

Revision No. 4	03 / 2007	Page 1 of 5
Kennecott Utah Copper Corporation Safety and Health Standards		Standard No. 10.5 Radiation

10.5.1 **INTRODUCTION**

10.5.1.1 Radioactive materials and radiation generators, which include both ionizing and non-ionizing radiation, are used at KUCC. It is the policy of KUCC to comply with applicable Federal and State regulations regarding radioactive devices and ensure that employees, contractors and third parties will not suffer adverse health effects from radiation. KUCC programs strive to maintain ionizing and non-ionizing radiation exposures "As Low As Reasonably Achievable" (ALARA).

10.5.2 **DEFINITIONS**

DESIGNATED WORKER - A person whose exposure may exceed 5 mSv (500mrem) per annum.
DOSE EQUIVALENT - The product of the absorbed dose in tissue. The units of dose equivalent are the Sievert (Sv) and rem (1Sv = 100 rem).
IONIZING - A general term applied to both electromagnetic waves and/or particulate radiation capable of producing ions by interaction with matter
RSO – Radiation Safety Officer

10.5.3 **REQUIREMENTS**

10.5.3.1 A RSO will be designated who, by experience and special training, is competent in health and safety as it relates to ionizing radiation safety.

10.5.3.2 The RSO will assess and communicate the risk associated with ionizing and non-ionizing radiation exposure to the Area Managers. Each Area Manager will then develop a site inventory list. The list must include radiation source type (i.e. XRF tube, isotope, etc.), type of radiation (i.e. X-ray, Gamma ray, etc.), activity/energy (i.e. Curies, KeV, etc.) and source location (i.e. Copperton grinding, etc.). The RSO is responsible to maintain the KUCC inventory of all radiation material that has a potential for adverse health effect.

10.5.3.3 The RSO shall maintain the Radiation Management Guide and document an audit of the radiation protection program content and implementation annually. The Kennecott Utah Copper Radiation Management Guide: An ALARA Program will meet all Utah Division of Radiation Control and Rio Tinto requirements.

10.5.3.4 The KUC Radiation Management Guide contains:

- Types of radiation sources, adequately characterized and described
- Defines how exposures can be reduced to as low as reasonably achievable (ALARA)
- Complies with all relevant requirements in the Rio Tinto Occupational Health Standards

References: KUCC Radiation Management Guide Title 10 CFR, Part 19, 20, 30, and 31. Utah Radiation Control Regulations R313-15, R313-40. KUCC Utah Radioactive Material Licenses Rio Tinto Occupational Health Standard B5 Radiation					
Signatures					
Original signed by: Frank Klobchar	5/11/07	Original signed by: R. McGowanJackson	5/23/07	Original signed by: Bill Champion	5/24/07
_____ Standards Committee Chairman	_____ Date	_____ General Manager HSEQ	_____ Date	_____ President, KUCC	_____ Date

- Defines chain of responsibility with duties and responsibility documented
- Educational requirements for employees and contractors
- Surveyed radiation areas and quantification of exposure sources/levels
- Exposure and medical monitoring programs based on established investigation levels
- Transportation requirements of radioactive materials
- Waste monitoring and disposal program
- Feedstock and equipment checks for naturally-occurring ionizing radiation
- Clearance and control procedures for all materials/equipment leaving site (including scrap)
- Leak (wipe) tests on sealed radioactive containing equipment
- Mine ventilation with specific reference to radiation protection (for underground mines)
- Water management and air emission control
- Lock-out procedures for vessels and equipment containing radioactive sources
- Emergency procedures
- Environmental impact risk assessment (air, water, waste, foods, etc)
- Product/waste life cycle control
- Dose assessment for employees
- Basic Training information

- 10.5.3.5 Where it is likely that the 95 percentile value of an ionizing radiation exposure mean calculated final total body dose exceeds 5 mSv (500 mrem) per annum, the area must be identified and mapped, signposted or otherwise clearly communicated to employees working in the area. Areas with ionizing radiation with annual doses greater than 15 mSv (1500 mrem) must be designated as restricted access areas.
- 10.5.3.6 Engineering controls are required in designated restricted areas.
- 10.5.3.7 Each person whose potential exposure exceeds 5 mSv (500 mrem) per annum or who is a designated radiation worker must undergo periodic personal radiation monitoring and medical examination that is reviewed by the medical adviser. The results must be discussed with the worker.
- 10.5.3.8 A Radioactive Material Operational Document must be completed by individuals, who wish to move, relocate or purchase radioactive materials or devices containing radioactive materials prior to moving or requisitioning of such devices. The document (Exhibit 10.5.1) must be forwarded to the RSO for approval and sign off in advance. The operational document will include the following items.
- A Description of the proposed operation in which radioactive materials will be used
 - Source serial number, activity and isotopes to be used.
 - Names of the personnel involved in the operation and the person in charge.
 - Area and location where the installation, removal or relocation will be performed.
 - Safety procedures and equipment to be used (including monitoring devices)
 - Start date and end date.
 - Approval signature of the RSO.
- 10.5.3.9 The RSO will determine the need for exposure monitoring of personnel.
- 10.5.3.10 An isolation procedure is required to assure that high voltage analytical equipment is de-energized and the gauge shutter mechanism is locked in the closed position during periods when a portion of an individual's body may be subject to the direct radiation beam. Interlock systems must be inspected and maintained. (See Safety and Health Standard 16.12)
- 10.5.3.11 Employees with a potential for exposure to radiation must be trained in the concepts of time, distance, and shielding to reduce the potential for exposure to radiation. (See KUC Radiation Management Guide and training information).

- 10.5.3.12 The RSO or a designated alternate (authorized by the RSO) shall make inventory inspections that account for each radioactive source and test the operation of the shutter (at least every six (6) months) at each facility where sealed radioactive materials are used or stored. (See the KUC Radiation Management Guide.)
- 10.5.3.13 Leak-test (wipe) surveys must be conducted by the RSO or designated individual at appropriate frequencies as determined by the RSO. (See the KUC Radiation Management Guide.)
- 10.5.3.14 Any damage to an instrument or a source container must be reported to the RSO immediately.
- 10.5.3.15 Each radiation source container must be marked with a clearly visible label bearing the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL".
- 10.5.3.16 Rooms containing analytical X-ray equipment shall be conspicuously posted with a sign bearing the radiation symbol and the words "CAUTION X-RAY EQUIPMENT".
- 10.5.3.17 Sealed radiation sources not in service will be stored in a designated locked storage facility. The Storage facility must be labeled with a sign bearing the radiation symbol and the words "CAUTION, RADIOACTIVE MATERIAL". The storage facility must be located away from high traffic areas and accessed only by those authorized by the RSO.
- 10.5.3.18 In the case of a fire, explosion or other event that damages a sealed source container, the area supervisor must first minimize exposure to people. The principles of distance, shielding and time must be incorporated in his actions.
- First remove people working in the immediate area
 - Isolate the damaged instrument
 - Prevent others from entering
 - Contact the RSO immediately
 - Refer to the KUC Radiation Management Guide.
- 10.5.3.19 Underground operations must initially conduct a baseline radon survey using passive area monitoring techniques, and conduct similar surveys once every two years. Areas with levels greater than the ICRP Action levels must be designated as restricted access or controlled areas.
- 10.5.4 **RECORDS**
- 10.5.4.1 The following records are required by the KUCC Radiation Program.
- Inventory List of all types of Radiation sources by Plant (maintained by RSO)
 - Risk assessment document (maintained by RSO)
 - Licenses and Amendments (maintained by RSO)
 - Six-month Inventory Inspections (maintained by Area Managers and the RSO)
 - Leak (wipe) test results (maintained by RSO)
 - Operational Documents (maintained by RSO)
 - Radiation Management Guide (maintained by the Area Manager and RSO)
 - Annual Program Audit (maintained by the RSO)
 - Training records (maintained by the Area Manager)
 - Employee medical records (maintained by the Medical Department)
 - A register of the Radiation regulations (maintained by the RSO)
 - Survey meter calibration certificates (maintained by Responsible Individuals and the RSO)
 - RSO training records and certificates (maintained by Responsible Individuals and RSO)
 - Exposure monitoring data (maintained by Area Manager and RSO)
 - All disposal records (maintained by RSO)

10.5.5 **TRAINING**

10.5.5.1 All personnel who operate X-ray analytical/medical equipment or who may open or close a fixed gauge shutter or remove and/or relocate a fixed gauge must receive specific training. The training must include KUCC radiation standard operating procedures, emergency procedures and the contents of the KUC Radiation Management Guide.

10.5.6 **RESPONSIBILITIES**

10.5.6.1 The Area Manager is responsible to ensure that an inventory inspection (as defined by the RSO) is completed and documented at least every six (6) months unless environmental conditions require more frequent inspections.

10.5.6.2 The primary responsibility for radiation safety lies with the individuals who use radiation equipment and radioactive materials. By-products, special nuclear materials, X-ray equipment or devices containing sealed radioactive materials shall be used only by or under the direct supervision of individuals authorized by the Radiation Safety Officer.

10.5.6.3 Supervisors or Responsible Individuals who maintain instruments used for quantitative radiation measurements (i.e. survey meter) are responsible for calibration. Instruments must be calibrated at intervals not to exceed 12 months.

10.5.6.4 The RSO or designated alternate (authorized by the RSO) is responsible for the following:

- Notify the Utah Division of Radiation Control in a timely manner if an instrument or a source container is damaged.
- Maintain a KUCC radiation inventory list and a list of authorized individuals.
- Assess and communicate the risk associated with ionizing and non-ionizing radiation exposure to the Area Managers.
- Maintain all records required by the General and Specific Licenses.
- Conduct leak-test surveys at appropriate frequencies.

REVISION HISTORY

Revision #	MOC#	Description of Change	Prepared By	Date
4	TS00116	General review and revision of standard	KUCC Safety and Health Standards Committee	03 / 2007

RADIOACTIVE MATERIAL OPERATIONAL DOCUMENT

Check One: Installation Removal Relocation

Has a MOC been completed? Yes No

If yes MOC # _____

Source Serial Number: _____ Activity: _____ Isotope: _____

Proposed Operation: _____

Employees Involved: _____ Contractor: _____
(Person In Charge)

Area and Location Work Will Be Performed: _____

Monitoring Equipment Used: _____

Start Date: _____ End Date: _____

Radiation Safety Procedures: _____

RSO Signature: _____

The "person in charge" shall complete this document each time a radioactive source is installed, removed or relocated. An RSO must sign each document prior to work commencing.

Copies: RSO
Facility Safety Engineer