



2017 Hard Rock Mining Facts





If you have turned on a light, entered a building, driven on a road, made a phone call, used a computer, or visited a doctor, then mining is an important part of your life.

We are dedicated to the people in our industry, the communities in which we live and the environment that nurtures us all. Mining provides the resources for a better future.

Economic Impact in Arizona

\$4.29 Billion

Total economic impact of hard rock mining industry in Arizona.

12,000

Number of direct mining industry jobs.

31,800

Number of indirect jobs generated by the mining industry.

\$102,860

Labor income per mining worker, more than double the \$49,820 for all Arizona workers.

\$482 Million

Total Arizona state and local taxes generated by mining companies and employees.

\$1.23 Billion

Total payroll of Arizona mining companies

\$2.77 Billion

Purchases from Arizona-based suppliers.

Source: L. William Seidman Research Institute, W. P. Carey School of Business at Arizona State University, *The Economic Impact of the Mining Industry on the State of Arizona 2014*, September 2015

National Economic Impact of Hard Rock Mining

415,000

Direct minerals mining jobs in the U.S.A.

734,000

Indirect minerals mining jobs in the U.S.A.

\$7.3 billion

State and local taxes attributable to mining.

\$11.6 billion

Federal taxes attributable to mining.



\$46,227,000

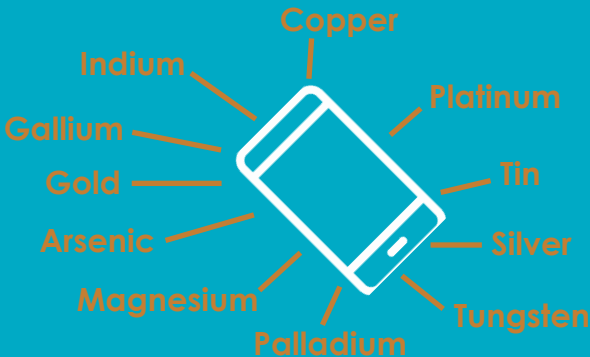
Direct labor income from mining.

Source: National Mining Association,
2016 Mining Facts.



Resources for a Better Future

Technologies made possible through mined minerals are empowering innovations for the future and providing the necessary resources for a better life.



Source: Minerals Education Coalition, mineralseducationcoalition.org/wp-content/uploads/10_9_13cellphoneanswer.pdf

66

Number of minerals used in the average computer.

90%+

Reduction in bacteria on hospital surfaces coated in anti-microbial copper.

5 Pounds

Weight of copper cylinder in atomic clock at U.S. Naval Observatory which is accurate to one part in a trillion.

50

Pounds of copper in a typical gasoline-powered vehicle.

165

Pounds of copper in an electric vehicle.

0.5

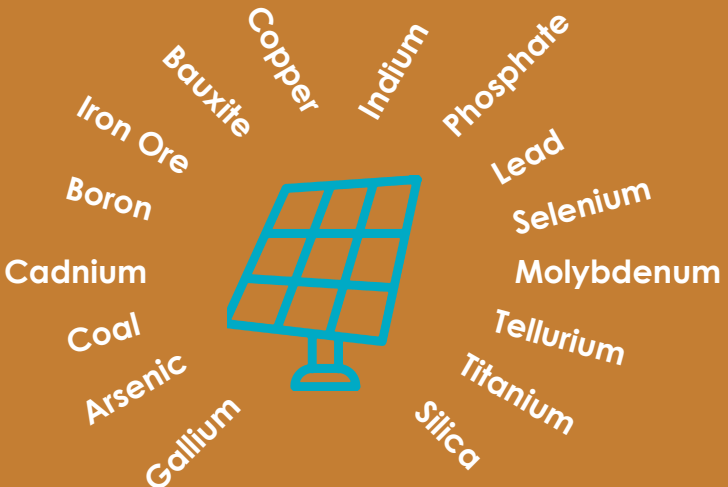
Ounces of copper in a mobile phone, which makes up 12% of the phone's total weight.

Sources: National Mining Association, *2016 Mining Facts*; USGS Mineral Resources Program, *Copper – A Metal for the Ages*; Metallic Copper as an Antimicrobial Surface, *Applied and Environmental Microbiology*, April 2011; Copper Development Association Inc., www.copper.org.

Resources That Power Our Lives

A mix of domestic coal, natural gas, nuclear power, oil and renewable sources ensures that U.S. households and businesses can minimize market disruptions and reduce reliance on foreign energy sources. Electric power generators use large

stators and rotors that are wound in copper. Wind energy is produced by turbines that contain copper and molybdenum-alloy steels. Uranium, molybdenum and copper are all used in the production of nuclear power.



4th

U.S. ranking in total world copper production, 2016.

65%

Amount of copper output for the United States that is mined in Arizona.

5th

U.S. ranking in total world copper reserves, 2016.

29

Number of minerals it takes to deliver electricity to our homes and businesses.

32%

Portion of Arizona's electricity that comes from coal.

29%

Portion of Arizona's electricity generated from nuclear energy powered by uranium.

Sources: National Mining Association, *2016 Mining Facts*; U.S. Energy Information Administration: <http://www.eia.gov/electricity/data/state/>; U.S. Geological Survey, Mineral Commodity Summaries, January 2016; Arizona Geological Survey, http://www.azgs.az.gov/minerals_mining.shtml



Caring for Our People

Ensuring the safety and health of our colleagues is a core value of the mining industry.

The goal? Zero fatalities and injuries. To achieve our shared goal, we employ safety measures beyond what are required by state and federal regulations.

To accelerate the pace of mine safety improvement, the U.S. mining industry has taken voluntary steps to implement best practices that encourage a culture of safety.

By identifying and eliminating potential hazards, and deploying state-of-the-art technology, the National Mining Association, its members and respected industry safety and health professionals have developed CORESafety, an award-winning safety framework that is bringing miners home safely after every shift, giving mining a lower nonfatal injury and illness record than manufacturing, construction or private industry.

2016

Safest year in U.S. mining history due to continuous improvement.



7

Ranking of mining industry among 17 NAICS industry categories for the lowest injury and illness rates.

56%

Rate by which injuries in U.S. mines have been reduced over the last 15 years.

63%

Rate by which fatalities in U.S. mines have been reduced over the last 15 years.

0

Number of fatal injuries at active mines in Arizona in 2014 and 2015.*

*The most recent years for which data are available.

1.3

Hours of lost time due to injuries per 200,000 hours worked by Arizona miners.

Sources: Arizona State Mine Inspector's Annual Report 2015; National Mining Association; U.S. Bureau of Labor Statistics

Caring for the Environment



Natural resources are at the heart of mining – environmental stewardship is imperative.

Today's mining projects begin with extensive environmental and engineering studies, public involvement in major decision-making, and compliance with scores of state and federal laws and regulations governing every facet of the environment, from wildlife habitat protection to water quality monitoring. Projects end with land reclamation that transforms sites for recreation, wildlife enhancement and other local community needs.

Building on the extraordinary environmental progress made in recent decades, the industry is committed to advancing technologies that make the use of our resources cleaner and more efficient.

75% - Water recycled at Arizona copper mines.

1.4% - Amount of total water supply in Arizona used by mining.

2.9 million – Acres of mined land that have been restored by U.S. mining companies.

\$10B+ – Amount the U.S. mining industry has paid to reclaim abandoned mines.

Sources: National Mining Association; Freeport-McMoRan Inc; ASARCO; USGS, National Water Information System.

Resources for Our Economy

Mining provides essential power and materials for nearly every industry and consumer product, and supplies low-cost reliable fuel for homes and businesses across the country.

The mining industry is supported by hundreds of thousands of hardworking Americans. In Arizona, the mining industry provided 43,800 direct and indirect jobs in 2014. These professionals are deeply proud of the contributions they make to our country each day, fueling America and supplying the materials that make our high quality of life possible and America a global leader in innovation.

**What hard rock
resources play a
key role in Arizona?**

Arizona's Major Hard Rock Mines

Approximate employment numbers as of
March 2017.

Freeport-McMoRan Inc.:

Bagdad - 790 Employees, CD 4, LD 1
Miami - 740 Employees, CD 1, LD 8
Morenci -- 3,350 Employees, CD 1, LD 14
Safford - 710 Employees, CD 1, LD 14
Sierrita - 770 Employees, CD 2, LD 2
Phoenix HQ & Other AZ - 1,300 Employees,
CD 7, LD 24

ASARCO, LLC.:

Tucson HQ - 63 Employees, CD 3, LD 3
Hayden Smelter - 543 Employees, CD1, LD 8
Mission - 572 Employees, CD 3, LD 2
Silver Bell - 167 Employees, CD 3, LD 11
Ray - 545 Employees, CD 1, LD 8

Carlota Copper Co.

A Subsidiary of KGHM - International:

Carlota - 43 Employees, CD 1, LD 8

Pinto Valley Mining Corp.

A Subsidiary of Capstone Mining Corp:

Pinto Valley - 588 Employees, CD 1, LD 8

Mines Under Development

A potential of more than 4,600 new direct mining jobs based on projected employment at full operation.*

**Rio Tinto Group/BHP Billiton Ltd.
Resolution Copper Project**

Copper, Est. 3,700 direct/indirect jobs, CD 1, LD 8

Hudbay - Rosement

Copper, 450 employees, CD 2, LD 14

Florence Copper Inc. - Taseko Mines Limited

Copper, 170 employees, CD 4, LD 8

Excelsior Mining Corp - Johnson Camp/Gunnison

Copper, 108 employees, CD 2, LD 14

Energy Fuels - Canyon Mine

Uranium, 60 employees, CD1, LD 7

Golden Vertex Corp., Inc. in AZ

A wholly-owned subsidiary of Northern Vertex Mining Corp. - Moss Mine

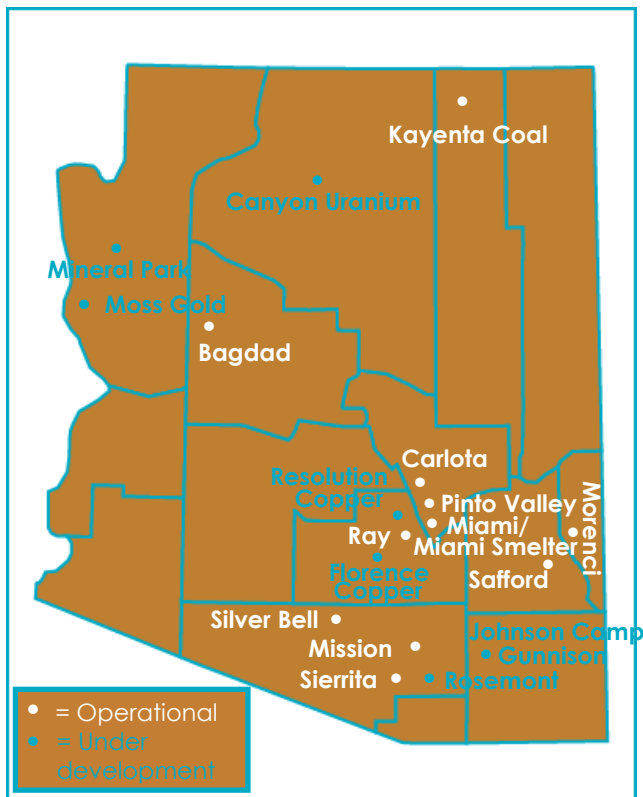
Gold, 100 employees, CD 4, LD 5

Origin Mining Corp. - Mineral Park Mine

Copper, 16 employees (currently), CD 4, LD 5

14 * Employment/job numbers relate to projections based on current expectations and are subject to change.

Location of Arizona's Major Hard Rock Mines



Minerals Produced by County

Apache

Peridot

Cochise

Copper,
Lime, Opal

Coconino

Uranium

Gila

Copper,
Peridot

Graham

Copper

Greenlee

Copper,
Molybdenum*

Maricopa

Amethyst

Mohave

Copper, Gold,
Turquoise

Navajo

Coal,
Gemstones

Pima

Copper,
Molybdenum*,
Rhenium*

Pinal

Copper,
Molybdenum*,
Silver*

Santa Cruz

Copper,
Silver*

Yavapai

Copper, Lime

** By-products of
copper*



Every American uses an average of

3.125 million lbs.

of newly mined minerals, metals and fuels in their lifetime, including 945 pounds of copper, based on an average 78.8 year lifespan.

Arizona's mining industry spends **\$2.77 billion** on supplies from Arizona-based companies, many of which are based in the greater Phoenix and Tucson areas. Their employees spend money in the community, further contributing to economic growth.

Services provided by suppliers to Arizona's mining industry include:

- Heavy construction equipment
- Commercial trucks
- Engineering firms
- Uniforms and work apparel
- Waste management
- Environmental planning
- Drills, cables, wiring, etc.



Sources: Minerals Education Coalition, 2016; Seidman Research Institute, ASU, *The Economic Impact of the Mining Industry on the State of Arizona 2014*.

Resources for Arizona's Infrastructure



Arizona's miners play an indispensable role in powering and building our state and nation.

From foundations to roofs, power plants to wind farms, roads and bridges to communication grids and data storage centers – Arizona's infrastructure projects begin with mining.

Roads, railways, buildings, stadiums, bridges, airports and other structures are supported by steel – a material dependent on mining. Even structures using

concrete employ steel for reinforcement. Copper's flexibility, conformity, thermal and electric conductivity and resistance to corrosion make it an ideal industrial metal. Molybdenum is used in steel alloys to make construction equipment, gas transmission pipes and municipal water supply pipes.

2,100

Square feet of copper on the dome on top of the Arizona state capitol building.

5,972

Number of copper panels on the Health Sciences Education Building on the Phoenix Biomedical Campus.

2,080 lbs.

Liberty Bell weight, comprised of 70% copper, 25% tin, and 5% a mix of lead, zinc, arsenic, gold and silver.

31 tons

Copper contained in the Statue of Liberty.

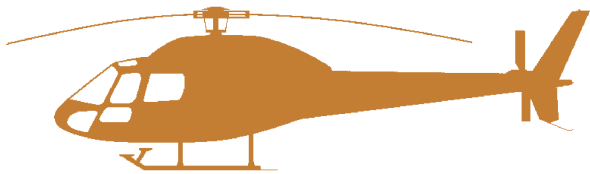
6 billion

Tons of steel used in U.S. National Highway System.

6%

Amount of molybdenum in the steel used in reverse-osmosis desalination plants.

Sources: International Molybdenum Association; National Mining Association, *2016 Mining Facts*; *The Arizona Republic*, 2/12/2012; <https://biomedicalphoenix.com/vision>



750,000

Tons of minerals that are used by the U.S. Department of Defense each year in technologies that protect our troops.

8 Miles

Amount of copper wire in a Boeing Apache Helicopter produced in Mesa, Arizona.

6.5 lbs.

Amount by which lithium-ion batteries can lighten a U.S. soldier's pack, while providing three times the charge.

43

Number of key minerals on which the U.S. remains more than 50% reliant on imports, subjecting our supply chains to geopolitical instability and supply disruption.

Sources: Boeing Inc; National Mining Association, *2016 Mining Facts*.

Resources for Our National Security

Metals and minerals are essential elements for safeguarding our nation.

Our Armed Forces rely on domestic metals and minerals for sophisticated weapons systems and safe transport of our troops. Our abundant supplies of metals and minerals minimize our reliance on foreign countries for these vital resources.

Rhenium is one of the world's rarest elements. The United States military depends on rhenium for certain high-temperature superalloys used in jet turbine engines and advanced electronic instrumentation and as a catalyst in petroleum refining. Freeport-McMoRan's mine in Sierrita is the only domestic producer of rhenium.

Careers in Mining

Sampling of occupations in Arizona mining

Mining & Geological Engineer

AZ employment: 340
Mean wage: \$91,240
Education: Bachelor's degree

Geoscientist

AZ employment: 390
Mean wage: \$81,940
Education: Bachelor's degree

Material Moving Machine Operator

AZ employment: 870
Annual mean wage: \$43,810
Education: High school diploma

Hydrologist

AZ employment: 270
Mean wage: \$72,640
Education: Bachelor's degree

Heavy Equipment Mechanic

AZ employment: 3,800
Mean wage: \$49,500
Education: High school diploma

Materials Engineer

AZ employment: 1,090
Mean wage: \$94,530
Education: Bachelor's degree

Surveying & Mapping Technician

AZ employment: 1,050
Mean wage: \$50,660
Education: High school diploma

Occupational Health & Safety Specialist

AZ employment: 1,200
Mean wage: \$69,990
Education: Bachelor's degree

Uranium Mining

29%

Portion of Arizona energy generated by nuclear power using uranium.

60%

Portion of emissions-free energy in the U.S. produced from nuclear power.

1st

Ranking of U.S. in world uranium consumption.

3

Number of states producing uranium concentrate - Wyoming, Nebraska, Utah.

2.9 million

Pounds of uranium produced in the U.S., 2016.

94%

Portion of uranium purchased for U.S. nuclear reactors from foreign countries, 2015.

0.65%

Grade of uranium ore in Arizona Strip, 5 times higher than elsewhere in U.S.

375 million

Pounds of uranium reserves in Arizona Strip.

Sources: U.S. Energy Information Administration, <http://www.eia.gov/>; American Clean Energy Resources Trust; U.S. Geological Survey

Speaking of Mining: Key Industry Terms

Alloy: A substance with metallic qualities that is composed of two or more chemical elements, of which at least one is an elemental metal.

Auger mining: Form of underground mining that uses an auger (rotary drill) to penetrate, break and transport drilled material onto a waiting conveyor belt. Usually employed to recover remaining material in deep overburden areas that cannot be reached economically by further contour or area mining.

Base metals: Non-precious metals, such as copper, lead, zinc, tin, aluminum and magnesium.

Bioleaching: Addition of naturally occurring bacteria to extract or remove a soluble substance from ore.

Financial assurance: A prerequisite for obtaining a mining permit, companies must post a reclamation bond to ensure sufficient funds to restore a site in the event a company fails to complete the reclamation plan approved by the permit.

Bullion: Mixture of gold and silver in cast bars. Also called doré.

Concentrate: The result of separating ore or metal from its containing rock or earth.

Demonstrated reserves: Deposits that are potentially minable on an economic basis with existing technology.

Dragline: A large excavation machine used in the surface mining process to remove overburden. The dragline has a large bucket suspended that is capable of scooping up huge amounts of

overburden as it is dragged across the excavation area. The dragline, is one of the largest land-based machines in the world.

Excavator: A large number of power-operated digging and loading machines, used increasingly in open-pit mining and quarrying.

General mining law: The primary statute that governs the right to mine locatable minerals on unappropriated public domain lands. Though enacted in 1872, it has been amended many times.

Hardrock minerals: Locatable minerals that are neither leasable minerals (coal, oil, phosphate, etc.) nor saleable, mineral materials (sand and gravel, etc.). Hardrock minerals include copper, lead, zinc, magnesium, nickel, tungsten, gold, silver, bentonite, barite, feldspar, fluor spar and uranium.

Leaching: The action of percolating liquid in order to remove the soluble parts. Ex. Sulfuric acid leaching of

copper is a process where a weak solution is percolated through low-grade ore heaped on an impermeable liner. Copper is then extracted from the liquid in a closed-loop system.

Locatable minerals: Those minerals - primarily metallic - that can be claimed and mined on public lands, under the General Mining Law of 1872; these do not include coal, oil, phosphate sodium, sulfur, or sand and gravel.

Metallic minerals: Minerals with a high specific gravity and metallic luster, such as titanium, rutile, tungsten, uranium, tin, lead and iron. In general, metallic minerals are good conductors of heat and electricity.

Minerals: *Scientific* - Naturally formed inorganic solids with a limited range in chemical composition and with orderly internal atomic arrangements that determine crystalline structure and physical properties.

Minerals: *Legal* - Substances occurring naturally with characteristics and economic uses that bring them within the purview of mineral laws; applicable laws from public substances that may be obtained under the lands by purchase, lease or claim.

Mineral claim: That portion of the public mineral lands that a person may claim for mining purposes in accordance with the Mining Law of 1872, as amended. There are four types of mining claims: lode, placer, millsite and tunnel sites. Only tunnel sites may not be patented under current law.

Non-metallic minerals: Minerals that lack the properties of the metallic minerals, i.e. carbon, diamond, coal, bitumen, asphalt, boron, sulfur, and rock salt.

Open pit: A mine or excavation open to the surface. Refers primarily to mines of metal ores; distinguished from coal surface mines.

Ore: Rock that contains important minerals, including metals.

Overburden: Layers of earth and rock covering a coal seam or mineral deposit.

Patent: A government deed; a document that conveys legal title to public lands to the patentee.

Placer deposit: An alluvial marine or glacial deposit resulting from the crumbling and erosion of solid rocks, and often containing valuable minerals.

Reclamation: The restoration of the land and environment after mining occurs.

Reserves: Known mineral resources from which a usable commodity can be technologically, economically and legally extracted using current mining techniques.

Scrubber: Any of several forms of chemical/physical devices that remove sulfur compounds formed during coal combustion. Technically

known as flue gas desulfurization systems, they combine the sulfur in gaseous emissions with another chemical medium to form an inert sludge.

Smelter: A furnace in which raw materials are melted, and metals are separated from impurities.

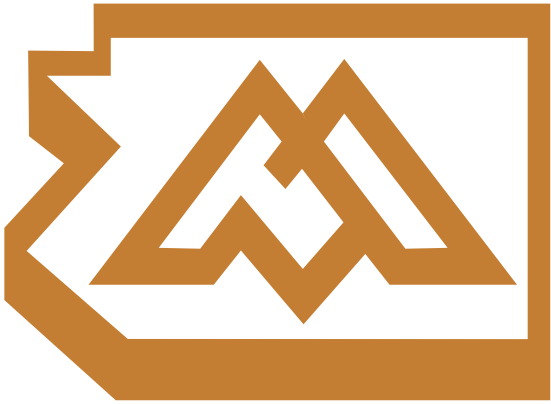
Strategic minerals: Those minerals considered essential for a country's economic and defense needs, satellite communications, automobile

parts and medical instruments.

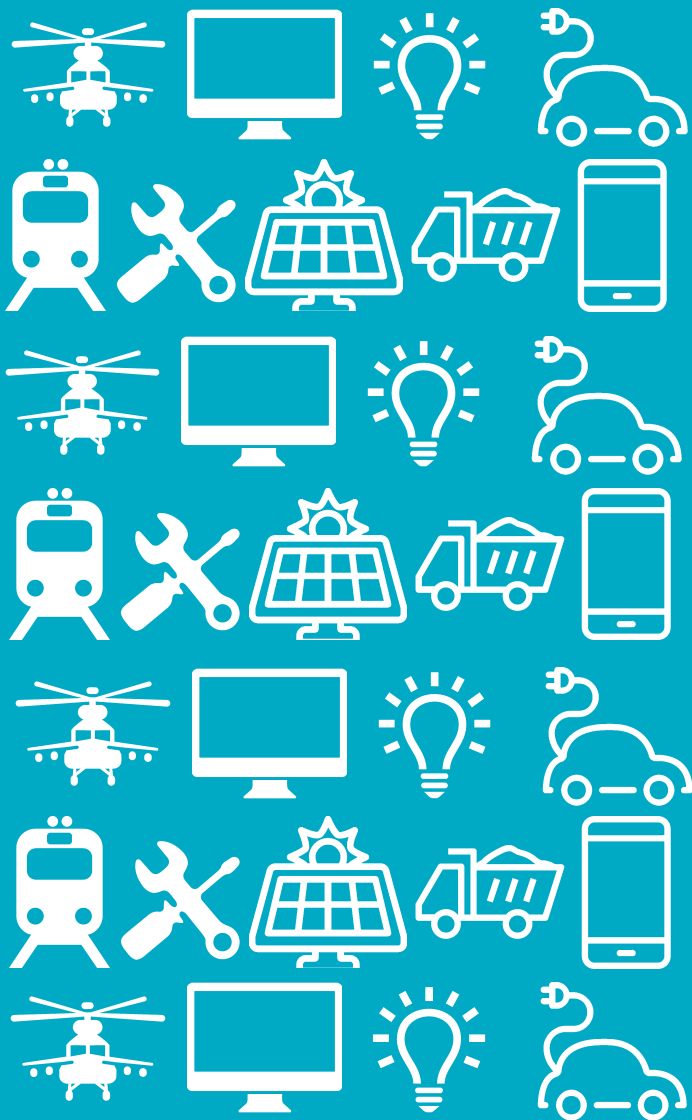
Tailings: The waste material left over after hardrock mining and milling processes have been completed.

Underground mine: Also known as a deep mine. Usually located several hundred feet below the earth's surface, materials are removed and transferred to the surface.

Sources: L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University, *The Economic Impact of the Mining Industry on the State of Arizona 2014*; Minerals Education Coalition, 2016 Mineral Baby, <http://mineralseducationcoalition.org/mining-minerals-information/mining-mineral-statistics/>; Copper Development Association Inc., www.copper.org; American Resources Policy Network, www.coppermatters.org/copper-facts; U.S. Energy Information Administration <http://www.eia.gov/electricity/data/state/>; U.S. Geological Survey, Mineral Commodity Summaries, January 2016; Arizona Geological Survey, http://www.azgs.gov/minerals_mining.shtml; International Molybdenum Association, <http://www.imoa.info>; National Mining Association, 2016 Mining Facts; National Mining Association, Fact Sheet: 40 Common Minerals and their Uses, September 2016, <http://nma.org/2016/09/16/fact-sheet-40-common-minerals-and-their-uses/>; Pitzl, Mary Jo, "Arizona Capitol gets birthday gift: A shiny new copper dome, 2/10/2012, <http://archive.azcentral.com/community/phoenix/articles/20120210arizona-capitol-birthday-gift-new-copper-dome.html>; Under Secretary of Defense for Acquisition, Technology & Logistics Strategic & Critical Materials, 2015 Report on Stockpile Requirements; USGS Mineral Resources Program, Rhenium—A Rare Metal Critical to Modern Transportation; Arizona State Mine Inspector's Annual Report 2015, U.S. Bureau of Labor Statistics; Grass, Gregor, Christopher Rensing, & Marc Solioz, "Metallic Copper as an Antimicrobial Surface," *Applied and Environmental Microbiology*, April 2011; <https://biomedicalphoenix.com/vision> Interviews with Sandy Fabritz-Whitney, Freeport-McMoRan Inc. and Mark Gaspers, Boeing Inc.



**ARIZONA
MINING ASSOCIATION**



Arizona Mining Association



Mission Statement:

To be the primary advocate of the Arizona mining industry through promoting sound public policy at all levels of government, educating the public about the benefits of mining and supporting the sustainability of a safe and responsible mining industry.

Vision Statement:

We are a diversified mining association that is the unified voice of responsible, sustainable and safe mining in Arizona. We support educational programs that demonstrate the importance and benefits of mining to the economy and the quality of life. Our members benefit from productive relationships and alliances with government, business associations and natural resource industry groups. Through our advocacy, we help Arizona be the premier location for mining investment in the United States.

Special Thanks:

The National Mining Association's (NMA) 2016 Mining Facts booklet provided inspiration and much data for this project. Thank you to the staff at NMA for their assistance!

916 West Adams Street
Suite 2
Phoenix, AZ 85007
(602) 266-4416

www.azmining.com

