STATE OF NEW MEXICO
BEFORE THE WATER QUALITY CONTROL COMMISSION

In the Matter of:	)	
	)	
PROPOSED AMENDMENT TO 20.6.2 NMAC (Copper Rule)	)	**No. WQCC 12-01(R)**
	)	

WRITTEN TESTIMONY OF JOHN BRACK

1. INTRODUCTION

My name is John Brack. I am currently President of Freeport-McMoRan Chino Mines Company, President of Freeport-McMoRan Cobre Mining Company, and Vice-President of Freeport-McMoRan Tyrone Inc. (collectively, Freeport-McMoRan), all of which are copper mines located in New Mexico. I have held similar positions at Freeport-McMoRan Americas operations in North and South America. My C.V. is attached as Brack Exhibit-1.

The Freeport-McMoRan operations in New Mexico operate under the umbrella of Freeport-McMoRan Copper & Gold Inc., a publicly traded company on the New York Stock Exchange (symbol FCX) and the largest publicly traded producer of copper in the world. FCX is a strong global organization with unwavering commitments to safety performance, support for communities where we live and work and excellence in environmental management. FCX understands the importance of operating in a safe and socially responsible manner because we are part of an interactive global community.

Through my testimony you will get an idea of the breadth of economic benefits enjoyed by the state and local communities directly and indirectly related to FCX operations.

I am presenting this direct written testimony in support of the Water Quality Control Commission's (Commission) adoption of the Proposed Copper Mine Rule presented with the Environment Department's Petition dated October 30, 2012 ("Proposed Rule"). Freeport-McMoRan will present several witnesses who will describe in detail the reasons why the Commission should adopt the Proposed Rule. My testimony is more general, and is intended to emphasize the importance of the Commission's adoption of detailed and specific rules for copper mining to give the industry the certainty it needs to obtain investment for the industries' future in New Mexico. My testimony provides an introduction into copper mining operations in New Mexico, the applications of copper products worldwide and an understanding of what goes into copper mine development and production. My testimony not only highlights the enormous benefits provided by and through copper mining in New Mexico, but also gives a better understanding of the enormous costs associated with all aspects of copper mining from pre-production exploration to actual open pit production. If the Proposed Copper Rule is successfully enacted, as drafted, copper mine operators will be regulated by the Environment Department and a host of other regulatory entities.

There are a myriad of Federal and State laws and regulations that constitute an overlapping, complimentary and comprehensive regulatory framework. Copper mine operators must interact with Federal entities like the Environmental Protection Agency and comply with laws like the Clean Air and Clean Water Acts. They must also interact with state agencies like The Environment Department, The Department of Energy, Minerals and Natural Resources and the State Land Office, which means complying with the Mining Act and the State Land Office Mining Rules along with the Proposed Rule. Compliance with all of the applicable requirements can take more than ten years of planning, permitting and interaction just to begin production; this means ten-plus years of investment without a return on that investment. Once you grasp the enormous capital, operating costs and time associated with bringing production online or expanding production it will become apparent that there exists an undeniable need to bring some level of certainty to the permitting process.

FCX is very positive about the long-term demand and outlook for our commodities. As discussed below, the global demand for copper has been steadily increasing as worldwide demand increases due to reliance on copper as the metal of choice for an increasingly electric-powered world. Freeport-McMoRan has a growth pipeline that extends over many years and that includes opportunities that we can pursue in New Mexico. For example, as of the end of 2011, the Chino and Tyrone Mines together had 110 million metric tons (MT) of mill ore reserves and 327 MT of leach ore reserves. The Cobre Mine has an additional 71 MT of leach ore reserves, which will require additional capital investment to bring into production. In addition to these reserves, which are estimated based on Securities Exchange Commission requirements and at a long-term average copper price of $2.00 per pound, the Chino, Tyrone and Cobre Mines collectively have an additional 275 MT of mineralized material recoverable as leach ore and 222 MT of mineralized material recoverable as mill ore based on a long-term average copper price of $2.20 per pound—only ten percent higher than the price used to estimate reserves. (*See* Excerpts from Form 10-K, 2011 Annual Report Pursuant to Section 13 or 15(d) of the Securities and Exchange Act of 1934, Brack Exhibit-2) The Proposed Rule will help obtain the sustaining capital and new investments needed to take full advantage of these mineral resources.

Copper prices have escalated substantially over the past ten years, from prices less than $1.00 per pound to the current price in excess of $3.50 per pound. (*See* Brack Exhibit-2). Much of this increase is the result of substantial new demand from the developing world, particularly China. During this period, supply has struggled to keep up with the new demand. The challenge – and this is one of the reasons that the copper price is so high – is that it takes considerable time to develop new sources of supply. The industry continues to face supply constraints including interruptions to existing operations and the challenges of bringing on new production because of a whole variety of issues – technical problems, cost constraints, environmental constraints, and so forth. So the fundamentals of the copper market remain strong. But because permitting processes are time consuming and can be uncertain (as is the current case in New Mexico) and community issues are ever-present and can be difficult to assuage, not to mention the high costs associated with engineering studies and construction cost escalation, we are forced to focus our efforts and investment dollars on projects that can be successful.

The Commission's current discharge permit rules provide little specific guidance on the requirements that a permit applicant must satisfy in order to obtain a permit for a new copper mine or an expansion at an existing mine. Consequently, mine operators currently are subject to an informal and subjective process that can and has changed during different administrations based entirely on internal policy changes. Tens of millions of dollars must be spent before development of a new copper mine even begins. Before a discharge permit is sought, a potential applicant must locate potential new mineral resources, obtain permits for exploratory drilling under the Mining Act, drill thousands of feet of boreholes at a current average cost of $100 per foot, employ professionals to review drill hole data to assess potential resource size and accessibility, evaluate infrastructure needs such as water and power supplies and transportation, and collect environmental data and evaluate surrounding environmental and community based impacts. Only after all of this work and expense will a mine developer have sufficient information to determine whether mining even is feasible and to begin the permitting process, which typically involves multiple permit applications to multiple Federal and State agencies and local governments.

Obviously, before making this large investment, a prudent mine developer will need reasonable certainty regarding the requirements that must be met to obtain the necessary permits. Under the current rules, even if informal agreements are reached with the Environment Department regarding the anticipated requirements, at any point during this uncertain process, the acting administration could potentially delay the process or stop it completely. In that case, the mine developer would have spent tens of millions of dollars on a potential project that is not able to move forward.

At existing copper mines, we continue to conduct exploratory drilling to identify potential new resources and to expand mineral reserves. At these existing mines, we can take advantage of knowledge of the ore deposits, existing infrastructure, and a trained work force in considering mine expansions. These factors give our existing mines a competitive advantage over greenfields mine developments in obtaining new investment to maintain and expand production. On the other hand, mature, existing mines typically are faced with declining ore grades. Moreover, investments in mine expansion currently run into hundreds of millions of dollars, funding that is difficult to obtain without reasonable regulatory certainty. In its current form, the permitting process is constantly in flux, subject to an ever-changing political landscape with changing policies. The resulting uncertainty makes investment in New Mexico relatively risky. We ask the Commission to take the politics out of the process and create a system that is based on a practical approach to mining, utilizing the best-proven technologies to maximize copper production, while minimizing impacts on ground water. But, most importantly, create a process that is stable and consistent.

II. <u>ECONOMIC BENEFIT</u>

To inform the Commission on the economic benefits that copper mining can provide to the State and local economies, I will give you a brief overview of the contributions Freeport-McMoRan is creating for New Mexico. Freeport-McMoRan employed approximately 1,601 workers as of January 2013 in New Mexico. The total direct and indirect impact of Freeport-McMoRan operations on the New Mexico Economy was approximately 4,300 jobs. The total direct and indirect economic impact of Freeport-McMoRan operations on New Mexico in 2011 was $326 million. (*See* 2011 Economic Impact Report for Grant County and New Mexico, Brack Exhibit -3) Direct impacts include approximately $154 million from operations and $42 million from spending by employees and $27 million from supplier purchases. There was an estimated $55 million from spending out of state and local tax revenues and $6 million in effects from spending from pension income. The economic benefits derived from Freeport-

McMoRan operations in New Mexico not only fuel local economies but thanks to the multiplier effect whereby infusions of extra income fuel spending and create further income, these effects extend across the economic landscape of New Mexico.

Freeport-McMoRan invests generously in the communities in which it operates, based on a set of guidelines designed to ensure that resources are used effectively to address high-priority needs and facilitate local capacity building to help build sustainable communities now and when our operations cease. The criteria supports our long-term goal of decreasing community dependency on our operations and ensure that we are entering into partnerships that support sustainability. We partner with non-governmental organizations, foundations and other community and government institutions globally to support community development initiatives. We have established community foundations or social funds in Indonesia, Peru, the U.S. and most recently in the Democratic Republic of the Congo to ensure that communities and local governments have a direct voice in how these funds are used. These community foundations and funds typically account for more than 50 percent of our annual community investment globally. Through philanthropy and volunteerism including our United Way Campaign, Freeport-McMoRan employees are also dedicated to making our communities better places to live and work.

In North America, we have established Community Investment Funds in communities near six of our operations. The Community Investment Fund in New Mexico was established in 2011. It is governed by a committee consisting of nine community leaders from diverse organizations and two Freeport-McMoRan New Mexico Operations representatives. The community leaders were selected by the Grant County Community Partnership Panel, which was established by Freeport-McMoRan three years ago to foster open and ongoing dialogue with the community, allowing the company and the community to work together to identify priority community issues and develop thoughtful solutions that address them. Our giving from all of these sources last year was almost $1 million and the projected giving in 2013 will be about $1.1 million.

I will next discuss how copper and copper products are used in the modern economy, followed by a discussion of the mine exploration and development as well as providing a description of copper mining operations. To provide additional information, I am providing a video very recently produced by the Society for Mining, Metallurgy & Exploration and the Edison Technology Center entitled Copper in our Electrical World. Brack Exhibit-4[1].

III. COPPER APPLICATIONS & INDUSTRY PRODUCTION

COPPER APPLICATIONS. The major applications of copper are in electrical wires (60%), roofing and plumbing (20%) and industry and machinery (15%). Copper can be combined with other elements to create various alloys. A small part of the copper production is used in production of compounds for nutritional supplements, creation of fungicides and even some anti-bacterial compounds.

Electrical wiring constitutes the most prolific use of copper; while other elements are found in the industry copper's unique conductivity properties set it apart. Copper wire is used in power generation, power transmission, power distribution, telecommunications and countless types of electrical equipment. Integrated circuits and printed circuit boards increasingly feature copper in lieu of aluminum because of its

[1] Brack Exhibit-4 is a video produced for use by the Society of Mining, Metallurgy and Exploration, Inc. and is set to be unveiled and disseminated at its annual meeting on February 25, 2013. As a result, the video is under embargo until the aforementioned date. We will respectfully request that the Commission allow submission of this document after the annual meeting.

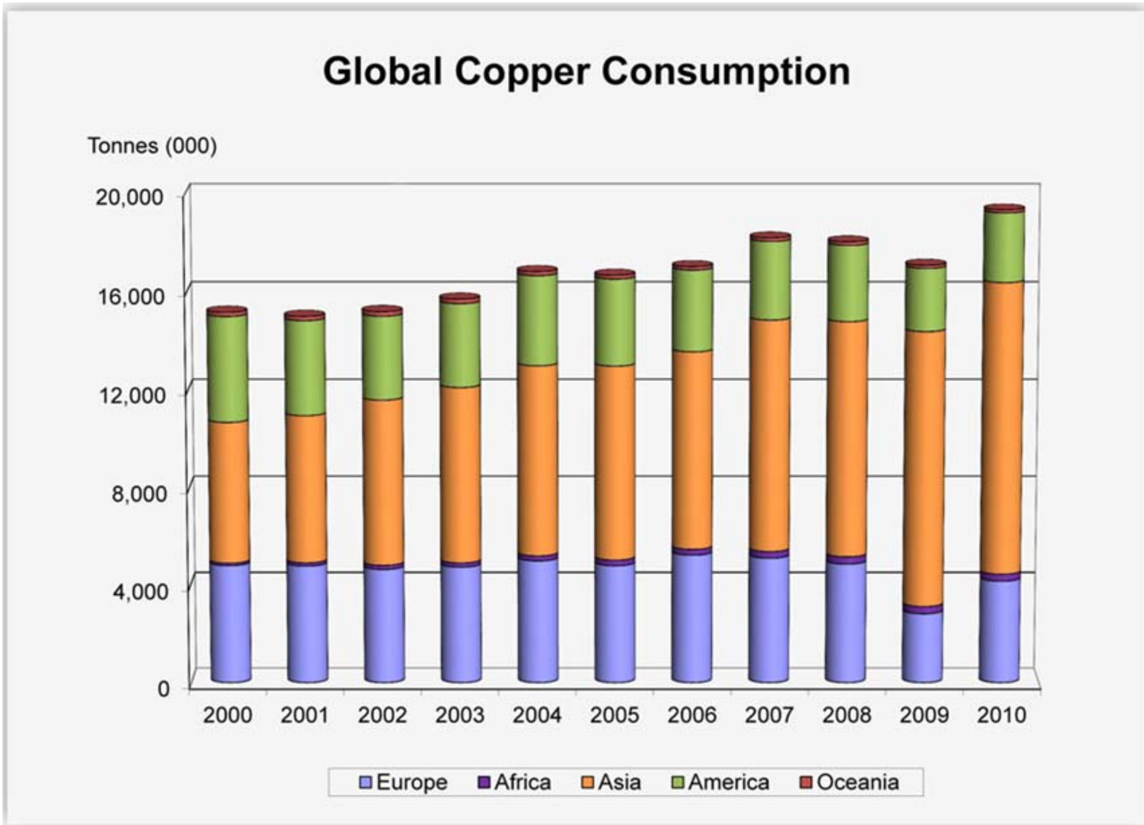
conductive properties. Copper's greater conductivity as compared to other metallic materials enhances the electrical efficiency of motors. This is important because motors and motor driven systems account for nearly half of all global electricity consumption and more than two-thirds of all electricity used by industry.

Copper has been used since ancient times as durable, corrosion resistant and weatherproof architectural material. Throughout history roofs, spires, domes and doors were all constructed with copper. Architects and designers long coveted the metal's distinctive natural green patina.

Copper is also used to line parts of ships to protect the underlying surfaces from barnacles and mussels because the metal is biostatic and bacteria will not grow on biostatic surfaces. Copper alloys also have intrinsic properties that destroy microorganisms including staphylococcus and influenza. For this reason, we have a seen a proliferation of cooper inside the home and hospitals, which can be directly traced to these anti-bacterial properties. We now see sinks, handrails, faucets, doorknobs, toilets and even healthcare equipment with copper components.

Perhaps the most exciting application for copper was announced by President Obama in the State of the Union Address in which the President called for Americans to work towards "a future where we are in control of our own energy, and our security and prosperity aren't so tied to unstable parts of the world." This charge was directed at the emerging renewable energy markets. Copper plays a vital role in sustainable electric energy, increasing the efficiency and reliability of wind and solar installations and their related power transmission systems. While renewable energy resources are generally not particularly efficient, for instance, the generation of electricity from renewable energy resources such as wind, solar and geothermal has a copper usage intensity that is typically four to six times greater than fossil fuels ("copper usage intensity" is an estimate of the pounds of copper necessary to install one megawatt of new power generating capacity). Thus, although wind, solar and geothermal systems are inherently inefficient copper wiring can abate some of those deficiencies by conducting the electricity more efficiently. In fact, copper will remain an integral part of any renewable resource proliferation. *See* Coppe*r* Essential for Green, Stephen T. Higgins, May 12, 2010, Brack Exhibit-5.

WORLDWIDE APPLICATIONS. Rapid growth in developing nations has generated an incredible need for copper. As previously stated, copper is an essential ingredient in everything from power lines and piping systems to automobiles and consumer electronics. Many countries around the world are in the midst of an historic urbanization and industrialization boom. In fact, China is probably the most graphic illustration of how copper demand is increasing exponentially. The country now consumes roughly forty percent (40%) of the approximately sixteen million tons of copper mined every year.

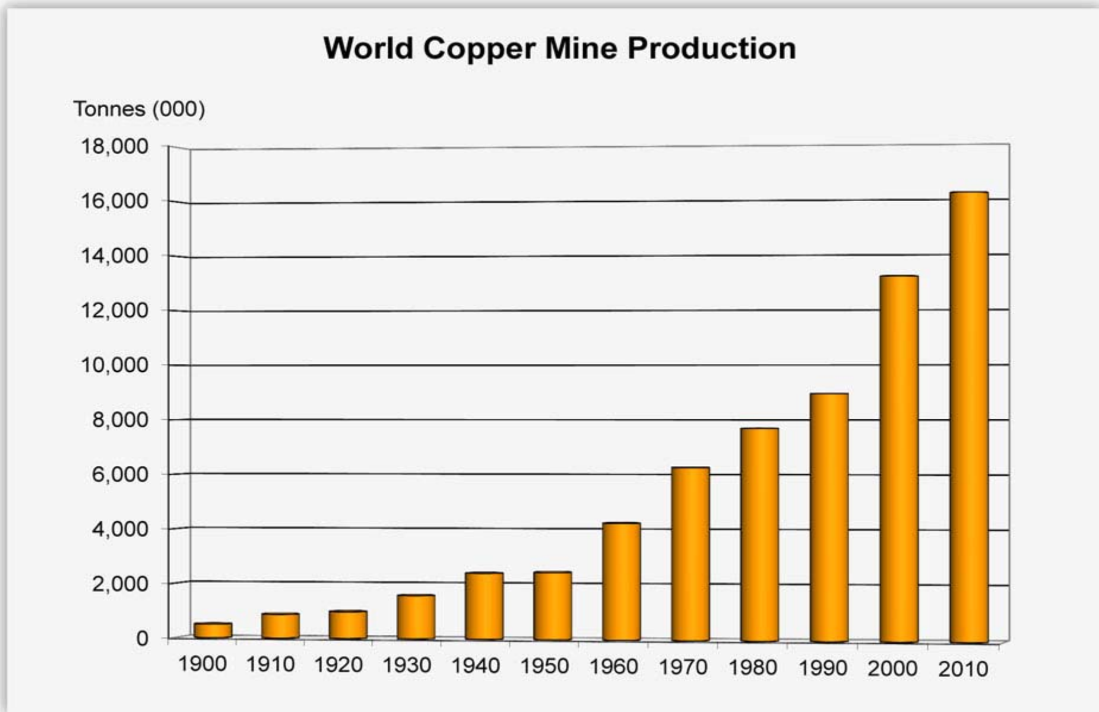


Source: World Bureau of Metal Statistics

It is conceivable at this rate of growth and consumption copper will become scarcer and scarcer. By 2020, global consumption is predicted to double and U.S. Geological Survey USGS researchers have estimated that firms would have to bring 35 new copper deposits online in the next decade to meet demand. It is important to note that alternatives are relatively unavailable. (*See* Copper Development Association, Annual Data Report, 2012, Brack Exhibit-6). Aluminum can be used as an alternative for electric cables, but in addition to being less efficient, it can be more dangerous. Many building codes specifically ban aluminum for this very reason.

<u>WORLDWIDE PRODUCTION</u>. The chief producers of copper are Chile, the United States, Australia, China and Peru. However, only 56 new copper discoveries have been made during the past three decades, and 21 of the 28 largest copper mines in the

world are not amenable to expansion. Furthermore, many large copper mines worldwide could be exhausted by 2015. Thus, as copper consumption is increasing, the quantity available is arguably insufficient to allow all developing countries to reach developed status with regard to copper applications. (*See* USGS Copper Statistics Information, Mineral Commodity Summaries 2013, Brack Exhibit-7)



Source: International Copper Study Group

<u>U.S. PRODUCTION</u>. Copper mining has been a major industry in the United States since the rise of the Northern Michigan copper district in the 1840's. The principal mining States, in order of descending production, are Arizona, Utah, New Mexico, Nevada and Montana. The mines in these States together accounted for 99 percent of domestic production. The primary source of copper mines in the United States is porphyry copper deposits. Porphyry copper deposits consist of disseminated copper ores that are relatively evenly distributed in large volumes of rock, forming high tonnage, low

to moderate grade ores. Despite their relatively low grades, porphyry copper deposits are the most significant source of copper due to their massive scale. Porphyry copper mines are typically mined for many years due to their size.

NEW MEXICO PRODUCTION. Copper has been produced in New Mexico since prehistoric times. Native Americans used copper for ornaments and tools and an Apache led Spanish officers to copper deposits in Santa Rita and production began in earnest in 1804. Copper production fell off because of increasing costs, difficult transportation and decreasing demand. Eventually, copper production in New Mexico ceased altogether when the mines were closed in 1834. When the New Mexico territory became part of the United States in 1848, gold and silver mining began. Numerous districts were discovered and mined for precious metals. Copper was recovered whenever possible. However, production ceased again when the Confederate Army invaded New Mexico in 1862. The end of the Civil War brought tremendous change to mining in New Mexico. Settlers and prospectors fled the war torn east to start new lives in the West. Prospectors from California's gold rush moved east to New Mexico when claims dried up out west. Soldiers were sent west to settle the territories and later became prospectors themselves. New metallurgic techniques were developed and copper became an important commodity. New Mexico became a State in 1912 and in 1914 World War I began. Metal prices and production increased, as metals were needed for the war effort. In 1918, the war ended and the ensuing economic depression forced many mines to close. New selective-floatation copper extraction techniques were invented in the 1920's that improved recovery of massive lead and zinc sulfide ore; copper was recovered as a byproduct. World War II saw an increase in copper production, as it was again necessary for the war effort. Copper prices steadily increased and copper production from the porphyry copper deposits steadily increased in turn. In the 1980's, solution extraction-electrowinning (SX-EW) technology was developed that enabled economic recovery of high-purity copper from very low-grade copper deposits. Today, two properties are in production with copper as the primary product here in New Mexico; the Tyrone and Chino Mines. (*See* New Mexico Energy, Minerals and Natural Resources Division, 2011 Annual Report, Brack Exhibit-8)

IV. STAGES OF MINERAL EXPLORATION

So much goes into mining a specific site prior to extraction – not merely time and monetary expense (although both are significant). Scientifically, merely finding and evaluating a site is an incredible endeavor. As discussed in detail below, the process from area selection through target generation and resource evaluation and definition costs tens of millions of dollars. After the potential for a copper mine is determined, the path to production has only begun, as a mine developer then must go through an arduous permitting process before extraction can begin and the developer can begin to recover on the investment. Thus, as an industry, the upfront costs are enormous; as a result, creating a regulatory structure that is criteria based and not subjective is incredibly important to preserve copper mining in New Mexico presently and into the future.

AREA SELECTION. This is a crucial step in mineral exploration that incorporates applying the numerous theories behind ore genesis, the knowledge of known ore occurrences and the method of their formation, to known geological regions. We use that information to determine potential areas where a particular deposit might exist based on basin modeling, structural geology, geochronology, petrology and a host of geophysical and geochemical comparisons. Our scientists then draw parallels from past exploration and make predictions about the viability of a region. These predictions take into account not only the size and accessibility of a resource but factors like infrastructure, location, transportation and market. These are all factors that go into cost of production and the economics of sales. There may be other factors like financial and tax incentives, and finally the cost associated with reclamation and potential permitting processes. All of these factors are considered and an enormous amount of money is expended prior to any permitting and years before any potential income is possible or realized. The longer the lead-time in getting permits the more adverse an impact on the economic potential of the mineralized zone.

TARGET GENERATION. This is the investigation phase of siting a copper mine by utilizing geology, geophysics and geochemical processes to map and assess a particular resource. Geophysical instruments used to measure variations in gravity, magnetism, electromagnetism and many other variables. The most common way to conduct a geophysical survey is aerial monitoring. Magnetometers are attached to airplanes and flown over potential resources. The magnetometers search for magnetic anomalies in the Earth's magnetic field. These anomalies indicate potential concentrations of magnetic minerals like copper. Ground-based geophysical surveys may also be utilized to evaluate a resource but they are less efficient and more costly and thus less widespread. Aerial photography is also a useful tool in assessing possible mineral resources by identifying host rock formations, major structures, historic workings, and mineral alteration zones. It gives the surveyor valuable siting information like tracks, roads, fences and habitation. Since the advent of satellite imagery and through advances in technology, we can now use spectroscopes in areas with little vegetation to map mineral deposits as well. Geochemistry is used to assess the mineral potential in geological formations by comparing the background concentration of minerals with concentrations measured in known mineral deposits. Geochemists can take samples of the rock in the exploration target and analyze the data for elevated concentrations of mineral and metal anomalies (single or multiple elements) that may be related to the mineral sought.

RESOURCE EVALUATION. If the exploration target shows potential, and most do not based on the financial risk associated with the political climate, commodity price and access to infrastructure, the decision may be made to more aggressively explore a potential site to quantify the grade and tonnage of the targeted mineral. This is achieved by drilling and sampling the prospective lode or strata with the ultimate goal being to determine if there exists a resource density sufficient to warrant the cost of production. Resource estimation may require pattern drilling on a set grid and down-hole probing of drill holes to determine ore body continuity. The aim of resource evaluation is to assess and hopefully expand the known size and ore grade of a deposit. A scoping study is often carried out on the ore deposit at this phase of exploration to determine if there is enough ore at a sufficient grade to warrant the cost of extraction. As a company, FCX is projected to spend $235 million worldwide in 2013 on exploration. Approximately 20% of this will be spent in North America.

RESERVE DEFINITION. Reserve definition is undertaken to convert a mineral resource into an ore reserve, which is an economic asset. The process is similar to resource evaluation, except more intensive and technical, aimed at statistically quantifying the grade continuity and mass of ore. Reserve definition also takes into account the milling and extractability characteristics of the ore, and generates bulk samples for metallurgical test-work, involving crushability, floatability and other ore recovery parameters. During this phase, engineers will look at the geotechnical stability of the resources and determine the potential instabilities of open pit or underground mining methods. At the end of the process, a feasibility study is published, and the deposit will be deemed economically viable or unviable. At this stage, a mine developer may estimate the mineral resources and ore reserves. “Mineral resource” is the determined concentration of mineralized material. “Ore reserve” is a mineralized resource that can be that can be extracted into a viable form at a profit.

GREENFIELDS & BROWNFIELDS. These are industry terms that simply refer to the state of the target land and the extent to which previous exploration has been conducted. Greenfields refers to pristine undisturbed land that has not been previously mined. Brownfields conversely alludes to land that has been trodden on repeatedly. The general meaning of Brownfield exploration is exploration conducted within geographical terrain within close proximity to known ore deposits and Greenfields constitute the remainder. Greenfield exploration has a lower strike rate, because the mineral potential is poorly understood. Consequently, Greenfield exploration is more conceptual, speculative and inherently risky.

EXTRACTION. Extraction methods may vary considerably and engineers will ultimately analyze a site and determine the most safe, cost effective and efficient method of mining, be it underground or open pit extraction methods. Mineral exploration does not cease with the decision to mine. Exploration of a Brownfields nature is conducted to find near-mine repetitions, extensions and continuity of the existing ore body. In-mine exploration and grade control drilling is a major concern of operating mines and can be an effective tool in adding value to existing mineral operations. Lessons learned from studying an exposed ore body, both empirically and scientifically, are invaluable to exploration geologists and geophysicists as the exact nature of the ore body may not exactly match the models used to define it.

POLITICAL RISKS. This is one of the most unpredictable factors when it comes to potential mining production. Even if a commercially viable deposit exists, political, environmental and social factors may make the discovery and development of the resource impractical or potentially impossible. This is a complicated topic because administrations can change after each election bringing in new policy advisors and new ideas. A change in government may mark a new period of support for mineral exploration or usher in a culture unfavorable to the development of mineral resources or in some cases ideologically opposed. These new ideas make their way through various agencies in many different forms, in some cases new policies are introduced, different regulatory structures may be implemented or, like in the present case, new rules are promulgated. The Proposed Rule has components from industry, some from environmental groups and ideas from the current administration. It is a result of a melding of pro-business policies with environmental protection. In its proposed form, the Commission's adoption of the Proposed Rule will promote business investment in New Mexico and, along with the Mining Act requirements, remain the most comprehensive set of copper mining regulations in the United States. But, most importantly, it would create a more stable and consistent environment for current and future copper mining operations.

The Proposed Rule would not rely extensively on variances to address the need for some design flexibility. A subjective variance process, while not in place historically, was imposed during the prior executive administration, to require variances in cases where groundwater might be impacted above ground water quality standards. To obtain a variance, a permit applicant must convince the Commission that compliance with a particular part of the regulations is an "undue burden." 20.6.2.1210 NMAC. Regulating through variances and depending on receiving them, when they are subject to the whims of ever changing administrations that can be and often are highly influenced by outside entities, are not an effective way to provide certainty and foster long term investment to occur.

In place of a very subjective variance process, the Proposed Rule would establish specific, environmentally protective requirements that reflect practical operational criteria. The Proposed Rule largely codifies requirements imposed by the Environment Department through conditions in discharge permits issued under the Water Quality Act over the last 30+ years. The existing rules provide broad discretion to the Department to establish permit conditions. The Proposed Rules would narrow that discretion, but still would provide some flexibility to vary from specific design requirements as long as objective performance criteria, such as achieving the same or better performance than the specified design, is demonstrated to the Department's satisfaction.

Under the variance approach advocated by some parties to this proceeding, due to the subjective standard to grant a variance, one administration might grant a variance when groundwater is affected and another might deny the exact same request under identical circumstances. It is fundamentally unfair to ask anyone to operate in such an environment. The Proposed Rule would eliminate the variance process for routine operating matters, which will create a uniform operational environment and remove politics from the process. The Proposed Rule would establish consistent protective standards for our environment and establish consistent operating standards for the copper industry. It does not remove standards, but creates a consistent and clear process by which existing and potential copper mining operations can operate.

V. OPEN PIT VERSUS UNDERGROUND MINING

Open-pit mining is a method of extracting rock or minerals from the earth by breaking, loading, and removal of ore and waste rock in the development an open pit or borrow. This form of mining differs from extractive methods that require tunneling into the earth also known as underground mining. Open pit mining methods are used when large volumes of disseminated minerals are found generally near the surface of the earth Parts of an open pit deposit may be exposed while other parts can be buried by hundreds of feet of overburden. In mining stripping ratio refers to the ratio of the volume of overburden (non-mineralized or uneconomical material) required to be removed to extract the ore. For example, a 3:1 stripping, ratio means that mining one ton of ore will require mining three tons of waste rock. Mining at a higher stripping ratio is less economical than mining at a lower stripping ratio because more waste must be moved (at a cost per ton) for an equivalent ton of revenue generating ore. This is a key metric in determining the viability to open and ongoing operation of a mine.

Underground mines are typically developed in high-grade vein or structurally controlled deposits where the host rock is stable using underground mining methods. Many of the near surface underground mines have been played out so more commonly underground mines now occur 1,000's of feet below the surface of the earth to follow vein controlled ore zones where excavating large volumes of waste rock would not be economical. When compared to surface mining, which requires overburden removal prior to ore extraction, underground mining operations tend to have lower stripping ratios due to increased selectivity. However, the challenge for underground mines is moving large volumes of material, because the larger equipment associated with open pit mines is not feasible.

Open pit mining requires the breaking and removal of waste and ore rock in rock levels or benches, starting at the surface and stair stepping down resulting in an open pit that resembles an inverted cone. The inclined section of the stepped walls is called the face or high wall and the flat part of the step is known as the bench. The bench area is used as the surface to mine from and prevents rock falls from spilling down the entire face of the wall. The mine and bench sizes vary based on the economics and the mine development schedule. The equipment fleet and associated facilities (stockpiles, tailing dams, concentrator mill, electro-winning/solution extraction plant) are also evaluated based on similar criteria. The steeper the high wall the smaller the footprint of the mine, because a lower volume of material will be moved. However, the bench stability, which must be maintained in an active mine, is controlled by bench height, static load, rock type, and geologic structures, like faults and fractures. Therefore most open pit mines are excavated on an angle that is sloped rather than vertical (90 degrees) for personnel safety and to minimize the damage to equipment and facilities from rock falls.

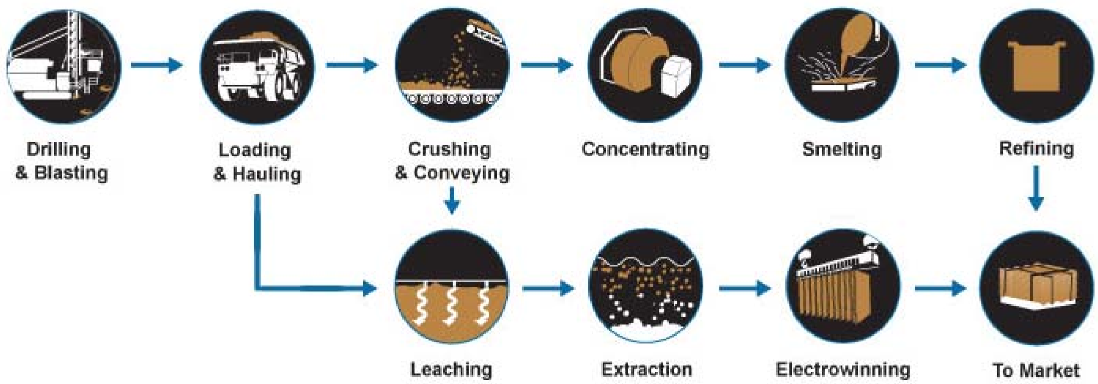
The Santa Rita Pit at the Chino Mine

In some instances additional ground support is required and rock bolts, cable bolts and shotcrete are used to stabilize a bench. Another common tool used at many mines is de-watering the high wall using a series of horizontal wells. This process has been shown to reduce rock slippage by drying the rock and reducing water pressure against the high wall.

A haul road is used to transport rock from the pit to the appropriate processing facility based on grade and mineralogy. They are continually maintained to ensure safe driving condition, minimize dust and reduce tire wear. The ore and waste rock stockpiles are tiered to create a stable configuration.

An ore body is exhausted when it cost more to mine than is profitable. Over time, metal prices fluctuate resulting in mine expansions, temporary closures, and ultimately final closure. Final closure triggers the culmination of a reclamation plan.

VI. COPPER MINE DEVELOPMENT & COPPER PRODUCTION



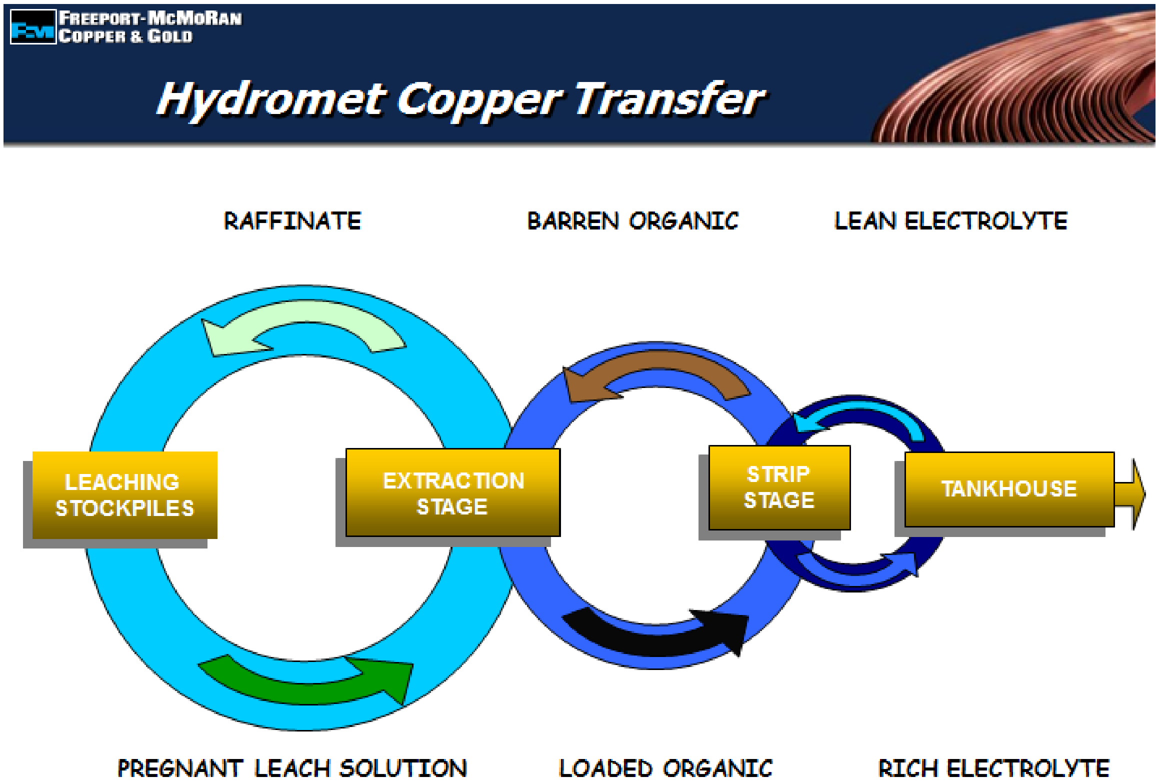
MINE PLANNING. Mine planning occurs at different stages of production and is a constant factor in operations. Long range planning is an assessment of the life of a mine used to justify the initial investment and assess future options. This investment is substantial; each stage prior to extraction must be evaluated. The initial costs beginning with exploration and moving through permitting and equipment purchasing will require an upfront investment of tens if not hundreds of millions of dollars. For instance, one large truck used to transport ore costs upwards of three million dollars and a single shovel used to remove ore can cost in excess of twenty five million dollars. Once the incredible upfront costs are evaluated, the need for transparency and certainty in the regulatory process is obvious. Medium range planning looks at quarterly and annual reports up to five years in the future to determine operating budgets and quarterly forecasts. The short-range plans are the most detailed and are used for daily operations. These plans may be updated due to equipment or processing problems. A temporary and permanent mine closure plan is developed and is updated every five years and financial assurance is put in place to ensure reclamation can begin as soon as the mine reserve is exhausted.

BLASTING. On a daily basis, rock containing copper ore and waste rock is systematically blasted in manageable blocks sizes using a mixture of ammonium nitrate and fuel oil (ANFO). Enormous shovels powered by electricity then excavate the broken rock. A typical P & H 4100 shovel bucket can hold 65 cubic yards and can fill a Caterpillar 793 haul truck in three to four scoops. Each of the 793 haul trucks can carry 265 tons of rock up the 10% grades of the haul roads for placement on leach or waste rock stockpiles or to feed the Concentrator.

OVERBURDEN/WASTE ROCK. Normally, an operator must remove hundreds of feet of overburden or waste rock to get to the mineralized ore underneath or adjacent to the ore on a bench. This waste material is then set-aside in huge piles. The stripping ratio, as discussed earlier, of waste rock to ore can varies over the life of the mine. The higher the "stripping ratio" the higher the operating cost of the mine. It is important to note that among the other Freeport copper mines, the Chino and Tyrone Mines are two of the more expensive mines to operate.

LEACHING. In general, this process is used to extract copper oxide and silicate ore like malachite, chrysocolla, and azurite. Once the ore is mined it is placed in a leach stockpile and the copper is removed using a leaching process. Leaching uses fluids (or raffinate) to liberate the ore from the waste rock. Oxide and sulfide ores are generally processed differently, so in the truck loading and dumping process they are separated and sent to different extraction facilities, if a Concentrator is available. The oxide ore requires the addition of a diluted sulfuric acid solution (0.3 to 0.6 %) to dissolve the copper. It is important that the oxygen supply is present during the leaching process to keep bacteria in the sulfide ores alive and active. The bacteria accelerate the oxidation and leaching process. Too much acid would destroy the bacteria as well as increase production costs. As a result, the oxide ores leach much faster than the sulfide ores. A more effective extraction process for copper sulfide ore (chalcopyrite) is the concentrator extraction process described below. The leach stockpiles are constructed in thirty (30) to fifty (50) feet high “pads” or “lifts”. As each level is built, a network of plastic tubing and drip systems or sprinklers is spread over the top of the pad to deliver a slightly acidic solution called raffinate. The raffinate percolates through the ore dissolving the copper into solution. This copper-laden water is called a pregnant leach solution (PLS) and it exits the stockpile and flows into collection sumps or tanks. Depending on the amount of iron, the copper enriched solution can appear light blue to brownish red in color. From there it is pumped to a solution extraction plant. Once the copper is removed from the PLS, the raffinate is recycled.

SOLUTION EXTRACTION (SX). Solution extraction is the lowest cost method available for producing copper metal that is over 99.99% pure. It is a selective separation process for isolating and concentrating copper from a water-based solution and is performed in three stages as identified in the diagram below. In the process, the PLS that has leached through the stockpiles contains a low concentration of copper along with other dissolved substances. This mixture is then infused with organic reagents. The copper reacts with the reagent to form a more soluble chemical compound and thus the copper is transferred to the organic solution. In order to recover the extracted copper, the organic solution is mixed or stripped with an electrolyte solution to create a chemical bond between the copper and the electrolyte. In this way, the copper is split from the reagent and what attaches to the electrolyte is copper in a concentrated form. Once the copper is removed the organic solution is recycled for future extraction.



ELECTROWINNING. The concentrated copper solution (rich electrolyte) is sent to an electrowinning tank. The rich electrotlyte flows through deep rectangular troughs called “cells”. Each cell is comprised of multiple lead anodes and copper cathodes. Cathodes are sandwiched between anodes less than an inch apart. The cells are electrically charged using direct current (DC). In a cell electrons will travel from the positive (+) charged anode then through the copper enriched electrolyte and then to the negative (-) cathode. As the current moves through the solution, copper is deposited on the cathodes. Within seven days the original cathodes that initially weighed fifteen pounds each will grow into two hundred pound cathodes. The cathodes are removed and stacked into five thousand pound bundles ready for transport.

<u>CONCENTRATOR</u>. This process is used to extract sulfide copper ore like chalcopyrite, bornite and chalcocite from the gangue rock. Chino operates a concentrator since that ore type occurs in abundance at the mine; while Tyrone currently mines mostly oxide material. The Tyrone concentrator was demolished and the area reclaimed after the depletion of the sulfide ore body. The first step in concentrator copper ore extraction is to crush the ore rock. The next step is to wet grind the ore rock, which is done in big canisters (Ball Mills) filled with metal balls and water. It is like a huge rock tumbler. The material is then put into a hydrocyclone, which spins the material using centrifugal force (controlled tornado) to separate the large particles, which fall to the bottom from the smaller particles that rise up spin and separate. The smaller particles go on to the next

stage of grinding for further size reduction. After this milling process is complete, the wet slurry is pumped into a floatation separator. In this machine air is injected through the slurry to make a frothy foam. The copper mineral particles cling to the air bubbles and the waste rock or tailings sink to the bottom of the separator. The copper laden froth is skimmed from the surface of the slurry, reground, and floated several times to allow the froth to hold more and more copper and fewer impurities each time.

FREEPORT-McMoRAN COPPER & GOLD

Chino Concentrator

Semi-autogenous grinding mills (SAGs)

Froth flotation

Following the concentration process, the solids are filtered into a final product that contains 30-40% copper and either transported by rail or truck to a smelter. The tailings, which are in an approximately 50% solids form, are carried by slurry to a tailing dam and deposited on the crest. The solids settle out and the water flows to the center of the dam and is decanted and then pumped back to the concentrator for reuse.

SMELTING AND REFINING. Copper concentrates produced from a concentrator are sent to a primary copper smelter. In very basic terms, copper smelting involves heating the concentrator to a very high temperature where the concentrate is melted in a large furnace and stratifies into layers based on the densities of the various constituents in the concentrate and the additions of silica and lime. Off-gases composed largely of sulfur dioxide are collected and converted into sulfuric acid in an acid plant. Molten copper is separated from the impurities, which are removed from the smelting process and allowed to cool into "slag." The molten copper is poured into molds to form copper anodes.

Copper anodes are approximately 98-99% pure and are sent to a copper refinery for further purification by dissolving the anodes and reforming them by electrolysis into pure copper cathodes. The impurities in anodes contain precious metals and other elements that are recovered in the refinery.

WATER AND COPPER MINING. Water is incredibly important to copper mining and is a coveted resource everywhere. From the first stages of mining, water is used to control air quality and maintain roads and it is used in many of the copper mining processes including ore concentration and leaching. Once the water is utilized for the specific mining purpose great efforts are taken to recycle this valuable resource. This is done to increase efficiencies, but just as importantly. as part of our resource stewardship effort and another way that we act as good community partners.

VII. CONCLUSION

Through this testimony, I hope I have expressed the key reasons why the Commission should adopt the Proposed Rule with specific changes proposed by Freeport-McMoRan's testimony. Adoption will promote continuation of current operations and promote expansion of the copper industry in New Mexico by providing reasonable regulatory certainty. I also hope to have introduced you to the key elements of the copper production process to assist in your understanding of the technical aspects of the Proposed Rule and the technical testimony presented by the other witnesses. Again, I encourage the Commission to adopt the Proposed Rule after you are satisfied that they meet the requirements of the Water Quality Act to protect ground water quality. Thank you for your time.

John Brack

D.