors](#) | [Teacher Comments](#)

MII's Mission

The Mineral Information Institute (MII) is a national 501 (c)(3) not-for-profit organization dedicated to educating youth about the science of minerals and other natural resources, and about their importance in our every day lives.

Each year MII works with interested professional and scientific associations, and various government and education agencies, to help classroom teachers develop materials that are directly usable by teachers in a variety of subjects and a multitude of grade levels. All programs require updating and maintenance to ensure their continuing value and use in the classroom. MII will provide that and will distribute those programs that merit continued use.

Supported by corporations, foundations, scientific associations, and individuals from across the nation, MII distributes these materials free to classroom teachers to supplement existing curricula. More than 29,000 K-12 classroom teachers in all 50 states, several Canadian provinces, and foreign countries receive teaching materials each year from MII.

MII is supported solely by donations. If we have helped you or you believe in what we do, please [send a donation](#).



MEMBERS ONLY

NEWSROOM

TECHNOLOGY

POLICY

STATISTICS

ABOUT NMA

EVENTS

CONTACT US



HOME



What's New at NMA?

- > [Secretary Norton Was an Exemplary Public Servant and Valued Trustee of the Nation's Resources](#)
- > [Regulating Mining Dust as Health Hazard Unwarranted](#)
- > [MSHA Headed in Right Direction with Emergency Temporary Standard](#)
- > [March 17th Edition of Mining Week](#)

Facts About...

Learn more about:

go



the AMERICAN RESOURCE

NMA is the voice of one of America's great basic industries. Our primary mission is helping the nation realize the contribution of resources derived from mining to our economic well-being and quality of life.

THE SAGO MINE ACCIDENT

[Contribute to the Sago Mine Fund, Support Lost Miner's Families](#)

[NMA Statement on Sago Mine Accident](#)

[Mining Safety Statistics](#)

Molycorp proudly sponsors:

The Molycorp Little Miners baseball.....and the Road Runners soccer team:



[Open House at
Lafarge North
America](#)

Communication is key to any good relationship, and that goes for neighbors too. As a fixture in hundreds of communities in the United States and Canada, Lafarge North America realizes the importance of sharing information about our operations with those who live and work near us. Whether it's a barbecue for the adults or games for the kids, Lafarge North America's open houses are opportunities for us to develop relationships with our neighbors in the community.

#2 - People

➔ Will people's well being be maintained and/or improved during and after the mining venture?

→ St. Cloud zeolite mine in Sierra County was first converted from a silver mill into a crushing plant for production of zeolites. Then the company diversified into reclaiming AML sites throughout NM as well as mining aggregate for roads and railroads. They now grow trees using their zeolite for reclamation plots throughout the state.



New technologies to improve worker safety

MILLING/GRINDING

GCC of America, Inc., Rio Grande Plant Tijeras, New Mexico

The Mill Maintenance Team at GCC's Rio Grande plant developed a system to minimize personnel exposure every time a ball mill requires a new charge or the addition of balls to the existing charge. Previously, after the mill shell access door was removed, barrels of balls were handled one at a time and carried overhead using the mill building bridge crane. Since the metal ball barrels are sometimes stored outside, they can develop unseen rust on the inside and bottom. The rusted barrels can burst when they are handled. The new system uses a concrete placement bucket with a clamshell gate. Barrels are now hoisted by a forklift with a barrel-gripping attachment and dumped into the concrete bucket. The mill building bridge crane hoists the bucket to the top of the ball mill. The bucket handles four barrels of balls at a time, eliminating the overhead conveyance of barrels in the work area. An unexpected benefit was realized when the time required to charge a mill was reduced by approximately 40%. Future ball mill charging projects will include a second concrete bucket to be loaded while the other is hoisted by the mill crane.

Safety Case Studies

[Download PDF Version](#)

'Slamming' for safety at New Mexico Coal

Safety



New Mexico Coal operation

Our New Mexico Coal operation in the USA initiated a behavioural-based safety leadership program in 2002. Led by the full management team, the program was developed with the aim of driving improvement in safety performance, which had been static for several years. In order to achieve Zero Harm, it was determined that the safety culture at New Mexico Coal needed a change. Training of the entire workforce was planned and completed.

Health and safety programs are important for happy healthy miners

'Let's get physical'

Intrepid Potash announces health initiatives



Erin Green/Current-Argus

At Tuesday's Intrepid Potash HealthCounts press conference at Carlsbad Medical Center, Dr. Jeffrey Boone, a doctor for Ute Denver Broncos Alumni, Jim Whyte, vice president of Intrepid Potash, and former Dallas Cowboy and Denver Broncos football player Wade Manning try out some treadmills.

Search this site

A SUSTAINABLE PERSPECTIVE

BHP BILLITON SUSTAINABILITY REPORT 2005

ABOUT THIS REPORT PERFORMANCE AT A GLANCE SUSTAINABILITY @ BHP BILLITON GOVERNANCE HEALTH SAFETY ENVIRONMENT COMMUNITY

You are here: Home > Health > Health Case Studies > Fit for Work/Fit for Life

Our Approach ▾

Our Performance ▾

Case Studies ▾

Cerroton Community Health

Advancing HIV/AIDS treatment

Fit for Work/Fit for Life

Aluminium Health Program

Diesel Exhaust Exposure

Health Case Studies

Download PDF Version

Fit for Work/Fit for Life initiative helps sites to manage health issues in the workplace

Health

The screenshot shows a website page for BHP Billiton's sustainability report. The main header is 'A SUSTAINABLE PERSPECTIVE' with the subtitle 'BHP BILLITON SUSTAINABILITY REPORT 2005'. Below the header is a navigation bar with links for 'ABOUT THIS REPORT', 'PERFORMANCE AT A GLANCE', 'SUSTAINABILITY @ BHP BILLITON', 'GOVERNANCE', 'HEALTH', 'SAFETY', 'ENVIRONMENT', and 'COMMUNITY'. A breadcrumb trail indicates the current location: 'You are here: Home > Health > Health Case Studies > Fit for Work/Fit for Life'. On the left, there is a sidebar with dropdown menus for 'Our Approach', 'Our Performance', and 'Case Studies', each listing specific case studies like 'Cerroton Community Health' and 'Advancing HIV/AIDS treatment'. The main content area features a heading 'Health Case Studies' and a sub-section titled 'Fit for Work/Fit for Life initiative helps sites to manage health issues in the workplace', which includes a small image of several people in orange uniforms exercising on treadmills. At the bottom right, there is a 'Download PDF Version' link and a 'Health' category label. A globe icon is located in the bottom right corner of the page.

Mining companies are proud of their health and safety programs, with many awards being won for H&S

USC News



January 28, 2005

United Salt Corp Safety Recognition

October 5, 2004

Our Hockley, Texas underground mine achieved 400,000 work hours without a lost time injury while our Carlsbad, New Mexico solar salt facility achieved a record 2,100,000 work hours without a lost time injury. Congratulations to both plants!

Carlsbad Current-Argus (LOCAL NEWS)
December 4, 2003

Mine gets top safety award

- By Jason P. Montoya: Current-Argus Staff Writer

CARLSBAD – A U.S. Labor Department official presented Mississippi Potash Inc.'s West Mine with the 2002 Sentinels of Safety Award on Thursday for the mine's safety record in 2002.

"My experience tells me that safety and health should be part of your business plan. It should be a core value of your organization's business components," said David Lauriski, assistant secretary of labor for mine safety and health.

"For us to be able to come out and promote this kind of event and promote the accomplishments of an organization like Mississippi Potash helps us show people that these types of things can be accomplished," he said.

Lauriski called the award the most prestigious honor of all industries in the United States.

Mississippi's West Mine earned the award in the underground nonmetal group with 263,371 employee hours without an injury that resulted in lost workdays. It was the fourth time since 1990 that Mississippi Potash Inc. has won the 77-year-old award.

The Sentinels of Safety Award – the oldest occupational safety award – is given out by the Mine Safety and Health Administration and the National Mining Association. Randy Foote, general manager of Mississippi Potash, attributed the honor to his employees' attitudes and efforts.

"It's really a recognition of the hard work our employees have put forth. By winning this award, we are recognized by our peers as having superior programs with employees who go out there and actually perform those programs," he

**Products****Contacts****Careers****Investor Relations****Press Room****Community / Environment**

Community / Env. Home

Community

Environment

Recycling and Reuse

Safety and Health[Home](#) > [Community & Environment](#)

Search

OK[Cement](#) [Aggregates](#) [Concrete](#) [Asphalt](#) [Gypsum](#)**► Full Case Study Document****Safety pays in New Mexico***Albuquerque, New Mexico*

Lafarge officials frequently tell associates that "safety pays." The catch phrase took on new meaning when Lafarge was selected to supply the concrete for a large job in New Mexico because of their outstanding safety record.

Details:

Sandia National Laboratories (SNL), a high tech, high-security company located at Kirtland Air Force Base in New Mexico, places a high priority on the safety performance of its suppliers. After a series of safety violations, including a mixer rollover accident, the company decided to seek a replacement.

SNL chose Lafarge because of the company's consistently high reputation for safety. The New Mexico AC&A Division spent more than five years developing a top notch safety program and training drivers and support personnel to develop and maintain safe work habits. The effort paid off – literally!

Last Update: 03/16/2006 07:39**Case Study**[Liquid Stone](#)[Exhibition](#)

The critics all agree that the Lafarge-sponsored Liquid Stone Exhibition at the National Building Museum is "heavy."

Find an MSDS

Link to [LNA's Material Safety Data Sheets](#)

E-mail Us

Have a question? [Contact Us](#)

Search Locationsnew mexico

#3 - Environment

- ⦿ Recognize environmental management as a high priority
- ⦿ Establish environmental accountability
- ⦿ Encourage employees at all levels to recognize their responsibility for environmental management
- ⦿ Adopt environmentally sound technologies
- ⦿ Adopt risk analysis and risk management.

St. Cloud received state reclamation awards for reclaiming AML at Lake Valley and other mine sites

Shafts on the Stone Cabin Claim



Before Construction



During construction



After construction

San Juan Mine



Located in Waterflow, New Mexico, the San Juan Coal Company has been presented with the Department of the Interior, Office of Surface Mining's 2004 National Reclamation Award, as well as the 2004 Best of the Best Award, for exemplary reclamation successes.

The grading techniques and channel design used at the San Juan Mine have represented the most innovative reclamation technology that has been developed for western coal mining during the past 25 years. Slopes have been created with the same

characteristics as the undisturbed lands. San Juan used a design process based on fluvial geomorphic principles, so the reclaimed topography is more stable, diverse, and resistant to damage from flash flooding than traditional reclaimed land in this arid environment.

The Best of the Best Award recognizes that outstanding reclamation is always a balance between production schedules, costs, and desire for the best possible reclamation. The ability to make it all work while achieving award-winning reclamation was best exemplified by the team responsible for the innovative regarding at the San Juan Mine. The group showed foresight, initiative, and creative implementation, attributes that make this group a model in both the coal industry and government regulatory environments.

Copper, Cows And Flycatchers Coexist In New Mexico

(July 2000)

In the quiet Gila River Valley in southwestern New Mexico, on Phelps Dodge property adjacent to the Tyrone mine, you'll find the world's largest population of the Southwestern willow flycatcher, a bird designated as endangered in 1995 under the Endangered Species Act.

The tiny bird is thriving amid the very conditions that a U.S. Fish and Wildlife Service report said would be most threatening to the species: water diversion, livestock grazing and floodplain agriculture. These activities occur extensively within the area. Yet, of the 500 pairs of flycatchers that remain in the world, more than 200 pairs are on the Phelps Dodge property. It's no fluke.

Shortly after the flycatcher was designated as endangered, Phelps Dodge began to work with independent biologists, Western New Mexico University, and the Gila National Forest to study environmental impacts on the bird's habitat on our property. In recent years, the company has funded restoration projects and leased water at no cost to the National Forest Service to help develop a habitat along the river.

And most recently, in a further demonstration of environmental stewardship, Phelps Dodge's New Mexico Operations funded a grant for additional study of the bird. The Rocky Mountain Research Station, a research division of the Forest Service, will continue to identify habitat, nesting and parasite concerns for the flycatcher in the Gila River Valley.

The Phelps Dodge funded study will collect data and incorporate it into several habitat models. These models will be used to identify areas for future riparian (river and riverside) restoration and flycatcher conservation.

#4 - Economy

- ➲ Mining, recycling, and conservation are important to provide the continued flow of commodities required to continue our way of life.
- ➲ Companies are in the business to make a profit

New Mexico Business Weekly
July 8th, 2005

Intrepid aims to bring Carlsbad 100 jobs

- by Clay Holtzman, NMBW Staff

A Denver mining company that has been investing big bucks around Carlsbad says it soon hopes to add 100 jobs and breathe more life into the state's resurgent potash industry.

Since early 2004, **Intrepid Mining LLC** has hired 250 Carlsbad workers furloughed from a bankrupt competitor – essentially doubling the company's workforce. Intrepid also has invested about \$60 million in acquiring and expanding mining and processing operations near the southeast New Mexico town. Intrepid says it will open a \$12 million plant to process a similar mineral, also near Carlsbad, within a month.

"We've been doing it quietly," says Robert Jornayvaz, principal with the **Intrepid Companies**, which owns Intrepid Mining LLC.

In late June, Intrepid received the support of the Eddy County Commission in its quest to secure \$21.5 million in state-backed Industrial revenue bonds. The company intends to use those bonds to fund a \$27 million solution-mining project, similar to the company's existing operations in Moab, Utah, that could generate 100 more jobs for Carlsbad.

Once expansion plans are complete in about 18 months, its principals say Intrepid will have invested about \$90 million in the Carlsbad operations, have a local workforce of more than 600 and increase production at the nation's largest potash production complex by more than 50 percent.

Po-waht?

New technologies using industrial minerals

http://www.pumicecrete.com/Pumice_Definition.htm

PUMICE-CRETE
BUILDING SYSTEMS OF NM

[Company](#) | [Pumice-Crete](#) | [Images](#) | [Contact](#)

Pumice Defined

Pumice-crete is a low density concrete made from pumice aggregate, portland cement, and water. It is a mix that succeeds in providing structural strength and insulation in one material. Typically it is poured on site in wall thicknesses of 14" or greater and no additional insulation or structural components are necessary. Wall surfaces are finished by applying plaster coats on the interior and exterior which further aid the thermal performance by trapping air within the honeycomb pumice-crete mix. The walls are very durable, fireproof, have good noise resistance, and are very aesthetically pleasing because they can be formed to fit many architectural appearances and styles. Being lightweight pumice-crete is relatively easy to install and is cast on site out of not highly manufactured ingredients making it a very resource efficient material. Pumice-crete buildings are warm and easy to heat in the cold of winter and stay cool and comfortable in the heat of summer. Pumice is a lightweight volcanic rock that is found in many parts of the world where volcanoes are present. It is a sponge like material formed by expansion of gases while molten lava rapidly cooled. It is a porous glass froth that is found in very shallow deposits in such places as New Mexico, Arizona, California, Oregon, Washington, and Idaho. Due to its toughness and durability it has been used as a lightweight aggregate in concrete for over two thousand years. It is an inert material and therefore has

Intrepid Ltd. (potash) and HRI Inc. (uranium) are investing in new technologies to determine if they can use *in situ* or solution mining.



#5 - TRADITIONAL AND NON-MARKET ACTIVITIES

- ⇒ Are traditional and non-market activities in the community and surrounding area maintained or improved with the operation?
- ⇒ Protective of indigenous cultures

Lafarge donated a
reclaimed aggregate pit
to the Laguna Tribe



Community



CHARITABLE GIVING

At Mosaic, we believe in partnering with non-profit organizations in the way that best addresses their specific needs. This involves monetary donations, of course, but our employees also give time.

You will find our employees in the Ukraine support and a school for children with speech problems. In helping rebuild homes for tornado victims and elsewhere that provides protective gear at vessel discharge | are supplementing a school breakfast and lunch program. We host the Alafia River Catfish Tournament, which raises dollars for environmental and recreational projects.

When it comes to direct monetary donations, the closest to our hearts is the United Way. In fact, by that combined to form Mosaic, IMC Global and Care, strong traditions of annual employee contribution have raised almost \$1.5 million for the United Way.

Some of our most frequent gift recipients include the American Cancer Society, the Boy Scouts of America, the National Parks Service and the Audubon Society.

Community Contact

Feb. 2 was Phelps Dodge Day in Albuquerque, N.M.

(February 2002)

Albuquerque Mayor Martin J. Chavez gave Phelps Dodge its own day in the New Mexico city.

The mayor proclaimed Feb. 2, 2002, as Phelps Dodge Day in Albuquerque to commemorate the 20th anniversary of Phelps Dodge's sponsorship of the Rio Grande Bio-Park's Zoo-to-You program. Zoo-to-You is sponsored by the company's Chino and Tyrone mining operations in New Mexico.

Chavez commended Phelps Dodge Corp. for its "strong community relations program that reaches out graciously to offer and promote such things as community arts, education, scholarships and grants, civic development, environmental awareness, safety training and volunteerism to many people."

The mayor's proclamation states that the company's contribution is appreciated by the second generation of New Mexicans who have learned about wildlife conservation and environmental issues.

Zoo-to-You is a traveling education program that takes zoo animals and animal-science programs to schoolchildren throughout New Mexico. The Zoo-to-You programs are presented by Bio Park docents who volunteer to travel with the zoo van and various small animals throughout the school year. Presentations are also made during the summer at public libraries and other educational facilities.

Over its 20-year history, the Phelps Dodge's Zoo-to-You van has visited more than 700,000 children throughout New Mexico.

"Phelps Dodge is our longest-standing community partner," said Ray Darnell, executive director of the Rio Grande Bio-Park, which consists of the Rio Grande Zoo, the Albuquerque Aquarium and the Rio Grande Botanic Garden.

"The company has supported Zoo-to-You in good times and bad, and its commitment to this education program and to the schoolchildren in New Mexico has never wavered," Darnell said. "I hope more companies will soon realize the benefits of including community improvement into business practice."

#6 - Governance

- ➔ Are the rules and incentives in place and as long as required to address operational consequences?
- ➔ Communication

Sustainable Development Organisational Structure



Caterpillar holds Global Forum on Sustainable Development in Mining at MINExpo 2004

[Pit & Quarry, Nov, 2004](#)

[New!] Save a personal copy of this article and quickly find it again with Furl.net. It's free! [Save it.](#)

Caterpillar held a Pre-MinExpo show at Caesar's Palace in Las Vegas for its family of global miners. Held Friday through Sunday before the start of the expo on Monday, the event featured a global forum on sustainable development in mining, a products and services briefing and a nightly Mine Site @ Night.

The Global Forum on Sustainable Development in Mining was a global gathering of miners for a day of exchange with industry leaders, real-time opinion polling, case studies and team-based, hands-on experiential learning. Ideas were shared and exchanged, from mining companies on the front line, on mining's triple bottom line--social, environmental and economic. Discussion on how safety initiatives fit into the business model was also discussed.

➤ From Anglo American:

“To secure a continuing license to operate, the mining and resources industry will have to frame its future in economically viable, socially beneficial and environmentally sound practices that are negotiated with communities within which it works.”

➤ From Rio Tinto

"We believe we can only continue to generate value for our shareholders over the long run if we excel in our performance on environmental and social issues. Sustainable development ...manages all the business risks to earn a license to operate from all stakeholders."

#7 – Synthesis and Continuous Learning

- ⌚ Is the project a net positive or negative for people and ecosystems?
- ⌚ Is there a process in place to synthesize and assess the continued progress towards sustainability?
- ⌚ Is there executive support from the company?

Many companies have educational materials in their web sites for teachers

<http://www.vulcanmaterials.com/social.asp?content=story>

[home](#) | [privacy policy](#) | [contact us](#) | [site map](#)

Vulcan
Materials Company



Social Responsibility

About Vulcan
Investor Relations
Social Responsibility
Social Responsibility Overview
Vulcan Foundation
Teacher Center
Construction Materials
Press Room
Employment

The Quarry Story



The Story of How a Quarry Works
Unless you've visited or toured a quarry, chances are you don't know much about what goes on inside one. In the simplest terms, a rock quarry is a place where little rocks are made from big rocks. Although the basic process is the same, each quarry is different and some of the things in Quarry Story may not apply to all operations. Geography, geology and the type of stone mined, how close a quarry is to neighbors, the size of the operation and the main transportation method used to get the stone products to customers all have an impact on how each quarry is designed and operated.

At Vulcan Materials Company, our primary business is quarry mining. We take big rocks out of quarries and make smaller rocks and sand by crushing them. We sell the crushed rock and sand to builders and contractors who use them to build roads, highways, bridges, houses, shopping malls, schools, churches and other buildings and structures.

Words that are highlighted in the Quarry Story are defined at the end.



Finding, Preparing and Designing a Site
Before we can start operating a quarry many preparations must be made. First, our [geologists](#) must find a place where there is a large supply of rocks beneath the earth's surface. We mine [igneous](#), [metamorphic](#), and [sedimentary](#) rocks to be used for construction. A [quarry](#) is frequently located near a community where our products are needed because if it isn't, it will cost our customers too much to haul the [crushed stone](#), which is very heavy, over long distances.

Obtaining Permits
After we find a good place to put a quarry, our geologists survey the land, and we develop a design that will make our quarry safe and efficient. Then, we have to get a variety of operating [permits](#) from local, state and federal governments. For instance, to obtain the environmental permits, it is necessary to provide a plan that shows we can and will obey all environmental rules of the state and federal governments. Once we obtain the proper permits, equipment is purchased, roads are built to the facility and we begin building the [processing plant](#).

New Mexico Bureau of Geology and Mineral Resources in cooperation with New Mexico Energy, Minerals, and Natural Resources Department hosted the 2005 Decision Makers Field Conference on Mining in New Mexico.



Rio Grande Cement honored with Quality Award

Jan 1, 2004 12:00 PM

GCC Rio Grande Cement's plant in Tijeras, N.M. was honored earlier this month with Quality New Mexico's highest accomplishment — Quality New Mexico's ZIA Award for Performance excellence, recognizing the company's commitment to progress toward excellence in business, education, government, and health care. Rio Grande was co-recipient of the honor along with Western New Mexico University

Rio Grande, a past Roadrunner recognition recipient, is New Mexico's only cement manufacturer. The award process and criteria are patterned after the Malcolm Baldridge National Quality Award.

Recent Articles from



- Volkswagen Dealer Tests Video in E-Zine
- Gold Mine: Ice.com Blogs the Bling
- Five Retail Opportunities for

Successful sustainable development involves the mining industry, government, and the community.

ICMM—International Council on Mining and Metals—10 principles

- ⇒ Implement and maintain ethical business practices and sound systems of corporate governance.
- ⇒ Integrate sustainable development considerations within the corporate decision-making process.

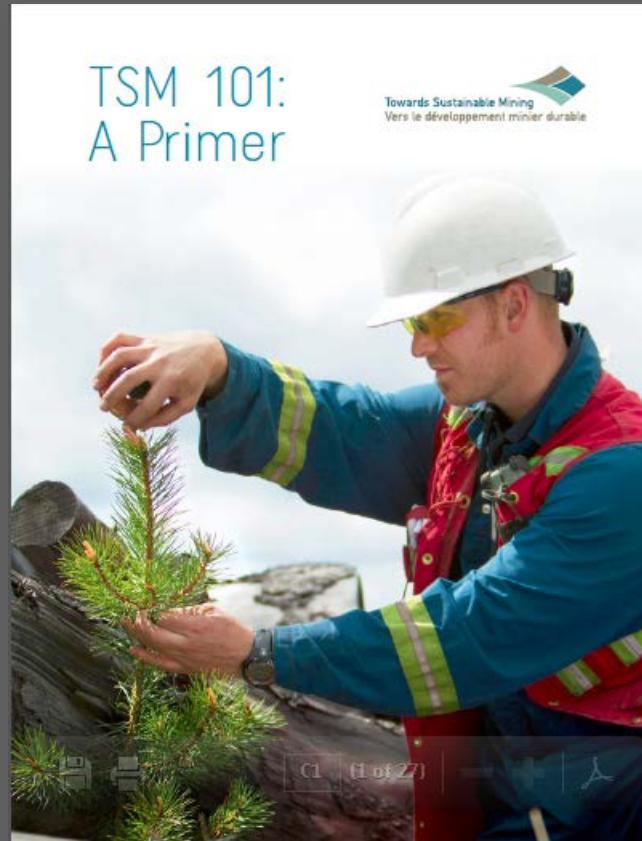
ICMM—principles

- ⇒ Implement risk management strategies based on valid data and sound science.
- ⇒ Seek continual improvement of our health and safety performance.
- ⇒ Seek continual improvement of our environmental performance.
- ⇒ Contribute to conservation of biodiversity and integrated approaches to land use planning.
- ⇒ Facilitate and encourage responsible product design, use, re-use, recycling and disposal of our products.

ICMM—principles

- ⇒ Contribute to the social, economic and institutional development of the communities in which we operate.
- ⇒ Implement effective and transparent engagement, communication and independently verified reporting arrangements with our stakeholders.
- ⇒ <http://www.icmm.com/our-work/sustainable-development-framework/10-principles>

Mining Association of Canada Towards Sustainable Mining



<http://mining.ca/sites/default/files/documents/TSM-101-A-Primer-Eng.pdf>

Mining Association of Canada

Towards Sustainable Mining

- ➔ Engaging with communities
- ➔ Driving world-leading environmental practices
- ➔ Committing to the safety and health of employees and surrounding communities

<http://mining.ca/sites/default/files/documents/TSM-101-A-Primer-Eng.pdf>

Mining Association of Canada

Towards Sustainable Mining

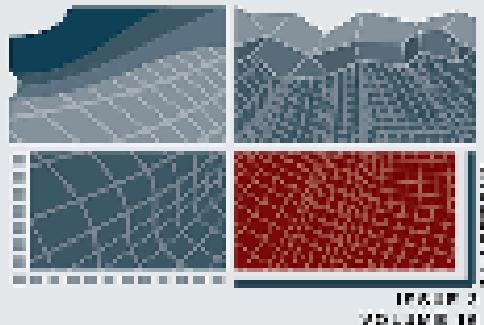
- ⇒ Accountability (participation is mandatory for all members)
- ⇒ Transparency
- ⇒ Credibility

<http://mining.ca/sites/default/files/documents/TSM-101-A-Primer-Eng.pdf>



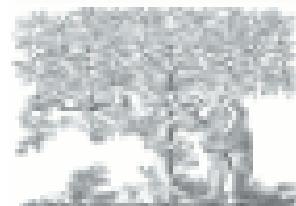
ISSN 1064-290X
ISSN 1875-6243

JOURNAL OF SUSTAINABLE MINING



CENTRAL MINING INSTITUTE
Kiev

HOSTED BY



ELSEVIER

Business case for sustainable development

Business case for sustainable development—business drivers

- ⌚ Supply and demand risks
- ⌚ Access to funding (stocks, loans)
- ⌚ Access to natural resources
- ⌚ Access to labor, educated labor
- ⌚ Political and regulatory environments
- ⌚ Operational efficiency and costs
- ⌚ Balance sheet
- ⌚ Reputation
- ⌚ R&D and innovation

Business case for sustainable development

- ⇒ Investors are more savvy, smarter, realize more factors affect profit than just supply and demand
- ⇒ World Bank investing in companies with a corporate history of positive sustainable development

Business case for sustainable development

- ⦿ **save costs** by making reductions to environmental impacts and treating employees well
- ⦿ **increase revenues** by improving the environment and benefiting the local economy
- ⦿ **reduce risk** through engagement with stakeholders
- ⦿ **build reputation** by increasing environmental efficiency
- ⦿ **develop human capital** through better human resource management
- ⦿ **develop human capital** through better human resource management

Business case for sustainable development—Corporate Social Responsibility (CRS)

- ⇒ focus on individuals
- ⇒ instilling an ethic of education and learning
- ⇒ put employees first as business' best assets and ambassadors
- ⇒ establish a system for keeping CSR debates and dialogues transparent and continuous
- ⇒ form smart partnerships, not for publicity or cover, but to realize CSR goals

Business case for sustainable development—Corporate Social Responsibility (CRS)

- measure and account for what they do
- report externally; but report in ways that reach all stakeholders, not just those on their mailing list or on the Internet

Lessons learned

Lessons learned

- ➲ Community understands time differently than mining companies
 - Mining companies might speak of progress over the last 10 years or the outlook for the next 10 years;
 - Indigenous peoples speak of their ancestors and the effects of mining on past generations, and the protection of traditional values for future generations; and
 - The labor community speaks about health problems created by exposure or practices 40 years ago.

Lessons learned

- ➔ Trust or lack of trust—legacy issues
- ➔ Perception of mining by many continues to become more negative
- ➔ importance of understanding historic and current governance and institutional arrangements with respect to mining and the communities of interest and the continued impact of these arrangements on issues related to mining
- ➔ need to understand the speed and direction of change into the future in order to move with them rather than after them

Lessons learned

- ➲ Lack of appreciation for the variety of values that are articulated in any discussion of sustainability—lack of a common frame of reference
 - Mining industry, sustainability is the ability to continue into the future
 - environmental NGO's sustainability refers to the ecosystem or biosphere
 - indigenous people or resource dependent communities it refers to the sustainability of their communities

https://www.iisd.org/pdf/2002/mmsd_sus_profile.pdf

**Is it possible to have
sustainable development,
sustainable economic
growth, sustainable
communities and a
sustainable society without
mining?**

What are some Roadblocks to Sustainable Development?

Roadblocks to Sustainable Development

- **NIMBY, BANANA and NOPE**
 - Locking up access to our resources is not sustainable, nor is it environmentally or socially responsible
 - Fails to recognize that poverty, not development, is the worst polluter
 - Arrogant--limits future generations' choices
 - Environmental imperialism – exporting the impacts of our consumption
- **Ineffective inter-agency cooperation**

Roadblocks to Sustainable Development

continued

- Over Regulation
 - The Babbitt 3809s
 - The Roadless Rule and similar attempts to create *de facto* wilderness
 - Solicitor opinions (millsite, excess reserves, etc.)
 - Court and agency interpretation of ESA, CWA, CAA
 - EPA
- The Permitting Process (NEPA)
 - The perpetual litigation machine
 - The never-ending story



Sustainable development: can
the mining industry afford it?

SUMMARY

- ⇒ Mining is a major form of creating wealth by providing the raw materials needed to sustain our way of life
- ⇒ Mining companies need to make a profit in order to remain sustainable
- ⇒ Mining companies have numerous opportunities to contribute to their communities and provide a sustainable future

Assignment

→ If going to SME

- Attend 2 talks on anything and report to the class
- Summarize the talks, state why you think it was a good or bad or so-so talk

→ Not going to SME

- Find a published paper of your interest
- Summarize the paper, state why you think it was a good or bad or so-so paper