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Morenci Safe Production Standard	Standard # 5.1.6	
Radiation Safety Program	OHSAS 18001:2007	4.4.6
	Revision #	02
	Revision Date	06/28/2013
	Effective Date	4/1/2011
	Document Owner	Industrial Hygiene
Review:	Approval:	
<i>Manager/Health and Safety: 9/2012</i>	<i>GM/Administration: 9/2012</i>	

1.0 PURPOSE:

1.1 This program is written in accordance with Arizona Administrative Code R12-1-407 with the intent to ensure the protection of all Freeport McMoRan Morenci Operations (FMI) employees and contractors working for FMI from exposures to radiation.

2.0 SCOPE:

2.1 This program applies to all FMI Morenci Operations areas, employees, contractors, and visitors that use or will be exposed to radiation sources used for production processes under normal conditions or in a foreseeable emergency.

3.0 TERMS, DEFINITIONS AND ABBREVIATIONS

ALARA is an acronym for as low as reasonably achievable which means the employer shall reduce all exposures to hazardous materials are kept to a minimum as it is feasible.

Occupationally Exposed Persons is a term for employee or individuals who will be exposed and are authorized to handle radiation through their normal job tasks and functions.

Non-Occupationally Exposed Persons are all individuals or employees who are not intended to be exposed to radiation, includes employees, visitors, contractors and members of the general public.

Arizona Radiation Regulatory Agency (ARRA) is the governing entity to regulate radioactive materials and policies for Freeport McMoRan Copper & Gold Morenci Operations.

Radiation Safety Officer (RSO) is a trained individual designated by the company to oversee and implement policies and procedures in relation to radioactive materials.

Radioactive Material is any material or device that emits radioactive particles or rays.

REM is a unit of measurement for radiation exposures to individuals, can also be expressed in millirem.

4.0 RESPONSIBILITIES:

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The Radiation Safety Officer of FMI Morenci Operations has ultimate responsibility for the Radiation Protection Program; however all employees are responsible and accountable for the protection of their personal health and safety as related to radioactive materials.

4.2 Supervisors and Managers

- Inform RSO of the addition of radiation sources to the applicable processes;
- Ensure individuals receive adequate training prior to handling or installing radioactive materials;
- Ensure relocation of radiation sources be approved by the RSO;
- Provide means for occupationally exposed employees to complete the task safely with minimal exposure to radiation.

4.3 Radiation Safety Officer

- Has ultimate responsibility for the implementation and maintenance of the Radiation Safety Program and promulgating any policies, standards and guidance related to radiological protection;
- Ensure that the site is in compliance with all ARRA and NRC regulations and guidelines;
- Perform biannual inventory checks;
- Retain all radioactive material related documentation;
- Provide radiation awareness and safety training;
- Responsible for radiation detection equipment and calibration;
- Notify the ARRA in the event of changes or emergencies with regards to radioactive materials.

4.5 Purchasing Administration

- Shall ensure that contractors receive radiation sources according to policy and safe operating procedures for receiving and shipping radioactive materials.

4.6 Occupationally Exposed Persons

- Ensure that handling of radioactive material is done in accordance with the training provided;
- Notify the RSO of any changes in location or damage to radioactive material or devices.

4.7 Non-Occupationally Exposed Persons

- Avoid areas of radiation activity;
- Notify RSO or supervisor of changes to location or damage of radioactive material or devices.

5.0 STANDARDS OF PERFORMANCE

5.1 ALARA Policy

Consistent with our operating philosophy and supporting procedures, it is the policy of FMI to conduct its radiological operations in a manner which ensures the health and safety of its employees and the general public. In achieving this objective, FMI shall ensure that radiation exposures to its workers and

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the public are maintained As Low As Reasonably Achievable (ALARA) and in compliance with regulatory limits consistent with our operations. The company is fully committed to implementing a radiological control program of the highest quality which consistently reflects this policy.

The company shall

- Conduct radiological operations in a manner that controls the spread of radioactive materials and reduces exposure to the work force and the general public and that utilizes a process which seeks exposure levels as low as reasonably achievable.
- Ensure personnel responsible for performing radiological work activities are appropriately trained.
- Ensure the technical competence of personnel responsible for implementing and overseeing the radiological control program. Qualification requirements commensurate with this objective shall, at a minimum, be consistent with applicable industry standards and promote professional development and excellence in radiological performance.
- Establish and maintain management involvement and accountability for radiological performance. Responsibility for compliance with company radiological protection requirements and for minimizing personnel radiation exposure starts with the laborer and progresses upward through the line of management.
- Ensure radiological measurements, analysis, worker monitoring, results and estimates of public exposures are accurate and appropriately made.
- Conduct oversight to ensure company requirements are being complied with and appropriate radiological work practices are being implemented. A subcommittee shall be appointed by the RSO to formally audit, at least annually, these procedures and practices.

5.2 Employee Exposure Notification

All employees who are occupationally exposed to radiation will be issued a radiation detection dosimeter. The dosimeters are to be handed out and collected by the RSO or his/her designee at the beginning of each quarter. The dosimeters are then sent in for analysis and results returned to the RSO indicating radiation exposure for exposed employees. In the event an employee receives a dose above 1 REM per quarter while performing duties such as the inventory, inspection, cleaning, leak testing or relocation of radiation sources the employee will receive notification within two working days in the form of written letter from the Radiation Safety Officer. The letter will include the dose received and the limit of exposure allowed by applicable regulatory agencies.

5.3 Radiation Inventory

A complete list of radiation sources will be kept by the Radiation Safety Officer. The inventory will include at least: the manufacturer, isotope, source birth date, original activity level and location of source. The inventory is to be updated whenever changes in location or inventory are completed.

Every six months an inventory check of all radioactive materials is to be done. The inventory check is to ensure that the sources are still active and in the location indicated on the list. It is also to ensure that the mechanisms of the source housing units are still in working order and labeling is current and legible.

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The four items checked will include tags legibility, physical condition, shutter condition and radiation signage. The inventory is to be signed and dated by the Radiation Safety Officer and retained according to policy.

5.4 Radiation Detection

Radiation surveys and leak tests will be done periodically as needed and required by regulatory agencies. Surveys are to be conducted using a Geiger counter that has been calibrated within the last 12 months. Survey forms are to be completed for every source when it is received and relocated. If radioactive sources have been added or removed from the radiation storage area and new survey of the storage unit will be conducted. The surveys are to determine if levels of cumulative radiation are below acceptable levels. Survey forms are to be given to the Radiation Safety Officer and retained according to policy.

Leak tests are to be performed in the appropriate intervals as indicated by the radioactive license agreement from the ARRA. Some sources require leak testing within 6 months while others are every three years. The leak tests will be performed by a trained individual or RSO. In the event of a positive leak test the RSO will notify the ARRA in writing within 5 days. Leak testing shall also be performed if there is any reason to suspect that a sealed source is leaking.

Safe Operating Procedures for surveys and leak testing can be obtained through the Industrial Hygiene SharePoint site or from the RSO.

5.5 Purchasing, shipping, receiving, disposal and installation of radiation sources

Purchasing

The RSO shall be notified if any department has intentions of purchasing radioactive sources to ensure that the purchased source is currently on the radioactive Materials License issued by the State of Arizona.

Shipping and Receiving

The RSO shall inspect any shipment of radioactive isotopes for leakage prior to entering or leaving the property. Sealed sources will have been leak tested within 6 months of their receipt or transport. The receiving personnel shall contact the RSO in the event of receipt of radiation sources. The receiving of such shall follow the safe operating procedure for receiving radiation sources found on the Industrial Hygiene SharePoint site or from the RSO.

All shipping packages shall be labeled according to the Department of Transportation labeling requirements for radioactive materials.

Disposal

In the occasion requiring the disposal or transfer of radioactive materials the Arizona Administrative Code R 12-1-439 shall be followed.

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Installation

Radioactive materials shall be installed in a manner that non-occupational exposed employee exposures are less than 100 millirems per year. Both X-ray and radioactive source gauges and instruments will be installed by the manufacturer or an installation team that has been trained in radiation safety and awareness. When devices are installed a survey shall be performed to ensure emitted radiation is below acceptable limits.

5.6 Emergency Procedures

In the event of a suspected or confirmed damaged or missing source the Radiation Safety Officer shall be contacted immediately. The emergency procedures for radiation sources is found on the Industrial Hygiene SharePoint site. The safe operating procedure for such emergencies will be followed. Ensure that the area is evacuated and is barricaded to prevent entry. Only trained individuals shall enter the area wearing a radiation dosimeter and appropriate protective clothing. The source shall be covered by material that will prevent or limit the release of radioactive rays and particle while a plan for removal or repair is created. A plan will be executed to clean up the spill or repair the device so that minimal exposure to radiation is achieved.

5.7 Training

Employee training shall be conducted on an as need basis for employees who will be working with or performing maintenance around any radioactive source or equipment containing radiation. Depending on the work performed the training offered is a radiation awareness course or radiation safety course. The training provided should include the following aspects:

- Basic radiation atomic structures
- Radiation isotopes
- Emitting particles
- Effects of Radiation on the body
- Acute vs. chronic exposures
- Exposure limits
- Radiation detections
- Emergency procedures

5.8 Licensing

The Radioactive Material License is issued by the Arizona Radiation Regulatory Agency and should not be allowed to expire. The application for renewal of the license shall be submitted to be received by the ARRA no later than 30 days prior to the expiration date of the license which is September 2013. All condition of the Radioactive Material License and the Application will be followed. All X-ray devices shall also be registered with ARRA.

5.9 Signage and Postings

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All areas that contain radiation materials shall be assigned as required by the ARRA. The following postings shall be made available and should be replaced is defaced or altered:

- State Notices
- Notices of Violations given by the ARRA and must remain posted for 5 working days or until corrective action for the violation has been completed, whichever is later
- Statement that a copy of the regulations in Title 12 chapter 1, this program and a copy of the Radioactive Material License can be obtained from the Radiation Safety officer

6.0 REFERENCE DOCUMENTS

6.1 Arizona Administrative Code R12-1-407

6.2 Radiation Safe Operating Procedures

6.2.1 Installation and Commissioning

6.2.2 Take Down of Devices for Storage

6.2.3 Radiation Survey

6.2.4 Leak Testing

6.2.5 Device Inventory and Inspection

6.2.6 Energy Control/Lockout

6.2.7 Contractor and Vendor

6.2.8 Radioactive Materials Procurement

6.2.9 Radioactive Materials Receiving

6.2.10 Entry into Monitored Vessels

6.2.11 Personnel Monitoring

6.2.12 Employee Training and Education

6.2.13 Declared Pregnant Females

6.2.14 Emergency Procedures

7.0 RECORDS

Name of the Document	Responsible for Control	Records Retention
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Approved copy of this Standard	Health & Safety	Permanent
Radiation Source Monitoring and Leak Test Results	Radiation Safety Officer	Permanent
Personal Dosimeter Monitoring Results	Radiation Safety Officer	Permanent
Radiation Source Inventory	Radiation Safety Officer	Permanent
Equipment Calibration Records	Radiation Safety Officer	Permanent
Training Records	Radiation Safety Officer / Training Department	Permanent
Pregnant Worker Declaration	Radiation Safety Officer	Permanent
Radiation Source Receiving, Disposal and Transfer Records	Radiation Safety Officer	Permanent

8.0 APPENDICES

8.1 Appendix A Radiation Protection of Pregnant Workers

9.0 REVIEW AND CHANGE

All changes, modifications and/or revisions must be documented on the table below:

<i>Description of Changes to this Document</i>
Review and Refomatted-no policy changes-on 9/7/2012
06/28/2013 Updated Records Table S. Elias Rev. 02

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Appendix A Radiation Protection for Pregnant Women

The purpose is to provide the pregnant worker with the facts about radiation that will allow them to make an informed decision about radiation exposure and assist in protecting you and your family's health and wellness.

Radiation is a natural part of our world. From the time when the earth was first formed and began to cool, radiation has been present. We receive radiation from many sources in our environment (both man-made and natural).

The amount of radiation a person receives is called the "dose" and is measured in standard units called rems. The term rem refers to the biological effect of radiation upon humans. According to the Health Physics Society, an average person in the U.S. will receive a dose of 300 mrem (300 thousandths of 1 rem) from natural background sources each year. Many of us receive additional radiation for medical reasons such as dental or chest x-rays.

For purposes of comparison, the average dose from one chest x-ray is from 2 to 3 mrem (2 to 3 thousandths of 1 rem). Radiation can also be received from natural sources such as rocks, sand, consumer products and the sun. Additional exposure is quite possible from working with radioactive materials or machines that produce radiation.

Radiation is used to greatly benefit humankind in the diagnosis, relief and/or cure of certain diseases and disorders. It has also been known for many years that high doses of radiation have adverse effects on living organisms.

The first trimesters (3 months) of a pregnancy are the most important to the developing child and its relationship to radiation exposure. Researchers have shown that the radio sensitivity of cells to damage is related to their reproductive activity and how rapidly the cells are dividing and growing into specialized cells. Thus, we see that children can be expected to be more radiosensitive than adults, fetuses (about 8 weeks to birth) are more sensitive than children, and embryos (conception to about 8

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weeks) even more sensitive. Exposure of the abdomen of the pregnant worker to penetrating radiation from either external or internal sources exposes the developing child.

Various processes at Freeport McMoRan Copper & Gold Morenci utilize radiation and/or machines that produce radiation. Employees who work in these areas are provided a greater possibility of personal exposure to radiation than in some of the other work environments at FMI. Freeport McMoRan is committed to keeping all occupational exposures (including exposure to a fetus) to levels that are as low as reasonably achievable. This is also known as the ALARA concept or philosophy.

Radiation workers are allowed to legally, with expectations of good health, receive up to 5000 millirem in any one year. Additionally, the revised Code of Federal Regulations (effective January 1, 1994) set a limit for exposure of an unborn child to man-made radiation at 500 millirems for the entire gestation period. FMI recognizes the need for this standard and is committed to remain in compliance with the standard. However, the dose limit of 500 millirems is for the embryo/fetus of a pregnant worker who makes a written declaration of her pregnancy and the estimated date of conception. Once declared, separate records will be maintained for the expectant mother. From that point to the end of the pregnancy, the RSO, the employees supervisor and the employee will work together to limit exposure during the entire period of gestation to 500 millirem or less. Monthly dosimeter badges will be used to track the dose absorbed more efficiently.

If the radiation levels in the working area are such that the embryo/fetus could receive 500 or more millirem before birth, these are some of the workers alternatives:

1. Decide not to continue assignments in that area. If a worker declares herself as being pregnant, the workers job assignments will not include duties that will expose the worker to more than a time weighted average of 500 millirems per 9 month gestation.
2. Reduce the exposure where possible by decreasing the amount of time spent in the radiation area, increasing the distance from the source, and using protective shielding.
3. Ask the supervisor for other duties that do not include any possible exposure to radiation.

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4. Delay having children until you are no longer working in an area where the radiation dose to the embryo/fetus could exceed 500 millirem.
5. Continue working in the radiation area, but with full awareness that you are doing so at an increased risk for your unborn child. This option is strongly opposed by FMI and is not condoned in any way by Freeport McMoRan or any of its officers, employees, agents or representatives.

IT'S YOUR DECISION

The following facts are offered by governing agencies to help in the decision making process:

- A. The first three months of pregnancy are the most critical. Decisions should be made quickly. Women should keep their exposures to radiation ALARA during the entire period of the pregnancy. The result will be minimal exposure to the fetus. Under no circumstance should any exposure during a pregnancy meet or exceed 500 millirems.
- B. The current occupational exposure limits are such that the actual risk to the unborn child is minimal.
- C. Sterility (or the loss of the ability to bear children) should not be a concern so long as the occupational exposure limits are not exceeded. The amount of radiation that would cause that effect is at least 100 times greater than the occupational exposure limits.
- D. If you were to work in an area where you received 500 millirem in a three month period, in nine months you could receive 1500 millirem. This exceeds the full-term limit as established in the Code of Federal Regulations by 1000 millirem. Therefore, if you become a Declared Pregnant Worker (DPW), be aware that the 500 millirem limit applies to the full period of the pregnancy.

Control measures of time, distance and shielding must be implemented to reduce your

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- exposure. Additionally the frequency of monitoring will be increased to a monthly basis in order to catch any exposure before the exposure is at or near 500 millirems.
- E. Special considerations should be used in the x-raying of pregnant women. Physicians should make sure that only absolutely essential exams should be conducted during pregnancy.