Getting the most from our research analysis

Let us know what information will help you make decisions that best serve the citizens and economy of Arizona

Bad decisions are usually not intentional - most often, they are the result of bad information, be it incomplete, blatantly false, or just generally misleading to the person or group making the decision. This has been the case for many issues with respect to natural resources and our environment, where unfortunately, much of the data and information presented to the general public and decision makers up to now has been false or grossly misleading.

This new bulletin, “Natural Resources Impact”, is intended to provide factual information and data gathered from credible experts that include members of the faculties of prestigious universities and institutions world-wide. It is our goal to provide decision makers (both public and private) with credible data and information generated by reputable researchers and scientists, so that important decisions affecting us all can be made with confidence and a thorough knowledge of the facts, not the rhetoric.

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The mission of the Mining Foundation of the Southwest is to promote public understanding and education related to the mining industry, both in the U.S. and abroad. mfsw@dakotacom.net

The Department of Mining and Geological Engineering is a founding department of the University of Arizona, the only mining engineering program in the PAC-10, and one of only 13 such programs in the US.
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No. 1 | Vol. 1 | 2005

Natural Resources *impact*

A publication of the Mining Foundation of the Southwest

GOOD INFORMATION = GOOD DECISIONS

factual information from credible sources for public and private decision makers and for all people who care deeply about our state and national economy and our environment

$3.3B Impact of Copper on the Arizona Economy

Excerpted from Dr. George F. Leaming, Western Economic Analysis Center “The Economic Impact of the Arizona Copper Industry 2004”, May 2005

About 2,300 government employees around the state of Arizona received their salaries because of taxes paid directly and indirectly by the Arizona copper industry in 2004. About half of those were employed in local public education, while most of the rest were in state government. The $2.1B in sales revenues obtained by Arizona businesses directly and indirectly was 21% higher this year than last. Arizona’s economy gained $3.3B in 2004 from the production of copper and 22, 400 Arizona residents had jobs and a combined personal income of $1B directly and indirectly. State and local governments received $194M in revenue as a result of the state’s copper production. In 2004, almost 44% of the copper industry’s direct purchases from other Arizona businesses were made from firms located in the Tucson Metropolitan Area resulting in direct payment of $344M to businesses in Pima County.

Direct Impact of Copper Mining in 2004
Top 8 Counties

Pima	$ 420.6M
Maricopa	372.1
Greenlee	155.7
Gila	111.8
Pinal	67.8
Graham	63.0
Yavapai	47.1
Cochise	37.2

$3.5B Impact of Rock Products

From: Arizona Department of Mines and Mineral Resources and Arizona Rock Products Association

Rock products produced in Arizona include sand, gravel and crushed stone , cement, asphalt, and ready-mix concrete and are directly tied to economic growth, building activity, and repair and expansion of transportation infrastructure. Production or rock products in Arizona in 2004 resulted in a direct and indirect economic impact for our state of $3.5B resulting in the support of 25,190 jobs. Rock products had a direct payroll expenditure of $364M covering 9,388 jobs and a total payroll impact of $817M.

Arsenic and Common Sense

Arsenic is a common element found in all rocks, soils, and in food we eat. It is the 20th most abundant element that occurs in rocks and soil in concentrations of 1 to 20 parts per million.

When arsenic is mentioned, the first thought is poison - and rightly so. For centuries arsenic was the poison of choice because in solution it has little taste, and such small amounts are fatal that they could not be detected in the victim. Today of course modern scientific instruments can measure arsenic to amounts less than 1 part in a billion (1 ppb).

Arsenic is one of 92 naturally occurring elements and quite a strange one. Our body needs small amounts of most elements even though they are poisonous in large amounts. Examples are selenium and iron. But we do not need arsenic for food health. Arsenic is a strong insecticide and herbicide as well as an animal poison, but is a common element found in all rocks, soils, and in the food we eat. It is the 20th most abundant element that occurs in rocks and soil in concentrations of 1 to 20 parts per million (ppm) and up to more than 10 times more than that in some foods like shrimp and almonds.

Many dangerous metals, like mercury for example, form organic compounds that are a deadlier poison than the metal itself. (Organic chemical compounds contain the elements carbon and hydrogen.) Arsenic organic compounds are not poisonous.

A hundred ppm arsenic in a cup of coffee is fatal, yet the same concentration of arsenic in shrimp is not. This is because arsenic is poisonous as an acid dissolved in water, but arsenic occurs in shrimp as an organic compound. The arsenic and iron in rocks and soil is not dangerous because we eat little and our body cannot "digest" the minerals. The Environmental Protection Agency set the allowable concentration of arsenic in drinking water at 0.01 ppm (effective January 23, 2006), but has set no limits for food, rock, or soil because there is no health hazard. Individual states may set limits based on risk models rather than health models.

A hundred parts per million arsenic in a cup of coffee is fatal, yet the same concentration of arsenic in shrimp is not.

Arsenic is found in many ores, especially gold ores where it may be at levels of one percent or greater. Because of this association arsenic is used as a "pathfinder" element in prospecting for gold deposits.

Gold ore processing requires crushing, grinding and leaching. Some arsenic together with other metals may be released from minerals into solution during the leaching process. The residue of ore processing ends up in a tailings dam or rock pile. Of great concern is not releasing arsenic-bearing solutions that may exceed water quality standards into the environment. In recent years, improved tailings dam construction and management practices have resulted in excellent retention of tailings solids, and minimized uncontrolled released of dissolved metals.

Arsenic is controlled by removing it from solution, lining tailings dams, and monitoring groundwater near the tailings. Arsenic is removed from waters by a combination of chemical precipitation, adsorption processes using activated carbon of ion exchange resin, and reverse osmosis. Most of these processes end with arsenic precipitated and disposed in the form of insoluble chemical compounds.

Lime is applied to tailings from some gold and copper processing plants to form insoluble calcium arsenates.

Tailings dams are underlain with low permeable clay and High Density Poly Ethylene (HDPE) liners to prevent accidental seepage into underlying aquifers. These dams are ringed with wells that monitor groundwater purity to ensure that the above measures work as planned.

Arsenic poisoning in the news is commonly related to natural occurrences of arsenic-bearing waters, or criminal activity – not to mining.

Contributed by Dr. David I. Norman, Professor of Geochemistry
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ARSENIC: Quick Facts

A part per million (ppm) is equivalent to 1 drop of food coloring in a 40-gallon bathtub of water

Most high-arsenic wells in the Western US are associated with volcanic rocks.

Not one of the high-arsenic municipal wells in the US, or any well in Bangladesh for that matter, is related to mining operations

In Bangladesh millions are dying from natural arsenic poisoning from shallow well waters. Drinking water with 0.1 to 5 ppm arsenic, which is widespread in Bangladesh, results in chronic arsenic poisoning. At lower concentrations common effects are skin mottling and increased rates of birth defects, heart disease and organ cancers. At higher arsenic concentrations the effects are skin and feet disfigurement, blackfoot disease (gangrene) and skin and organ cancers. The effects of drinking water with 0.2 ppm arsenic for decades can produce the same effects as drinking water with several ppm arsenic for a few years. Elevated arsenic waters are commonly associated with shallow wells in geologically young rocks. Hot spring waters commonly have elevated arsenic concentrations. The Bangladesh arsenic source is river sediment. There is a minor, but not insignificant problem, with well-water arsenic in the US. In the western states about ¼ of the municipalities have at least one well with an arsenic concentration greater than the EPA limit of 0.01 ppm. Most high-arsenic wells in the Western US are associated with volcanic rocks. Not one of the high-arsenic municipal-wells in the US, or any well in Bangladesh for that matter, is related to mining operations.

Copper Makes The Internet Work For You

Copper has been the key element in launching what has been termed the Information Communications Technologies (ICT) era and "the new economy."

It is hard to believe that a metal that has been used by mankind of over 10,000 years is the "linchpin" for many of today's technological innovations. Indeed, copper has been the key element in launching what has been termed the Information Communications Technologies (ICT) era and even "the new economy."

The Internet and the Worldwide Web have become almost second nature to most of us today because of its economic, speedy and efficient communications.

Most people are aware that the Internet is based on telephone systems and that telephone systems use copper in wiring. However, the Internet is more complex than that. Copper telecommunications cable is, in fact, but a minor part of copper's role in the Internet because the Internet is dependent on electrical power – lots of power!

In addition, there are copper-based routers, bus bars, electrical grounding systems and lightning arresting systems at every data center.

There are copper-based routers, bus bars, electrical grounding systems and lightning arresting systems at every data center.

The many networks that make up today's Internet are linked by installations that are variously called "data centers," "server farms," "web farms" or "Internet hotels." Data center is often a generic term used to describe a number of different types of facilities that house digital electronic equipment for Internet housing, data storage and transfer, credit card and financial transaction processing, telecommunications and other activities that support the ICT. Copper is required in data centers in the form of transmission and distribution power cable, magnet wire for motors, generators and transformers, refrigeration tubing for air conditioning systems and, to a lesser extent, telecommunications cable. To illustrate that this is a "growth industry" - as of September 2005 there were 70,000,000 web sites registered – up from just 23,000 ten years ago.

Penny-Wise: Know Your Copper Vocabulary

Copper is an element contained in a variety of minerals found in Arizona such as chalcopyrite, chalcocite, azurite, malachite, chrysocolla, and turquoise.

The copper minerals are largely contained in rocks that are similar to granite.

The copper-bearing rocks range in age from 55 million years to 2 billion years.

Contributed by Dr. William H. Dresher, PhD, P.E.
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COPPER: Quick Facts

Arizona produces 60% of the copper used in the US

An average 2,100 ft^2 house uses 440 pounds of copper

The average automobile uses 50 pounds of copper and that amount keeps growing

A Boeing 747-200 uses 632,000 feet of copper wire

A Triton nuclear submarine uses 200,000 pounds of copper

A typical piece of farm equipment uses 63 pounds of copper

The latest and most powerful locomotives from General Electric use 16,000 pounds of copper and five miles of copper wire