Department of Health & Safety Guideline		GUIDELINE NO.	FCX - 15
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Surface Blasting Guideline		TASK CLASSIFICATION	Highly Critical / Critical / Non-Critical
APPROVAL DATE – January 29, 2013	**ORIGINAL DATE** – November 30, 2011	**RELEVANT SOPS** – SITE SPECIFIC	

I. Purpose and Scope

These guidelines apply to all Freeport-McMoRan employees and contractors involved in blasting activities and outlines Blasting SOP minimum requirements for all operations. This document provides a set of standards that site SOPs must address.

Sites have varying levels of interaction with Blasting Contractors; these guidelines apply regardless of the degree of contractor involvement. Ultimately, a Responsible FCX Employee will be accountable for all surface blasts on site including project work.

II. Definitions

A. Responsible FCX Employee – Blasting Supervisor, Blasting Engineer, Lead Blaster or other “qualified” person who is a direct employee of FCX. This definition does not include contract blasting personnel.
B. Direct Control – Having face-to-face contact to ensure clear and concise communication.
C. Blast Site- Is the area where explosive materials are handled during loading including the perimeter formed by the loaded blast holes and 50 feet (15.3 meters) in all directions from loaded holes. A minimum distance of 30 feet (9.1 meters) may replace the 50 foot requirement if the perimeter of loaded holes is marked with a barrier.
D. Blast Area- The area in which concussion, flying material or gases from an explosion may cause injury to persons or damage to property.
E. Stemming - refers to rock crushed to 80% 1 inch to 1 ¼ inch with a maximum size of 2 inch (based on 10 5/8” hole diameter, varies according to hole size). There should be no fines.
F. Explosives Transport Truck- The vehicle that carries blasting accessories (powder truck).
G. Misfire- Complete or partial failure of explosive material to detonate.
H. Sweeping/Clearing/Blocking- The process of ensuring all personnel are removed from the blast area and re-entry is restricted prior to detonation.
I. Problem hole is a hole that:
    a) has a “bridge over” condition
    b) takes too much or too little stemming
    c) has lost, cut or damaged downlines
    d) is too close to the crest
    e) is too close to an adjacent hole
    f) is not identified in the blast plan
    g) is too short or too deep
    h) has column subsidence
    i) has other inconsistencies

III. General Requirements

A. Site specific SOPs will clearly designate a Responsible FCX Employee.
B. SOPs will insure that blast locations and expected time is communicated to affected work groups daily.
C. Blast initiation devices will be serviced annually or more frequently if specified by the manufacturer.
D. **Each site will have a lightning detection system and safety procedures in the event of an approaching electrical storm.**
E. Personnel will be trained and demonstrate competency to recognize and manage distractions and process interruptions. All training shall be documented.
F. All blasting processes will be carried out in a safe and efficient manner.

IV. Responsibilities

A. Responsible FCX Employee will:
   a) Provide **field oversight** of the entire blasting process. (Ensure delivery of the blasting plan to the crew and monitors work to ensure SOPs are followed)
   b) Ensure the blast design has been reviewed by a qualified person to verify that the initiation plan and hole timing are reasonable. If more than one shot is planned, the initiation plan and delay between shots will be evaluated to make sure that the shots do not interfere with each other.
B. FCX and Contractor Supervisors will assess the work load for crew members and allocate resources as appropriate to minimize distractions and decision making errors and eliminate implied haste.
C. Mine Managers will:
   a) champion safe blasting processes
   b) provide leadership that minimizes perceived haste
   c) ensure that blasting processes and geotechnical activities are coordinated
   d) ensure audits are performed and action items are addressed (see Appendix C)
   e) ensure that sufficient and capable staff are available to oversee blasting processes
   f) ensure that sufficient equipment is available to safely facilitate blasting processes
D. Blockers and Sweepers will be FCX employees (for production blasts and secondary blasts) whose assignment begins at the pre-initiation meeting and are responsible for:
   a) blocking traffic at the assigned area
   b) understanding and repeating back the assignment
   c) following instructions without deviation
   d) stopping the initiation process if a deviation to the blocking plan is detected

   NOTE: For project blasts using contractors site will follow the D & B Contractor Guidelines
E. Blasting Engineers or other qualified persons will oversee:
   a) blast locations
   b) drill pattern designs

c) determination of loads and timing (taking into consideration the type of material, fragmentation and geotechnical requirements)

V. Identification of Blast Holes – Drilling and Sampling

The purpose of this section is to insure that holes are properly identified.

A. Drillers will place a numbered stake at each cuttings pile and verify that the stakes are numbered correctly
B. Extra holes or holes determined to not be loaded (drilled for maintenance or any other reason) will be properly identified with a stake that reads “Do Not Load” or similar language or instructions that indicate that the hole should not be loaded. These holes will be filled prior to Priming whenever possible
C. Each site will develop SOPs to inspect the pattern for unlabeled holes and will include steps to properly notify the Responsible FCX Employee

VI. Pre-shift Team Meeting

A pre-shift meeting will be held by blasting crews each shift. The pre-shift meeting shall include the following:

A. Work locations
B. Unique or continuing hazards
C. Equipment needed for assigned work
D. Hole specific loading instructions for a pattern (water, hardness, product, etc.)
E. Identification of parties for communication and unique work being done in areas adjacent to the blast site
F. Preliminary blocking locations
G. The anticipated time of the blast
H. Identification of the Responsible FCX Employee
I. Other pertinent information

VII. Pre-loading Area Inspection and Blast Site Conditions

The purpose of this section is to insure that the risks associated with the blast are identified and controlled.

A. Blast area inspections shall be performed before loading starts
B. The Responsible FCX Employee will verify that the blast plan map accurately represents the blast pattern in the field (i.e. number of holes, hole locations, problem holes)
C. Sites will verify that all potentially affected persons have been informed of blast
D. During the inspection blast site access and egress routes shall be evaluated and appropriate actions taken
E. The Responsible FCX Employee will determine the boundaries of the blast area. The following items shall be considered when determining the boundaries of the blast area:
    a) Concussion
    b) Fly rock
    c) Fumes, ventilation and prevailing wind conditions
    d) Air blast
    e) Subsidence
    f) Adjacent infrastructure
    g) Equipment locations including maintenance activities
    h) Noise and vibration
    i) Geological features
    j) Adjacent underground or surface workings
    k) Hazards associated with the loading pattern
    l) Holes not intended to be loaded will be labeled “Do Not Load”, “BO”, or similar language, and filled in as soon as possible
    m) Any unlabeled holes that are discovered will be properly identified through consultation with the map and the Responsible FCX Employee
    n) Questions or concerns that arise from the area inspection will be resolved through consultation with the Responsible FCX Employee before loading starts

VIII. Explosive Storage and Transportation

The purpose of this section is to insure that explosives are handled and transported safely and in accordance with regulations.

A. A person or persons will be assigned responsibility for managing the magazines
B. All outdoor magazines will be built to the BATF standards and sited to the American table of Distances. If a country's laws or standards differ from those in the US, the more stringent standard will be enforced
C. All magazines will be:
    a) Fitted with a lightning protection system
        - proper grounding is sufficient
        - yearly records of grounding checks are required and must be documented
    b) Constructed outside the corridors of power transmission lines
    c) Properly signed from each approach indicating contents and have warnings such as "No Smoking", "Explosives Stored Here", "Authorized Personnel Only", etc.
        - signs must be positioned so that a bullet passing through them will not strike the magazines
D. The location of all fire extinguishers will be clearly marked
E. Smoking, matches, open flames, and spark producing devices are not permitted within 50' of a magazine. Cell phones must also be kept outside of the magazines
F. All magazines will contain a book or similar method for the recording of all explosives movements in and out of the magazine and current inventories. If the records are kept in a central office each magazine will have its own section to record movement of product from that magazine
G. Only essential nonsparking equipment used for the operation of the magazine may be stored with explosives
H. All magazines will contain an updated copy of authorization, permits or licenses
I. The locks on magazines will be rotated per regulatory standards
J. Bills of Lading (BOL's) and packing lists shall be kept in a secure location for the specified minimum period of 5 yrs
K. All explosives, detonators, and accessories will be transported in accordance with statutory regulations (See Appendix A)

IX. Priming

The purpose of this section is to insure that detonators and primers are handled safely and usage matches blast design. This will allow for proper accounting of detonators and primers prior to loading.

A. All holes will be taped for depth and water level before priming. The Responsible FCX Employee will be notified of any significant variance from expected measurements before the hole is primed
B. The blast site will be secured with yellow cones .
C. Warning signs will be used to block all accesses to the blast pattern to be primed and loaded
D. Explosives products will be laid out in a careful, efficient and well-coordinated manner (between holes, on the outside of the cuttings pile and out of the flow of traffic)
E. Primers will be assembled only at the hole collar and will immediately be carefully lowered into the hole
F. All detonators will be fully enclosed within the booster according to the manufacturer's recommended procedures
G. When down hole detonators are used a redundant down line will be required. At least one of the detonators will be an electronic type capable of having its integrity verified from the surface
H. An acceptable, standardized weighting system must be used to insure proper placement of the booster in the explosives column
I. Downlines must be anchored securely into position at the surface in the cutting piles Wooden stakes or poles are recommended
J. A physical inventory of boosters and detonators used for the blast will be done in the field at each blast pattern and verified against the blast plan map count. The Responsible FCX Employee will verify the detonator inventory after the products are laid out to ensure that the amount used matches the number of holes being loaded

X. Loading

The purpose of this section is to ensure that holes are loaded per the blast design and that problems that arise during loading are dealt with appropriately.

A. All holes will be re-taped for depth and water level before loading
B. The loading trucks will wait to load holes until they have enough holes primed to empty a truck
C. Loading personnel will know the upper weight limit of product to be loaded and the planned stemming height of each hole
D. The powder column rise of each hole will be monitored until the stem height is achieved or the maximum load is reached
    a. Any deviation from expected column rise over a set amount during loading will be immediately brought to the attention of the Responsible FCX Employee
    b. Site SOPs are required
E. The required records must be kept for every hole loaded
F. After loading, downlines must be checked to insure that the booster and detonator are properly embedded in the powder column
G. Interruptions in the loading process will be documented and communicated to the Responsible FCX Employee
H. All loading trucks will be parked off the pattern after loading is finished
I. Explosives transport trucks will not be left unlocked (unattended) with explosives on board and they will be relocked immediately after unloading

XI. Stemming

The purpose of this section is to ensure that stemming activities are done in such a way to eliminate cut downlines, “bridge overs” and help identify problem holes.

A. The recommended stemming material and equipment is:
    a) Clean (minimum fines), crushed gravel as specified in the definition of stemming
    b) Side-dump articulating loader
B. The stemming process will not begin until after all the holes are primed and the loading is far enough ahead so that stemming activities will not interfere with the loading process
C. Stemming material shall be strategically placed at the blast site using a spotter
D. Detonator downlines will be positioned to eliminate damage
E. Downlines will be secured prior to stemming
F. Stemming material shall be carefully poured down blast holes to eliminate downline damage and control dust
    a. Stemming piles should be wetted down to prevent dust
G. Stemming operators should safeguard against oversized material being accidentally introduced down blast holes
H. Stemming operators must be properly trained in procedures used in case of a lost, cut or damaged down line
I. Stemming operators shall inform the Responsible FCX Employee of any problem holes

J. The Responsible FCX Employee must address and ensure that any and all “problem holes” are reported on the Blast Summary paperwork
   a. Unloaded or “bad” hole information should be included as well

XII. Tie-in

The purpose of this section is to ensure detonation of all holes in the blast pattern and proper timing of all holes.

A. The Responsible FCX Employee shall generate a tie-in sequence diagram of every blast hole
   a) This diagram will be included with the other blasting documentation required from the daily blasting activities.
   b) The Responsible FCX Employee shall review the sequence diagram with personnel doing the tie-in.
B. Programmable electronic detonators with accompanying software and hardware are required. (Pre-split and secondary blasts are exempt)
C. Tie-in of pattern shall begin only if it will not interfere with other blasting unit processes or cause distractions to those tying in
D. When using programmable delays, the blast crew will use the logger tests to verify hook up reliability.
   a) If a “bad” detonator is encountered the back-up system will be utilized
   b) Documentation of the situation and extra product usage on the Blast Summary is required
E. For pre-splits or secondary blasting, after tie-in is complete, the pattern must be independently checked by two individuals, verifying completeness and matching to the blast map
   a) Both should initial the check on the Blast Summary.
F. Detonator count will be obtained from the data logger and a check made against the field inventory recorded on the Blast Summary (adjusted for “bad” or extra dets used if necessary)
   a) Any discrepancy must be reported to the Responsible FCX Employee and rectified before moving into the blast initiation stage
G. A shift supervisor and\or shot blockers should be notified at least 30 minutes prior to completing tie-in so that shot blockers can prepare for the pre-blast meeting.

XIII. Pre-blast Meeting

The purpose of this section is to ensure that all personnel involved in the clearing and initiation of a blast are clear about their assignments, properly equipped and know their responsibilities.

A. Prior to the pre-blast meeting numbered blue cones will be placed to MARK the blocking position
B. The pre-blast meeting will include all blockers and sweepers and will be face-to-face
C. The Responsible FCX Employee will conduct the meeting
D. Each blocker and sweeper will receive their assignment in the meeting and the Responsible FCX Employee will ask them to repeat back their assignment and their responsibilities
E. Blockers\Sweepers and their assignments must be documented
F. All blockers will remain at the meeting until the meeting is over
G. Yellow cones will be provided for each blocking position to block the road
H. All vehicles used for clearing and blocking will be equipped with a functional two way radio and functioning beacons and /or flashers
I. If vehicles are not used for blocking, a person with a flag, radio and yellow cones is acceptable

XIV. Clearing/Sweeping the Blast Area

The purpose of this section is to ensure that the blast is properly cleared and that all affected personnel are notified.

A. Clearing for a shot will be directed / supervised by the Responsible FCX Employee
B. Clearing an area for a blast will begin at the blast site and proceed outward
C. All affected personnel will be notified prior to clearing to allow for orderly preparation and evacuation of the blast area
D. All affected equipment will be positioned or relocated to a safe position to prevent damage from fly rock or blast vibration
E. All equipment in the blast area will be physically cleared of personnel
F. During clearing, all entries previously cleared will be guarded to prevent re-entry into the cleared area ("back doors" will be held)
G. Those clearing/sweeping for a shot must be FCX employees who have been trained and that training has been documented

XV. Securing and Holding Blocking Position

The purpose of this section is to insure that blocking positions are never compromised and clear, concise communication is maintained between the Responsible FCX Employee and each blocker.

A. Securing and holding of blocking positions will be directed by the Responsible FCX Employee
B. Blockers will:
    a) Be trained to FCX standards and the training documented
    b) Drive to assigned blocking location identified by the corresponding numbered blue cone
    c) Turn vehicles or equipment used for blocking perpendicular to the flow of traffic (if vehicles are used)
    d) Use yellow blast cones to block the road
    e) Have contact with the Responsible FCX Employee via radio
    f) Communicate to the Responsible FCX Employee, in detail, actions taken to clear the area and that the blocking position is secure
    g) Not permit entry to the secured area by anyone without permission of the Responsible FCX Employee.
C. The Responsible FCX Employee will:
    a) Prior to pre-blast meeting determine blocking locations and place a uniquely numbered blue cone at each location (This is to mark the blocking location NOT to block the road)
    b) Maintain a blocker checklist and use it to verify completion of assignments
    c) Do a redundant check with each blocker prior to the last blast warning
    d) Instruct each blocker to hold their position if a delay occurs
    e) At the end of the delay, check with each blocker before continuing with the last blast warning

XVI. Blast Initiation

The purpose of this section is to ensure all detonators are communicating, the blast area is clear and that all blocking positions are secure.

A. Blast initiation will be directed / supervised by theResponsible FCX Employee
B. Blast initiation will take place from a location safe from hazards resulting from blasting
C. The blast initiation location will be a safe distance from electrical interference (e.g. power lines, power cables, radios). Radio must be kept a minimum of 10' from blasting equipment during the initiation process
D. The firing / initiation system will be enabled AFTER all clearing and blocking activities are finalized
E. The firing / initiation system will be in the possession of the blasters and under control of the Responsible FCX Employee at all times
F. The firing / initiation system will be connected by the Responsible FCX Employee or a person under his/her **direct control**
G. Two-way radio communication between the Responsible FCX Employee and all blockers will be maintained throughout the clearing, blocking and initiation processes
H. The Responsible FCX Employee will ensure that all electronic detonators used in a blast continue to "communicate" with the blast initiation device throughout the blast initiation process
I. The "communicating det count" will be checked against the "detonator used count" verified during priming and loading
J. **Shooting "through errors" or "with errors" is strictly forbidden**
K. Blasting personnel will be competent in safe practices in the event that a blast fails to detonate
    a) If the pattern must be "re-entered", the blasting equipment must be "safed" (take the dongle with you) and site SOPs must be followed.(For electronic detonators the waiting period is 15 minutes)

XVII. Post Blast Inspection

The purpose of this section is to ensure that the blast holes have been detonated and the area is safe for re-entry.

A. A post-blast inspection will be performed under the supervision of the Responsible FCX Employee
B. All blockers will remain in place during the post-blast inspection
C. Yellow cones will demarcate the blast site until the post-blast inspection is complete and the Responsible FCX Employee gives the "all clear"
D. A minimum of 5 minutes must elapse before re-entry into the blast site
E. Do not re-enter if noxious fumes or excessive dust exist clouds are present

XVIII. Blast Monitoring

The purpose of this section is to ensure that blast vibration data is recorded and utilized to manage slope stability.

A. Blasts will be viewed from above if possible
B. A blast vibration monitoring system utilizing seismographs shall be instituted and actively managed, by both Blasting and Slope Stability personnel

XIX. Misfired Hole Procedure (see CFR 56.6311 – Appendix D)

The purpose of this section is to ensure that personnel involved in blasting and operations processes are trained to recognize a misfire and are familiar with the SOPs for dealing with a misfire.

A. All blasting personnel will:
    a) Know the definition of a misfire
    b) Be familiar with the blasting products used
    c) Be familiar with what a misfire looks like and how to determine if there is a misfire
    d) Be familiar with the waiting period for a suspected misfire
B. There will be systems in place to:
    a) Restrict access to a misfire
    b) Document misfires and handle them properly
    c) Mark misfires in the field in an easily recognized manner
    d) Enter the misfire into shovel/loader GPS systems (if used) to alert shovel and loader operators of the location
    e) Inspect bench floors for evidence of any misfired product remaining after mining through
    f) Safely dispose of misfired (recovered) products
    g) Offset future drilling locations to prevent from drilling into explosives possibly remaining in the bench floor
C. A safety session on unfired powder column and blasting component recognition will be part of shovel, loader and RTD training including annual refreshers
D. Misfires occurring during the shift shall be reported to mine management no later than the end of the shift
E. Perform Root Cause Analysis (RCA's) for misfires
    a. Action plans will be developed and implemented

XX. Sleeping / Guarding Shots, Lightning Storms

The purpose of this section is to ensure shots slept overnight are safely managed.

A. Each site will have an SOP for sleeping shots
B. Shots will be slept overnight only in extraordinary circumstance
C. Shots slept overnight will be guarded or barricaded to prevent unauthorized access to the blast pattern
D. In the event of an approaching electrical storm, the Responsible FCX Employee or a designated shift supervisor will be responsible for clearing the blast area in the same manner as clearing for a shot
E. The designated shift supervisor must be informed of the situation (face to face) and given a site map along with a clearing and blocking plan (documented)
F. The Responsible FCX Employee or a designated shift supervisor will determine when activities may resume within the blast area

XXI. Record Keeping

The purpose of this section is to ensure accurate records are kept as required by regulation.

A. Daily FCX magazine inventories transactions shall be recorded for all blasting products checked out and unused product checked back in (FCX verification required)
B. Magazine physical inventories shall be checked for accuracy at least once per month and verified by FCX supervision quarterly
    a. Any discrepancy shall be immediately investigated.
C. A yearly close out and starting inventory will be taken and maintained as part of the permanent records required by the regulatory agencies (FCX verification required)
D. Each site shall maintain daily blasting documentation (Blast Summaries) that contain information such as load amounts, blast diagrams, timing configurations, “bad” or “problem” holes, and other “out of the ordinary” or pertinent information
E. Licensees and permit holders must keep all records pertaining to explosives, in permanent form, for not less than 5 years
F. License and permit documentation shall be kept current and displayed in conspicuous areas
G. Records of Employee Possessors and Responsible Persons must also be maintained and updated as needed

Appendix A – Transportation Audit List

Explosives transportation audit will include:

A. Proper placards visible in all four directions?
B. Day boxes are securely fastened to the vehicle or confined within the vehicle body to prevent spillage?
C. Day boxes with explosives locked in transit and on the pattern when product is not being unloaded?
D. Vehicle loads are within the rated vehicle carrying capacity?
E. Non-sparking materials for container lining and fasteners?
F. No other materials transported with explosives?
G. Detonators and boosters transported on the same vehicle stored in separate, compliant day (field) boxes?
H. Vehicles equipped with two 20 pound multipurpose dry fire extinguishers?
I. The volume and quantity of explosives do not exceed the limits established by regulatory authorities?
J. Means to control of inventory of explosives established?
K. Magazine areas made secure with either a lockable gate and fence or lockable storage box for explosives, meeting the requirements of the applicable agency?
L. Magazines designed to prevent vehicle impact to the magazine?
M. Magazines located in a proper manner to control surface drainage?
N. Explosives refuse (empty boxes) inspected, broken down, and disposed of properly on site?

Appendix B – Competency and Training (Future Development)

All employees and contractors who participate in drilling, sampling, blasting or support blasting activities shall be trained to effectively perform their duties. This training shall be documented.

A. Sites will develop a list of required skills and evaluate individuals to verify they are competent prior to participating in or supporting blasting activities. The skills shall include:
   a) Staking drill holes
   b) Duties of Responsible FCX Employee
   c) Duties of a Lead Blaster
   d) Duties of a sampler
   e) Conducting a pre-loading site inspection
   f) The identification of unique hazards for blast patterns
   g) Hole loading practices for routine and non-routine holes
   h) Magazine inventory control
   i) Safe transport of explosives
   j) Field inventory control
   k) Inventory reconciliation
   l) Guarding a shot overnight
   m) Establishing evacuation areas for blocking
   n) Effective blocking for a blast
   o) Post blast inspections
   p) Managing misfires or discovered explosives
   q) Lightning storm precautions \ actions

Appendix C – Blasting Safety Steering Team Requirements

The FCX Blasting Safety Steering Team (BSST) will evaluate existing standards, set new guidelines, and monitor site performance.

1. The BSST will consist of:
   A. Sponsor, GM level or Director Level
   B. Lead
   C. Site champions
   D. A health and safety representative

The Company BSST will conduct annual audits at mine sites to monitor compliance, look for best practices, and provide feedback for continuous improvement. Audits will include review of compliance with corporate guidelines, training, SOPs, and field practices. Follow-up audits may be conducted depending on site performance.

An annual meeting will be held with all members to review practices and make recommendations for change where needed. Changes to the current guidelines and appendices must go through a formal approval process with the company BSST and brought back to the site BSST for implementation.

2. Sites will establish a Site BSST with:
   A. Sponsor-Mine Manager
   B. The site champion
   C. A geotechnical engineer
   D. A health and safety representative
   E. A member of the site blasting crew
   F. Contractor representative

3. Supervisors at each site will be responsible to ensure that practices are being followed on a daily basis. Monthly audits or quarterly audits of blasting practices will be completed for compliance and identification of improvement opportunities. These audits will include both pit and contractor work practice assessments to ensure compliance with site blasting procedures and this guideline. A standard format will be used for the audits. The sections covering Pre-Blast Meeting, Clearing, Securing (Blocking), Initiation, and Post Blast Inspection will be done at least quarterly. The other sections can be done less frequently (if there are no major safety findings), but at least twice per year.

4. Sites will include blasting operations as part of the risk assessments, ISO, and OHSAS processes as applicable. Records will be maintained for the appropriate time periods at each site for reference in audits.

Appendix D – (CFR 56.6311) Handling of Misfires

(a) Faces of muck piles shall be examined for misfires after each blasting operation

(b) Only work necessary to remove a misfire and protect the safety of miners engaged in the removal shall be permitted in the affected area until the misfire is disposed of in a safe manner

(c) When a misfire cannot be disposed of safely, each approach to the area affected shall be posted with a warning sign at a conspicuous location to prohibit entry, and the condition shall be reported immediately to mine management

(d) Misfires occurring during the shift shall be reported to mine management not later than the end of the shift

Note to item (c) - Known misfires will be barricaded (encircled) at least 30 feet away from the misfire and will have signs placed at all access points