PIÑON RIDGE MILL

HEALTH AND SAFETY PLAN

MONTROSE COUNTY, COLORADO

ENERGY FUELS RESOURCES CORPORATION
31525 Highway 90
Nucla, Colorado 81424

October 2010

Prepared by Energy Fuels Resources Corporation

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Attachments

Master Procedure List

Procedure Number	Procedure Name	Latest Revision Date	Latest Revision Number
Administrative Procedures			
AD020	Preparation, Control, and Distribution of Procedures	10/13/2010	0
AD030	Organization	10/13/2010	0
AD040	Radiation Protection Program Performance Review	10/13/2010	0
AD060	Training Records Documentation and Tracking	10/13/2010	0
AD080	As Low As Reasonably Achievable (ALARA)	10/13/2010	0
AD090	Accident Investigation	10/13/2010	0
AD100	Job Safety Analysis	10/13/2010	0
AD110	Contractor Requirements	10/13/2010	0
AD120	Drug Policy	10/13/2010	0
General Health and Safety Procedures			
HS010	Safety Meetings	10/14/2010	0
HS020	Bloodborne Pathogen Exposure	10/14/2010	0
HS030	Hearing Conservation	10/14/2010	0
HS040	Vehicles and Mobile Equipment	10/14/2010	0
HS050	Confined Space Entry	10/14/2010	0
HS060	Electrical Safety	10/14/2010	0
HS070	Excavation and Trenching	10/14/2010	0
HS080	Fall Protection	10/14/2010	0
HS090	Flammable Materials Storage	10/14/2010	0
HS100	Ladders and Scaffolding	10/14/2010	0
HS110	Lockout/Tagout	10/14/2010	0
HS120	Hand and Power Tools	10/14/2010	0
HS130	Respiratory Protection – Use And Fit Test	10/14/2010	0
HS131	Respiratory Maintenance, Inspection, Cleaning and Storing	10/14/2010	0
HS132	Medical Evaluation for Respirator Use	10/14/2010	0
HS140	Air Quality Surveys - Non-Radiological	10/14/2010	0

Master Procedure List (continued)

Procedure Number	Procedure Name	Latest Revision Date	Latest Revision Number
Radiological Health and Safety Procedures			
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RH020	Decontamination	10/13/2010	0
RH030	Posting	10/13/2010	0
RH040	Radiation Exposure Action Levels	10/13/2010	0
RH050	Uranium Bioassay	10/14/2010	0
RH060	Radiation Work Permits	10/14/2010	0
RH070	Release of Equipment to Unrestricted Areas	10/13/2010	0
RH100	Shipment of Yellowcake, Ore or Contaminated Equipment by Truck	10/14/2010	0
RH110	Beta and/or Gamma Exposure Rate Surveys	10/14/2010	0
RH120	Alpha and Beta-Gamma Contamination Surveys	10/13/2010	0
RH130	Occupational General Air Particulate Survey	10/13/2010	0
RH140	Radon -222 Decay Product Surveys	10/14/2010	0
RH150	Occupational Breathing Zone Monitoring	10/13/2010	0
RH151	Calibration of Air Samplers Using the Bubble Method	10/14/2010	0
RH160	Source Leak Test, Shutter Test, and Inventory	10/14/2010	0
RH170	Nuclear Density Gauges	10/14/2010	0
RH200	Personnel Release Surveys	10/14/2010	0
RH210	Personal Radiation Dosimeters	10/14/2010	0
RH300	Radiation Dose Calculations	10/14/2010	0
RH301	Worker Exposure to Long-lived Radionuclides in Airborne Particulate Matter	10/14/2010	0
RH302	Radionuclide Concentrations in Air Samples	10/14/2010	0
RH303	Dose Calculation Spreadsheets	10/14/2010	0
RH310	Declared Pregnant Worker	10/14/2010	0

Master Procedure List (continued)

Procedure Number	Procedure Name	Latest Revision Date	Latest Revision Number
Environmental Monitoring Procedures (See Operational Monitoring Plan)			
EV010	Environmental Dose	7/25/09	0
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EV021	High Volume Air Sampler Calibration	7/25/09	0
EV030	Radon 222	8/20/09	0
EV060	Vegetation Sampling	8/17/09	0
EV070	Environmental TLD	8/20/09	0
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EV120	Radon Flux	8/20/09	0
EV130	Weather Monitoring	8/20/09	0
Security Procedures (See Security Plan)			
SP010	General	TBD	0
SP020	Hourly Employees	TBD	0
SP030	Entrance Authorization	TBD	0
SP040	Visitors	TBD	0
SP050	Vehicle Policy	TBD	0
SP060	Property Removal	TBD	0
SP070	Telephone Messages	TBD	0
SP080	Radiation Safety	TBD	0
SP090	Bomb Threat	TBD	0
SP100	Payroll Distribution	TBD	0
SP110	Drug and Alcohol Abuse	TBD	0
SP120	Unauthorized Entry	TBD	0
SP130	Yellowcake Shipment	TBD	0
SP140	Emergencies	TBD	0
SP150	Entrance Through Electronic Gate	TBD	0
SP160	General Controls for Access	TBD	0
SP170	Waiver and Release Form	TBD	0

Acronym List

A	Area
ACGIH	American Conference of Governmental Industrial Hygienists
AL	Action Level or airline (respirator)
ALARA	As Low As Reasonably Achievable
ALI	Annual Limit on Intake
ANSI	American National Standards Institute
APF	Assigned Protection Factor
BP	Barometric Pressure
Bq	Becquerel
BZ	Breathing Zone
CACP	Company-Approved Competent Person
CDPHE	Colorado Department of Public Health and Environment
CEDE	Committed Effective Dose Equivalent
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CF	cubic foot
cfm	cubic feet per minute
Ci	Curie
cm	centimeter
cpm	counts per minute
d	days
DAC	Derived Air Concentration
DDE	Deep Dose Equivalent
DOT	Department of Transportation
dpm	disintegrations per minute
ED	Effective Dose
EDE	Extremity Dose Equivalent
EDTA	Ethylenediaminetetraacetic Acid
EFR	Energy Fuels Resources Corporation
EPA	U.S. Environmental Protection Agency
FF	Full Face
g (gm)	gram
HazCom	Hazard Communication
HBV	Hepatitis B Virus
HCP	Hearing Conservation Program
HF	Half Face
Hg	Mercury
HIV	Human Immunodeficiency Virus
HR	Human Resources

Acronym List

IARC	International Agency for Research on Cancer
ICRP	International Commission on Radiological Protection
IDLH	Immediately Dangerous to Life and Health
kV	Kilovolt
L	liter
LDE	Lens Dose Equivalent
LEL	Lower Explosive Limit
LLD	Lower Limit of Detection
lpm	liters per minute
LPN	Licensed Practical Nurse
MDA	Minimum Detectable Activity
MEC	Minimum Explosive Concentration
ml (mL)	milliliter
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
NEC	National Electrical Code
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards & Technology
NRC	U.S. Nuclear Regulatory Commission
NTP	National Toxicology Program (U.S. Department of Health and Human Services)
NUREG	U.S. Nuclear Regulatory Commission Guidance Document
NVLAP	National Voluntary Laboratory Accreditation Program
O2	Oxygen
ODE	Organ Dose Equivalent
OPIM	Other Potentially Infectious Material
OSHA	Occupational Safety and Health Administration
OSL	Optically Stimulated Luminescent Dosimeter
PAS	Personal Air Sampler
PEL	Permissible Exposure Limit
PPE	Personal Protection Equipment
ppm	parts per million
psi	pounds per square inch
QA	Quality Assurance
Ra	Radium
RCRA	Resource Conservation and Recovery Act
RDP	Radon Decay Products
Rn	Radon

Acronym List

RN	Registered Nurse
RSO	Radiation Safety Officer
RST	Radiation/Security Technician
RWP	Radiation Work Permit
SCBA	Self-Contained Breathing Apparatus
SDE	Shallow Dose Equivalent
SSTF	Sample Submittal and Tracking Form
Sv	Sievert
TBq	Terabecquerel
TEDE	Total Effective Dose Equivalent
TGAC	Total Gross Alpha Activity Concentration
Th	Thorium
TLD	Thermoluminescent Dosimeter
TLV	Threshold Limit Value
TWA	Time Weighted Average
U	Uranium
U3O8	Uranium Oxide (Yellowcake)
WL	Working Level
WLM	Working Level Month
yr	year
μg	microgram
°C	degrees Celsius
°F	degrees Fahrenheit

Safety Policy Statement

It is Energy Fuels Resources belief that our people are our most important asset and that the preservation of employee Safety and Health must remain a constant consideration in every phase of our business. It is our intent to provide a work environment as free of hazards as possible.

All employees are responsible for working safely and productively, always remaining aware of hazards in their jobs and following recognized safe work practices, including the use of Personal Protection Equipment (PPE).

It is also Energy Fuels Resources belief that any Health and Safety Program must have total employee involvement. Therefore this program has management's highest priority, support, and participation.

PRODUCTION IS NOT SO URGENT THAT WE CANNOT TAKE TIME TO DO OUR WORK SAFELY.

Stephen P. Antony,
Executive Vice President, Chief Operating Officer

Responsibilities

Safety Department

Responsible for developing and maintaining the Health and Safety Plan which represents Energy Fuels Safety Program. The Safety Department shall provide support and resources, as required, to assist in implementation and verification of this program.

Safety Committee

Responsible for assessing conditions in the Mill to evaluate if actions can be taken to reduce personnel and environmental doses to levels that are As Low As Reasonably Achievable (ALARA).

Managers and Supervisors

Responsible and accountable for implementing and maintaining safe operation of activities over which they have control, and ensuring immediate corrective actions are taken to eliminate or control hazards.

Employees

Responsible and accountable for the safety of their own actions, the use of safety devices and personal protective equipment, and for complying with safe practices and approved procedures. Work-related accidents, incidents, injuries, illnesses, and near misses shall be reported to supervisors as soon as practicable.

1.0 Introduction

The Piñon Ridge Mill is committed to the protection from accidental loss of all its resources, including employees and physical assets. In fulfilling this commitment to protect both people and property, Energy Fuels Resources Corporation (Energy Fuels) will provide and maintain a safe and healthful work environment in accordance with current industry standards and compliance with legislative requirements. We will strive to eliminate any foreseeable hazards which may result in fires, security losses, property damage accidents, and personal injuries or illnesses.

All personnel (including employees, visitors and contractors) will be responsible for minimizing accidents within our facilities. Job practices and procedures are defined in the Health and Safety Plan for all employees to follow. Accidental loss can be controlled through good management in combination with active personnel involvement. Loss prevention is the direct responsibility of all managers and employees alike.

This plan has been prepared to inform Mill personnel of the rules, procedures and work practices that are designed to keep them and their fellow workers from being injured. The procedures in this plan relate directly to health and safety. This plan should be used in conjunction with other procedures that are in place at the Mill presented in the following plans:

- Emergency Response Plan
- Material Containment/Spill Prevention Control and Countermeasure Plan
- Security Plan
- Operational Monitoring Plan

We place personnel safety above every other consideration. It is the policy of Energy Fuels Resources to provide all Mill personnel with the working conditions and procedures necessary to make a safe work place and that everyone be allowed sufficient time to do their work safely.

The safe practices and work procedures outlined in this plan were derived from actual experiences, and are the results of joint cooperation by many individuals who have worked in the industry in an attempt to establish a sound set of rules for safe conduct. These procedures consist essentially of the application of “best industry practices”, good judgment and common sense.

If Mill personnel do not understand a work rule or procedure, they should ask their supervisor to explain it to them. Mill personnel are responsible for a thorough knowledge of all the rules which apply to the work they are doing. They may be given an examination at any time to test their knowledge of the applicable rules.

Disregard for or violation of any of these rules may result in a serious or fatal injury to Mill personnel or their fellow employees. Compliance with the safety rules is a condition of employment. Violation can result in a disciplinary action, up to and including discharge.

Preparing and distributing this plan will not in itself make the Mill safe. The Mill can only be made safe by the efforts of Mill personnel and their application of these rules.

OUR GOAL IS TO ELIMINATE ACCIDENTS.

The Health and Safety Plan presents the following information:

- Guidelines for reporting unsafe conditions in the workplace (Section 2.0)
- Company policy on employee conduct (Section 3.0)
- Use of personal protection equipment (PPE) (Section 4.0)
- Health and safety programs and procedures (Section 5.0)
    - HazCom Program (Attachment A),
    - Administrative Procedures (Attachment B),
    - General Health and Safety Procedures (Attachment C), and
    - Radiological Health and Safety Procedures (Attachment D).
- Mill safety personnel organizational structure (Section 6.0)
- Radiation Work Permits (Section 7.0)

2.0 Reporting Unsafe Work Conditions

Mill personnel have a responsibility to themselves and their fellow coworkers to make the Mill a safe environment. A primary tenet in making the workplace safe is identifying unsafe conditions before an injury, illness or fatality occurs. As such, it is the responsibility of all management and operational personnel to:

- Correct or report all unsafe conditions to a supervisory person or to the Safety Department as soon as possible.
- Report all injuries, no matter how slight, to a supervisor immediately. Also report all accidental occurrences or conditions that may have a potential for injuring someone. If you wish to see a physician for any occupational injury or illness, contact your supervisor for an authorization slip before seeing the doctor.

3.0 Employee Conduct

The conduct of Mill employees significantly affects the overall safety of all those working and visiting the Mill. For this reason, Mill employees will be subject to disciplinary action, up to and including discharge, for any of the following safety offenses.

- Violation of any safety rule.
- Smoking on Mill property. It is the policy of Energy Fuels to prohibit smoking in the restricted area and all indoor enclosed areas in order to provide and administer a safe and healthy environment for all employees. Smoking is permitted in outdoor areas outside of the restricted area such as parking lots and in vehicles (provided the vehicle is outside the restricted area).
- Entering the Mill site while under the influence of liquor or illegal drugs, or having them in your possession while in the Mill site.
- Fighting, wrestling, or engaging in "horseplay" such as water fighting while on the premises.
- Removing without authority or destroying or tampering with any safety device, sign, signal or sampling equipment.
- Removal of any company property without specific written authorization.
- Carrying firearms into the Mill area without specific written permission.
- Giving false information or testimony during investigation of incidents.
- Eating, drinking and chewing in the restricted area of the Mill; except in areas designated by the Radiation Safety Officer (RSO).
- Failure to properly perform radiological surveys/scans of equipment or personnel when leaving the restricted area of the Mill.

4.0 Personal Protection Equipment

Although use of engineering controls and administrative procedures are the primary methods to be used at the Piñon Ridge Mill to maintain exposures to hazardous materials and safety related risks as low as is reasonable achievable, Personal Protection Equipment (PPE) is a useful method of protection in hazardous environments and is required to be worn at all times in the restricted area of the Mill (except where noted below). In addition, PPE is required for specific activities that are conducted on the Mill property. Mill personnel have a responsibility to make their supervisor aware of any situation in which they feel the provided PPE is inadequate or malfunctioning for any reason. The following guidelines shall be followed in regards to PPE:

- Hard hats, safety shoes, and safety glasses with side shields must be worn at all times in the plant area; except in the control rooms, offices and change rooms.
- Contact lenses may be allowed for use on-site on a case-by-case basis as approved by the RSO or his designee.
- "Bump" caps and metal hard hats are not allowed.
- Other PPE may be required based on the location and nature of the work being performed including, but not limited to ear plugs, respirators, rain gear, welding helmets, goggles, gloves, rubber boots, face shields and safety belts. If an employee has doubt regarding the adequacy of PPE provided, they will contact their supervisor.
- Each employee is responsible for the condition of their PPE which shall be inspected prior to each use. Defects in the PPE will be immediately reported to a supervisor.
- The following equipment is required when working on pipelines or vessels containing acids or caustics:
    - Face shield and/or chemical splash goggles.
    - Rubber coat and pants.
    - Rubber gloves and rubber boots.
    - Other equipment specified by the RSO, Alternate RSO, Plant Manager, or Foreman for that particular job.
- Hair that extends below the T-Shirt collar or extends two inches laterally from the head (on a natural lay) must be contained by a net or other adequate means.
- Unusually large or protruding rings or other hazardous items of jewelry shall not be worn except while working in the Administration Building.
- The use of a safety belt and properly adjusted life line is required where there is a danger of falling six feet or more except while performing work under the ladder and scaffolding procedure in this plan. This rule applies when going beyond the handrails of walkways and on top of any tanks at the Mill.

- Proper clothing shall be worn at all times. Loose, ragged clothing which could create a hazard will not be allowed on the job. Sleeveless shirts are not to be worn on the job.
- It is a condition of employment that all personnel who may be required to wear a respirator must be clean shaven to assure that the respirator fits properly. Personnel will be fully trained and must be medically approved prior to using respirators.

The PPE required for specific tasks is defined in employee training, health and safety procedures and/or radiation work permits.

5.0 Health and Safety Procedures

The procedures developed for the Piñon Ridge Mill include a variety of processes that are performed at the Mill. The procedures are divided into six categories. The procedures presented in this plan relate to the Hazard Communication Program, Administrative Procedures, General (non-radiological) Health and Safety Procedures, and Radiological Health and Safety Procedures. Environmental Procedures and Security Procedures are presented in the Operational Monitoring Plan and the Security Plan, respectively.

The six categories of procedures used at the Mill are:

Hazard Communication (HazCom) Program – Includes the training, labeling and other ways in which Mill workers, contractors and visitors are advised about the hazardous chemicals are to be stored, used, or produced on the Piñon Ridge Mill site.

Administrative Procedures - Includes corporate policy, administration of the procedures manual itself, Mill organization, conduct of audits, recordkeeping, project evaluation, and material acceptance processes.

General Health and Safety Procedures – Includes health and safety practices that do not necessarily include radiological materials such as safety meetings, occupational safety, trade safety, respiratory protection, confined space entry, and non-radiological air quality.

Radiological Health and Safety Procedures – Includes radiological training, bioassays, instrument calibration, occupational monitoring, radiological surveys of equipment and personnel, and calculation of occupational doses.

Environmental Procedures – Includes sampling of environmental media including air, water, vegetation, and soil. The process for calculating environmental dose is also described in this section. These procedures are provided in the Operational Monitoring Plan.

Security Procedures – Includes procedures that security personnel use for site access control, employee relations, yellowcake shipment, emergencies, and bomb threats. These procedures are provided in the Security Plan.

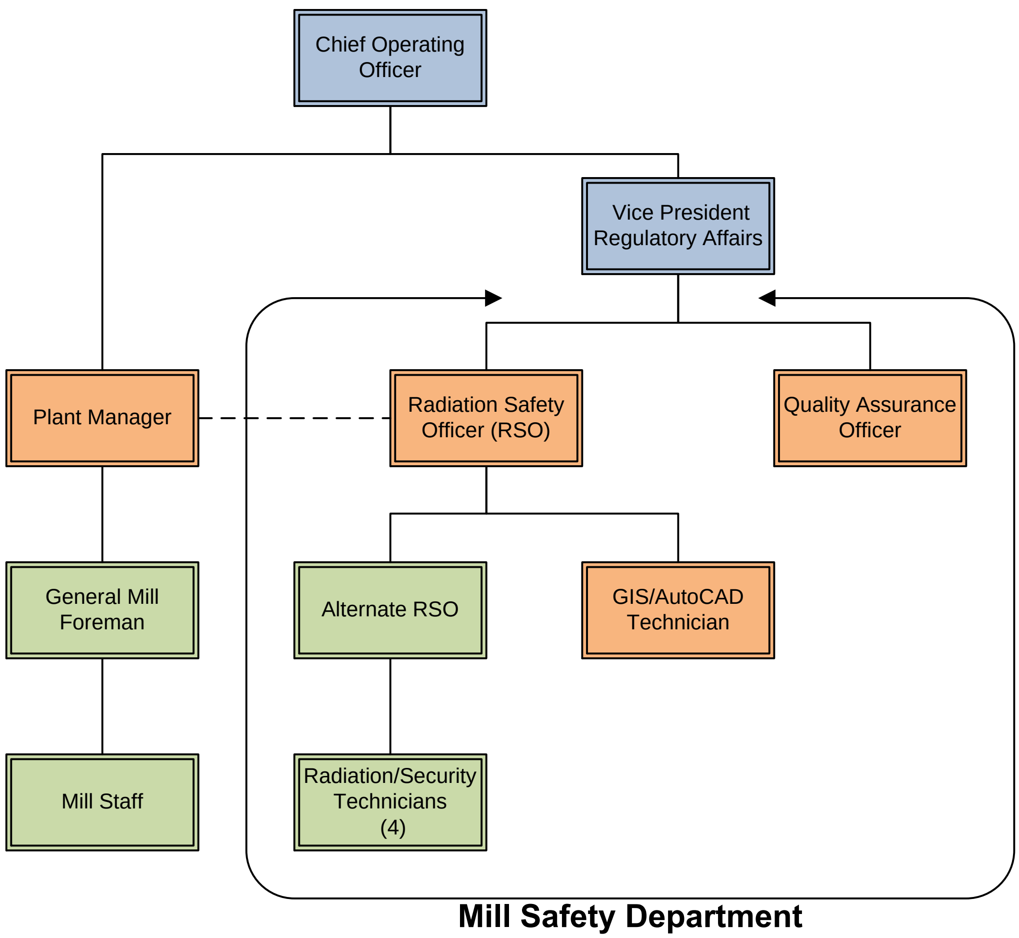
When the Health and Safety Plan or a procedure requires a revision, the person responsible for supervising the activities covered by the procedure initiates the change in accordance with Procedure AD -020, Preparation, Control, and Distribution of Procedures. Following final approval of the procedure, the procedure is issued a new revision number and date. The revised procedure is then distributed to affected Mill personnel as soon as practical and training materials are updated to reflect the revisions made, as necessary. Additionally, the RSO will determine if immediate re-training of affected personnel is necessary.

All procedures are retained on file for the active period of the CDPHE radioactive material license. In practice, nearly all records will be retained for the duration of the Piñon Ridge Mill radioactive material license and well beyond. This is necessary for the purposes of determining the liability during and after the lifetime of the Mill. For example, radiation doses of workers may need to be verified and/or recalculated in response to an employee's health issues later in life. This would require access to the employee's records of their training and where and when they worked as well as the supporting data that was used to calculate the employee's dose.

6.0 Mill Health and Safety Personnel

6.1 Health and Safety Department

The Health and Safety Department consists of Mill personnel responsible for day-to-day health and safety of operations. The organizational chart below illustrates the Health and Safety Department positions and where they are in the Mill organizational structure.



6.2 Safety Committee

The Mill Safety Committee is responsible for assessing conditions in the Mill to evaluate if actions can be taken to reduce personnel and environmental doses to levels that are As Low As Reasonably Achievable (ALARA). The Safety Committee consists of the Mill Manager, the RSO, the Alternate RSO, a foreman, and an hourly employee from both Operations and Maintenance.

The Safety Committee is responsible for evaluating the overriding principles and justification of any proposed or ongoing activity. The committee's objectives include optimization of the activity in relation to potential dose and dose limitation. Based on their review, the Safety Committee may recommend modifications and improvements to operations, facilities, equipment and personnel utilization. The review process will consist of aspect definition, listing the pros and cons, screening the pros and cons using applicable laws, regulations and regulatory guidance documents, recommending action on an aspect, and follow-up on a recommended action. The Safety Committee meets at a minimum on a monthly basis and more frequently if necessary to address ad-hoc issues at the discretion of the RSO.

7.0 Radiation Work Permits

A Radiation Work Permit (RWP) is required for any work with radioactive materials which has not been described in a written operating or maintenance procedure. Operations that may require a RWP include:

- Work on equipment (pumps, piping etc) in the near vicinity of any unshielded (shutter open) nuclear source.
- Work on the bag houses or pollution control equipment which may contain radioactive material.
- Work involving processing equipment, e.g. work in a tank containing or suspected to contain concentrated uranium (yellowcake or pregnant solution) in a dry form or in such a form that contamination by ingestion or inhalation of radioactive materials could occur.
- Response to spills and/or other unplanned events involving the potential for exposure to radioactive material
- Work as may be directed by the RSO or the Alternate RSO to ensure ALARA.

The detailed procedure for requesting, producing and issuing a RWP is presented in Procedure RH-060 in Attachment D. Prior to completing an RWP, a job safety analysis will have been performed in accordance with the Radiation Work Permits Procedure AD-100.

Attachment A

Hazard Communication Program

HAZARD COMMUNICATION PROGRAM

ENERGY FUELS RESOURCES

PIÑON RIDGE MILL

MSHA ID # TBD

October 2010

Energy Fuels Piñon Ridge Mill
Hazard Communication Program

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Appendices

1.0 GENERAL

Hazard Communication (HazCom) is the training, labeling and other ways that miners, mill workers, contractors and visitors are warned about the hazardous chemicals stored, used, or produced on the Piñon Ridge Mill site. All persons who come to this site have the "Right to Know" about any hazardous chemicals to which they may be exposed.

This written program complies with the Hazard Communication requirements of the Mine Safety & Health Administration (MSHA), 30 CFR Part 47.

The Radiation Safety Officer (RSO) is the person designated to coordinate the HazCom program at the Piñon Ridge Mill.

A list of the primarily hazardous chemicals stored at the Mill is provided in Appendix A.

1.1 Availability

A current copy of this written hazard communication program will be available in the following locations:

- Administration Building
- Change Room
- Warehouse
- Control Room

1.2 Applicability

This program is applicable to:

- All work areas of this Mill site.
- Every hazardous chemical brought to the Mill or produced at the Mill which the RSO has deemed to be hazardous based on the Hazard Determination Criteria; to which a person can be exposed under normal working conditions or in the event of an accidental spill or release and which is not exempted from the program by MSHA under 30 CFR Part 47.81.
- Every employee, contractor and their employees, visitor or any other person who could be exposed at the Mill site.

1.3 Tasks, Frequencies and Responsibilities

This written program should be reviewed at least annually to assure its accuracy. Every chemical brought onto the Mill property must be evaluated to determine if it is hazardous and to ensure that the label is legible and in English. A master inventory of hazardous chemicals will be maintained. Whenever a new chemical is brought onto the Mill site it will be added to the master inventory. If a chemical will no longer be used at the site it must be disposed of properly and removed from the master inventory. The RSO and Alternate RSO should coordinate this list.

If the chemical is hazardous, the Purchasing Agent or RSO should collect the Material Safety Data Sheets (MSDS) or request one from the supplier and distribute copies to the administration office, the warehouse and the portion of the Mill where the material will be handled. If the chemical is new to the Mill site, affected personnel must be trained in the safe handling and of the hazards associated with the chemical before it is used. The master inventory of hazardous chemicals should be checked to see if the new chemical is listed and, if it is not, it should be added by completing the appropriate forms and submitting them to the Safety Department.

The Safety Department will maintain current, legible and accessible MSDSs for each hazardous chemical in the master inventory. When a revised MSDS is received it must replace the outdated MSDS; damaged or illegible MSDS must be replaced; copies of revised or replacement MSDS must be distributed to all individuals who handle or use the chemical.

Labels on hazardous chemicals shall be checked prior to use for legibility and accuracy (chemical in the container must be the same as indicated on the label). This is the responsibility of all employees handling or using the hazardous chemicals. New labels must be requested from the Safety Department if the current label is in poor condition.

If a chemical is no longer on the site, the affected Mill personnel must be notified that the chemical's MSDS will be disposed of in 3 months. This will be done by the Safety Department.

2.0 DETERMINING CHEMICAL HAZARDS

Chemicals at the Mill site will be considered hazardous for the purpose of this program if the chemical has the potential to harm persons as indicated by any of the following:

- The chemical's label or MSDS indicates that it is a hazard.
- The chemical is produced at the Mill and scientifically valid evidence indicates that it can be a hazard to exposed persons.
- The chemical is a mixture produced at the Mill which contains at least 1% of a hazardous chemical or 0.1% of a carcinogen.
- The chemical is listed as hazardous or carcinogenic on any of the following lists:
  - MSHA standards in 30 CFR chapter 1
  - Occupational Safety and Health Administration (OSHA) "Toxic and Hazardous Substances"
  - American Conference of Governmental Industrial Hygienists (ACGIH) "Threshold Limit Values and Biological Exposure Indices"
  - U.S. Department of Health and Human Services, National Toxicology Program (NTP) "Ninth Annual Report on Carcinogens"
  - International Agency for Research on Cancer (IARC) "Monographs and Related Supplements" Volumes 1 through 77

If scientifically valid evidence is otherwise unavailable for a chemical produced at the Mill, the chemical must be tested to determine its physical and health hazards.

The RSO will decide whether a chemical at the Mill is within the scope of this program by addressing the following criteria:

- Does it have a warning label or an MSDS indicating a hazard?
- Can a person be exposed to it under normal work conditions, or if misused, or in the case of an accidental release or spill?
- Is it at least 1% of a mixture produced at this Mill, or if it is cancer-causing, does it make up at least 0.1% of a mixture?

If the answer is YES to any of these questions, and the material is not exempted by Section 3.0, it should be on the Mill's chemical list (see Appendix A).

3.0 CHEMICALS AND PRODUCTS EXEMPT FROM HAZCOM

The following chemicals (and substances) are exempt from the HazCom standard:

- An article is exempt from these HazCom standards if it:
  - Releases no more than insignificant amounts of a hazardous chemical, and
  - Poses no physical or health risk to exposed miners
- All biological hazards, such as poisonous plants, insects, and micro-organisms are exempt.
- Consumer products or hazardous substances regulated by CPSC are exempt if:
  - Personnel use it for the purpose the manufacturer intended, and
  - Such use does not expose personnel more often or for longer periods than ordinary consumer use
- Cosmetics, drugs, food, food additives, color additives, drinks, alcoholic beverages, tobacco and tobacco products, or medical or veterinary device or product, including materials intended for use as ingredients in such products (such as flavors or fragrances) are exempt when intended for personal consumption or use.
- All ionizing or non-ionizing radiation, such as alpha or gamma, microwaves or x-rays, are exempt. However the Mill-specific HazCom procedure requires labeling of chemicals and substances that are otherwise required to be labeled due to their hazardous nature to be labeled for radioactivity where appropriate.
- Wood or wood products are exempt if they do not release or otherwise result in exposure to a hazardous chemical under normal conditions of use (e.g. wood is not exempted if it is treated with a hazardous chemical or if it will be subsequently cut or sanded).

4.0 LIST OF HAZARDOUS CHEMICALS

Appendix A contains a current list of all hazardous chemicals used, stored, or produced at this Mill, including hazardous chemical waste. Each hazardous chemical on this property will be clearly identified in exactly the same way on the list, its container label, and its corresponding MSDS.

5.0 LABELING

The labeling system at this Mill is National Fire Protection Association (NFPA). Every hazardous chemical (as defined by the HazCom standard) at this Mill should normally be kept in the original container and have a label that:

- Clearly identifies it.
- Is legible, accurate, obvious and in English.
- Warns of specific hazards (such as flammability, skin irritation, cancer, etc.).

Employees will immediately report to their supervisor any container or bulk storage of chemicals found with a missing, defaced or illegible label. If the identity of the chemical is known with certainty, the Radiation/Security Technician (RST) will create or obtain a replacement label or temporary label before the chemical is next used. If the identity is not known with certainty, the RSO or Alternate RSO should be notified so that identification can be made or the chemical can be disposed of in a safe manner.

Pipes carrying chemicals will be labeled according to the latest version of ANSI A13.1 and A535.1. These standards include color coding, naming of components and flow direction.

If the chemical is an EPA regulated hazardous waste, it will be labeled in accordance with Resource Conservation and Recovery Act (RCRA) regulations. When a label or tag must be created on this mill property, use the format for an appropriate label in Appendix B.

6.0 EXCEPTIONS TO LABELING REQUIREMENTS UNDER HAZCOM

A placard, sign, process sheet, operating procedures, or other suitable alternative may be used instead of a label for bins, hoppers, tanks, or other stationary process containers that hold a hazardous chemical. The alternative must identify the container to which it applies and contain the same information as a label and be readily available to workers throughout the work shift and in the work area.

Portable containers (such as a glass beaker in the lab, or a pan of solvent or used oil in the shop) do not require a label if used during a single work shift and the user knows the identity of the chemical, its hazards, and any protective measures needed. However, before the end of the shift, that person must either place a proper label on the container, transfer any remaining chemical in the container to a properly labeled container, or completely use the chemical, leaving the container empty.

All chemicals kept in manufacturer's or supplier's original packaging labeled under other federal labeling requirements do not need to be further labeled under the HazCom standard.

Any "hazardous substance" covered by the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and any "hazardous waste" covered by the RCRA are exempt from HazCom labeling requirements.

Wood or wood products do not need to be labeled in most instances. However, it must have an MSDS if it releases harmful amounts of a hazardous chemical or is cut or sanded, producing wood dust.

Vehicles driven onto Mill property are required to be placarded and labeled in accordance with U.S. Department of Transportation (DOT) standards. The DOT container labeling and vehicle placarding requirements, as they apply to radioactive materials, are provided in Procedure RH-100 in Attachment D of the Health and Safety Plan. Other labeling and placarding requirements may be required based on non-radioactive components or properties of the material being shipped. The DOT Hazard codes are:

- **1 Explosive**
- **2.1 Flammable Gas**
- **2.2 Non-Flammable Gas**
- **2.3 Poisonous Gas**
- **3 Flammable Liquid**
- **4.1 Flammable Solid**
- **4.2 Spontaneously Combustible**
- **4.3 Dangerous when Wet**
- **5.1 Oxidizer**
- **5.2 Organic Peroxide**
- **6.1 Poison – Keep away from food**
- **6.2 Infectious Material**
- **7 Radioactive**
- **8 Corrosive**
- **9 Miscellaneous**

7.0 MATERIAL SAFETY DATA SHEETS

Every hazardous chemical on this property will have a current, legible, and accessible MSDS. Each MSDS must be clearly cross-referenced to its corresponding label and chemical list described under the "Labeling" section above. If a chemical arrives on the mill property with no MSDS, and it is either known or suspected to be hazardous, the RSO, Alternate RSO, or Purchasing Agent must be contacted immediately. The individual will contact the manufacturer for an MSDS. Likewise, if a chemical is found stored or in use with no MSDS on file, the same procedure should be followed.

Whenever an MSDS is received on a new hazardous chemical, the RSO will schedule a meeting with affected supervisors and/or mill operators to review the information in the MSDS prior to use of the chemical. The supervisor must assure that the employees in the area are thoroughly familiar with the subjects covered in the MSDS pertaining to hazardous chemicals in their work areas. When a revised MSDS is received the outdated MSDS should be replaced as follows:

- Remove the outdated MSDS from the Notebook and replace it with the revised MSDS.
- The outdated MSDS should be kept on file for 3 months before destruction.

A master file of MSDSs is kept in the RSO's office and in the Warehouse. In addition, MSDS for chemicals used in particular areas are accessible in these locations. MSDSs are accessible by at least one of the following:

- By computer
- By paper copies
- By fax-on-demand service
- By calling the manufacturer

If it is necessary to create an MSDS at the Mill use the format in Appendix C.

Any discrepancies discovered in an MSDS should be reported to the RSO or Alternate RSO, who will contact the supplier for clarification or replacement of the MSDS.

Any employee or contractor may obtain a free copy of the Mill chemical list or any MSDS at the Mill by contacting the RSO, Purchasing Agent or Warehouse Clerk. If a copy of a HazCom-related document is requested that reveals a Trade Secret at the Mill, the following procedure will be followed:

- The requestor will be required to sign a confidentiality agreement concerning the Trade Secret.
- If possible, information will be redacted so that the confidential information will not be revealed.

8.0 TRAINING REQUIREMENTS

The RSO or Alternate RSO is the authorized instructor for HazCom training at the Mill. Training will be conducted in accordance with the approved MSHA training plan. All new employees will receive HazCom training during the initial new hire training and additional training in the specific hazardous chemicals they will be working with during their task training. If a new chemical is introduced into the work area, affected employees will receive training on the hazards associated with this chemical.

HazCom training will include the following items:

- The physical and health hazards of the chemicals in the individual's work area.
- The requirements of HazCom.
- The Mill's HazCom program, including labeling and MSDS locations.
- The operations or areas of the Mill where hazardous chemicals are present.
- How to tell if a chemical is present.
- What protective measures to take.
- The work practices, engineering controls, emergency procedures, and the use of personal protective equipment available at the Mill.

Records of training must be recorded on MSHA Form 5000-23.

Sample HazCom training materials are presented in Appendix D

Piñon Ridge Mill HazCom Procedure

Appendix A

Hazardous Chemicals Stored on Site

Hazardous Chemicals Stored On Site

1. Sulfuric Acid
2. Ammonia
3. Ammonium Sulfate
4. Sodium Hydroxide
5. Sodium Carbonate
6. Flocculent
7. Kerosene
8. Sodium Chlorate
9. Hydrogen Peroxide
10. Alamine 336
11. Isodecanol
12. Diesel Fuel
13. Gasoline

NOTE: Refer to the Piñon Ridge Mill Materials Containment Plan for chemical information sheets and MSDS's

Piñon Ridge Mill HazCom Procedure

Appendix B

Chemical Label/Tag – Blank

Chemical/Substance Name:

Specific Hazards:

☐ Flammable

☐ Caustic

☐ Carcinogenic

☐ Reactive (with ______________________________)

☐ Other (____________________________________)

PPE Required:

Piñon Ridge Mill HazCom Procedure

Appendix C

Material Safety Data Sheet (MSDS) - Blank

Material Safety Data Sheet

Section 1: Chemical Product and Company Identification

Product Name:
Synonyms:
Catalog Code:
CAS Number:
Chemical Formula:
Intended Use(s):

Manufacturer/Distributor Information
Name:
Address:

Telephone:
Emergency:
Date Prepared:
Preparer's Signature:

Section 2: Composition/Information on Ingredients

Composition:

Name	OSHA PEL	ACGIH TLV	Other Limits	Percent by Weight

Other Information:

Section 3: Hazards Identification

Potential Acute Health Effects:

Potential Chronic Health Effects:
Carcinogenic Effects:
Mutagenic Effects:
Teratogenic Effects:
Developmental Toxicity:

Environmental Hazards:

NFPA Hazard ID: Health: Flammability: Reactivity:

HMIS Hazard ID: Health: Flammability: Reactivity:

Other Comments:

Section 4:	First Aid Measures

Inhalation:

Skin Contact:

Eye Contact:

Ingestion:

Section 5:	Fire/Explosion Measures

Flammability Properties

Flash Points: Flammable Limits: LEL: UEL:

Auto-Ignition Temperature:

Fire/Explosion Hazards:

Extinguishing Media:

Fire Fighting Instructions:

Unusual Fire/Explosion Hazards:

Section 6:	Accidental Release Measures

Notification Procedures:

Protective Measures:

Spill Management

Land Spill:

Section 6: Accidental Release Measures (continued)

Water Spill:

Environmental Precautions

Small Spill:

Large Spill:

Section 7: Handling and Storage

Precautions to be taken in Handling and Storage:

Proper Storage Method:

Suitable Containers/Packaging/Materials:

Unsuitable Materials and Coatings:

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Personal Protection

Respiratory Protection:

Hand Protection:

Skin and Body Protection:

Exposure Limits:

Chemical Name	ACGIH	OSHA	Supplier

Section 9 :	Physical and Chemical Properties	
Appearance and Odor, Taste:		
Molecular Weight:		
Melting Point:	Boiling Point:	Freezing Point:
Critical Temperature:		
Coefficient of Oil/Water:		
Evaporation Rate:	Specific Gravity:	
Percent Volatile:		
pH:		
Vapor Density:	Vapor Pressure:	
Solubility:		

Section 10:		Stability and Reactivity
Stability:	Stable	Conditions to Avoid:
	Unstable	
Incompatibility (Substances to avoid):		
Hazardous Decomposition Products:		
Hazardous Polymerization:	May Occur	Conditions to Avoid:
	Will not Occur	
Special Remarks:		

Section 11:	Toxicological Information
Routes of Entry:	
Health Hazards (Acute and Chronic):	
Carcinogenity:	
Signs and Symptoms of Exposure:	
Medical Conditions Generally Aggravated by Exposure:	

Section 12: Ecological Information

Ecotoxicity:

BOD5 and COD:

Products of Biodegradation:

Toxicity of Products of Biodegradation:

Special Remarks:

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transportation Information

Dot Classification

Proper Shipping Name:

Primary Hazard Class/Division:

UN/NA Number:

Packing Group:

Labels:

Placards:

Markings:

Identification:

Special Provisions for Transport:

Section 15:	Other Regulatory Information		
Federal and State Regulations:			
Other Regulations:			
Other Classifications:			
WHMIS (Canada):			
DSCL (EEC):			
HIMS (USA):			
Health Hazard:	Fire Hazard:	Reactivity:	Personal Protection:
National Fire Protection Association (USA):			
Health:	Flammability:	Reactivity:	Specific Hazard:
Protective Equipment:			

Section 16:	Other Information
References:	
Other Special Considerations:	
Date Created:	
Last Updated:	
Definitions/Descriptions:	

Piñon Ridge Mill HazCom Procedure

Appendix D

Sample HazCom Training Material

Hazard Communication

Energy Fuels Resources
Piñon Ridge Mill

Introduction

- Chemicals are fundamental to life, but can also cause sterility, cancer, burns, and heart, lung or kidney disease. They can cause fire and explosions, but can also help fight fire and control explosions
- The mining industry reported over 3,000 chemical burns and poisonings to MSHA between 1990 & 1999. The belief that this was excessive as well as the potential for long term health risks led MSHA to develop a Hazard Communication Standard

Program Basics

- Inventory chemicals at the Mill site and determine which are hazardous
- Keep a list of the hazardous chemicals
- Establish a written HazCom program
- Prepare a label and Material Safety Data Sheet (MSDS) for all products
- Make sure all containers are labeled
- Keep MSDSs for the hazardous chemicals at the mine site
- Train miners about the HazCom program

Hazard Determination

- Chemicals at the Mill must be identified to determine if they are a physical or a health hazard
- Physical Hazard – can cause injuries (combustible liquid or gas, organic peroxide, may be flammable, explosive)
- Health Hazard – can cause illnesses (may be acute – short term; or chronic – long term)

Exemptions from HazCom Rule

- Consumer Products – If an ordinary consumer product is purchased, it is exempt if you use it as the manufacturer intended it, and it does not expose the operator more often or for a longer duration than ordinary consumer use
- Articles – Manufactured goods such as plastic and metal pipes, conveyor belts, steel and tires are exempt if they release no more than insignificant amounts of a hazardous chemical, and pose no physical or health risk to exposed Mill personnel

Exemptions from HazCom Rule – cont'd

- Personal Items – Food, tobacco products, drugs, cosmetics, or other personal items are exempt if they are packaged and labeled for retail sale and intended for an individual's personal consumption or use

Examples & Variables on Exemptions

You purchase a case of cleaner with ammonia for your truck drivers to clean their windshields. The drivers clean them 2 or 3 times each shift. Should this be included in the HazCom program?

No – This is a consumer product being used as an ordinary consumer would use it

Examples & Variables on Exemptions

You purchase a case of cleaner with ammonia for your janitor to clean counters, mirrors, windows, bathroom tile and other parts of your plant. The janitor performs this work all day long. Should this cleaner be included in the HazCom program

Yes – The cleaner will be used as the manufacturer intended, but the janitor is exposed to ammonia for a longer time than an ordinary consumer would be

Examples & Variables on Exemptions

You decide to enlarge a platform constructed of galvanized steel. A welder adds to the frame by welding additional galvanized pipe to the existing frame. Would the galvanized pipe be a part of the HazCom program?

Yes – While the pipe is still an article, the welding releases zinc fumes and several other hazardous chemicals from the pipe and would therefore not be exempt

Labeling

- A label is an immediate warning about a chemical's most serious hazard
- Containers of hazardous chemicals must be marked, tagged or labeled with the identity of the hazardous chemical and appropriate hazard warnings
- Every hazardous chemical container must be labeled unless it is exempt under 30 CFR 47.92 Subpart J
- If a substance is transferred from a labeled container to a portable unlabeled container and will be completely used by the transfer person, the container does not have to be labeled.
- If the chemical is not used up by the end of the shift, it must be returned to the original container.

Labeling – cont'd

- If you have bins, hoppers, tanks, or other stationary process containers holding a hazardous chemical you may use signs, placards, process sheets, batch tickets, operating procedures or other suitable alternatives to a label
- The raw material being milled does not have to be labeled if no hazardous chemicals are added
- You have to label containers of hazardous chemicals produced during ore processing, such as a leach tank where sulfuric acid is added

Labeling – cont'd

- Labels must include:
  1. The chemical's identity that permits cross referencing between the label, the list of hazardous chemicals and the MSDS
  2. The appropriate hazard warning (skin irritant, carcinogen, flammable)
  3. Hazards should be prioritized based on severity
  4. Target organs affected should be included if applicable
  5. The name and address of a responsible party that can provide additional information

Labeling – cont'd

- Products that go off site (e.g. uranium and vanadium oxide) must be labeled
- Containers with damaged labels must be re-labeled immediately (during the shift when it was damaged)
- You are not responsible for inaccuracies on a label provided by the manufacturer of the chemical
- You should update your label when you learn new information about your product
- ***You must not remove or deface existing labels***

Material Safety Data Sheets

- The chemical MSDS provides comprehensive technical and emergency information
- It serves as a reference document for exposed Mill workers, health professionals and firefighters or other safety workers
- "Availability" means that you cannot have obstacles that delay access to HazCom information

Material Safety Data Sheets – cont'd

- The MSHA HazCom standard allows you to keep MSDSs in a way that you choose provided the information is available to employees
- Methods to maintain MSDSs:
  1. May use a 3 ring binder (can get very bulky at a plant with many MSDSs)
  2. May use a computer database (everyone must have computer access)
  3. May access them from an internet MSDS library (again computer availability a must)
  4. May use fax on-demand service

Material Safety Data Sheets – cont'd

- You must have a MSDS for your product or raw material if it is hazardous
- A MSDS must be maintained at the Mill for as long as the chemical is at the Mill, and Mill workers must be notified 3 months in advance before you dispose of the MSDS - notice can be verbal, or written
- The most current version of an MSDS must be made available if a manufacturer changes the contents of the MSDS

Material Safety Data Sheets – cont'd

- What information is required on an MSDS?
  - *Identity* – the chemical and common name if it is a single entity and all the hazardous ingredients if it is a mixture. It must permit cross-referencing between the list of hazardous chemicals, the chemical's label, and the MSDS
  - *Properties* – the physical and chemical properties such as boiling point, melting point, vapor pressure, evaporation rate, solubility in water, pH, appearance and odor, flash point and flammability limits

Material Safety Data Sheets – cont'd

- *Physical Hazards* - the potential for fire, explosion and reactivity
- *Health Hazards* – the potential to cause illness or injury, such as its acute and chronic health effects, the signs and symptoms of exposure, any medical conditions that are aggravated by exposure and the primary routes of entry
- *Carcinogenicity* – this information must be included

Material Safety Data Sheets – cont'd

- *Exposure Limits* – either the MSHA or the OSHA exposure limits must be included or any other limit set by an organization such as the ACGIH or NIOSH
- *Safe Use* – precautions for safe use such as hygienic practices, protective measures during repair and maintenance of contaminated equipment, and procedures for clean-up of spills and leaks

Material Safety Data Sheets – cont'd

- *Control Measures* – ventilation, process controls, restricted access, protective clothing, respirators, and goggles
- *Emergency Information* – appropriate emergency procedures such as special instructions for fire fighters and first aid procedures; name address and phone number of a contact person who can provide additional information in case of emergency
- *Date Prepared* – preparation or revision date

Toxicology

You may be exposed to toxic substances while on the job. Some of these chemicals have been well-studied, while others have little information available. All chemicals should be handled as if they are hazardous.

Toxicology – cont'd

Toxicology is the study of the nature, effects and detection of poisons in living organisms. The toxicity of a substance is its ability to cause harmful effects to a single cell, an organ or an organ system, or to the entire body. Some effects may be easily and quickly seen – such as dizziness, nausea, shortness of breath or skin irritation. Other toxic effects may not show up for many years.

Toxicology – cont'd

- Dose-response – the greater the amount (dose), the more likely you are to be adversely affected (response). This is influenced by the length of time you are exposed, how the substance enters your body, and how quickly the substance is removed from your body
- Toxicity – the potential of a substance to cause harm

Toxicology – cont'd

- Entry routes for chemicals into the body:
  - ***Inhalation (breathing)***
  - ***Skin contact/absorption***
  - ***Eye contact/absorption***
  - ***Ingestion (swallowing)***
  - ***Injection or puncture***

Inhalation

- Materials pass through the major airways into the lungs ending at the air sacs. Chemicals can dissolve in the lungs and pass into the blood stream at this point.
- Substances such as respirable silica dust which don't move into the blood stream may remain in the lungs and cause damage there.

Skin Contact and Absorption

- The skin is the largest organ of the body and protects it from external hazards.
- Some chemicals, including many solvents and metals can cause an inflammation of the skin called dermatitis or result in other allergic reactions.
- Other chemicals such as acids can burn the skin.
- Substances can also enter the body through cut or cracked skin
- Other chemicals, like some solvents, dissolve the skin's protective oil barrier and pass into the blood supply through the small blood vessels or capillaries.
- Some workplace chemicals, including arsenic and tar, have been linked to skin cancer.

Eye Contact

- Chemical or foreign particles are likely to irritate or burn the eyes.
- Some substances can be absorbed through the eyes and cause problems elsewhere in the body.

Ingestion

- If a worker smokes, eats, or drinks around chemical substances the chemical may be swallowed.
- Uranium dust particles may be swallowed after they are trapped in the mucous in the airways and then moved to the back of the throat.

Injection & Puncture

- Injection is a major concern in health care or first aid settings, but puncture or cuts occur in many occupations.
- Bacteria, fungi, and other chemical substances may enter the body through a cut or puncture wound.

Health Effects of Chemical Hazards

- **Allergens** – Materials which affect the body's immune system causing reactions such as wheezing or dermatitis. Exposure to even a small amount of the substance may cause a reaction in a sensitized person.
- **Asphyxiants** – Materials such as carbon dioxide or acetylene which displace oxygen in the air.
- **Carcinogens** – Substances which act on the genetic material of cells, causing uncontrolled cell growth (cancer).

Health Effects of Chemical Hazards

- **Irritants** – Substances that cause pain and reddening of the exposed area, usually the skin and respiratory system. Effects usually immediate.
- **Mutagens** – Materials that change the genetic material of cells.
- **Neurotoxins** – Materials that damage the nervous system
- **Teratogens** – Materials that affect the developing embryo, resulting in birth defects.

Possible Sites for Disease

- Every organ and system is a possible site for occupational disease. The "routes of transport" through the body are the most likely parts to be effected:
  - **Portals of entry** (skin and lungs)
  - **Blood** (carries the chemicals throughout the body)
  - **Organs of exit** (kidney, liver, bladder)

Summary

- HazCom is a complex and detailed concept and a MSHA standard
- Know the process and procedures at the location where you work
- Know the location of the MSDSs
- Know how to read the MSDSs
- Know what chemicals are in the area where you work

SITE HAZARDOUS CHEMICALS

Sulfuric Acid

- A clear colorless to yellow oily liquid
- Reacts violently with many organic and inorganic chemicals and water
- Will cause severe burns to the skin and eyes upon contact
- In case of contact, flush with plenty of water for at least 15 minutes
- If swallowed, get medical attention immediately
- PPE should include full acid suit, goggles with face shield, acid-resistant gloves, and acid-resistant foot protection

Anhydrous Ammonia

- Colorless gas that is lighter than air and has a strong irritating odor
- Generally stable but reacts violently with strong acids
- May be flammable under certain conditions
- Contact with skin or eyes can cause severe burns
- Inhalation can cause irritation and severe burns to the mucous membranes and respiratory tract
- In case of skin or eye contact, flush with water for at least 15 minutes and seek medical treatment
- Wear face shields with goggles, chemical resistant gloves and suits, and have adequate ventilation or use approved respiratory protection

Hydrogen Peroxide

- Clear, colorless and odorless liquid
- Strong oxidizer – contact with combustibles may cause fire
- May cause irreversible tissue damage to the eyes including blindness
- May cause skin irritation or burns to the nose throat and lungs
- Upon contact, flush with water for at least 15 minutes and seek medical attention
- If ingested, rinse mouth with water, dilute by drinking 1 to 2 glasses of water and seek medical attention
- Wear chemical resistant goggles with a full face shield and chemical resistant clothing, boots and gloves

Sodium Hydroxide

- May be solid white pellets, or white solution with no appreciable odor
- Solutions are corrosive to body tissues and metallic materials and may react violently with acids
- Severe irritation and burns may result upon contact with the eyes, skin or respiratory tract
- If contact with skin or eyes occurs, flush with water for at least 15 minutes and get medical attention
- If ingested, rinse mouth and dilute with 1 to 2 glasses of water and seek medical attention
- Use goggles with full face shields and chemical resistant clothing, including shoes and gloves

Ammonium Sulfate

- Odorless solid (crystals), brownish gray to white in color
- May cause skin and eye irritation upon contact or respiratory irritation if inhaled
- In case of contact, flush eyes or skin with water for at least 15 minutes; in case of inhalation, remove to fresh air and get medical attention if necessary
- Use gloves, safety glasses with side shields or face shields, and respiratory protection (if necessary)

Kerosene

- Colorless to pale straw or red oily flammable liquid with a characteristic odor
- Causes irritation to the upper respiratory tract and eyes and skin contact can cause defatting of the skin along with irritation and burning
- If contact with eyes occurs, flush with water for at least 15 minutes and wash skin with soap and water upon contact
- If swallowed, seek medical attention
- Use face shields with goggles where splashing may occur and use nitrile gloves to protect hands; wash contaminated clothing before reuse

Alamine 336

- Pale yellow liquid with Ammonia odor
- Causes skin and eye irritation, may be harmful if swallowed
- Immediately flush eyes or skin with plenty of water for at least 15 minutes, move to fresh air and get medical attention
- Use local exhaust ventilation, safety glasses with side shields, and rubber or plastic gloves when handling

Isodecanol (Exxal 13)

- Clear, colorless, flammable liquid with distinct odor of alcohol
- Irritating to eyes, excessive exposure may result in eye, skin, or respiratory irritation
- If material is inhaled, remove from further exposure; seek medical attention if respiratory irritation, dizziness or unconsciousness occurs
- If exposure occurs, flush skin and eyes with water for at least 15 minutes, remove contaminated clothing, and seek medical attention if necessary
- Use goggles or face shields, chemical resistant gloves, and respiratory protection as required

Sodium Carbonate (Soda Ash)

- White, odorless, granular solid that reacts with acids to release carbon dioxide gas and heat
- Direct contact will cause irritation of the eyes and prolonged contact may cause skin irritation; excessive inhalation may cause irritation to the mucous membranes and respiratory tract
- Flush exposed areas with water for at least 15 minutes; if inhalation hazard exists, remove to fresh air
- Appropriate eye and face protection should be utilized; respiratory protection may be used when appropriate, and clothing with long sleeves and gloves should be worn when handling the material

Vanadium Products

- Vanadium products present at various stages of production at the facility include Ammonium Metavanadate and Vanadium Pentoxide
- Both products can cause severe respiratory irritation, coughing, bloody noses and wheezing
- Coloration of the tongue and mouth have been noted
- Eye and skin irritation may result from prolonged contact
- Protective clothing including gloves must be worn when handling these products
- Appropriate respiratory protection must be worn at all times when working in areas where these products are present

Sodium Chlorate

- White odorless crystals
- Will cause irritation to the eyes and skin upon contact
- Irritation to the respiratory tract (sore throat and coughing) and gastrointestinal tract (liver and kidney damage) will occur upon inhalation or ingestion
- Strong Oxidizer – contact with other materials may cause fire
- Wear chemical resistant clothing including gloves and boots, and face and respiratory protection where exhaust ventilation is inadequate
- Flush skin or eyes with water and get medical attention immediately if ingested or if severe inhalation is experienced

Attachment B

Administrative Procedures

1.0 PURPOSE

This procedure provides the format and standard practices to be used in preparing, revising, distributing, and controlling procedures.

2.0 APPLICABILITY

This procedure applies to all environmental, radiological, and emergency procedures at the Piñon Ridge Mill.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Colorado Rules and Regulations Pertaining to Radiation Control (6 CCR 1007-1)

3.1.2 Job Safety Analysis Procedure AD-100

3.1.3 Radiation Work Permits Procedure RH-060

3.2 *APPENDICES*

Appendix A – Procedure Template

Appendix B – Procedure Change Form AD-020A

4.0 RESPONSIBILITY

4.1 The Plant Manager or designee is responsible for:

4.1.1 Assuring that all routine Mill operations involving radioactive materials are supported by the written procedures specific to the operations.

4.1.2 Assuring that all non-routine Mill activities involving radioactive materials have had a job safety analysis performed per the Job Safety Analysis Procedure AD-100 and are described in Radiation Work Permits (See Procedure RH-060), which offer radiation protection requirements suited to the activity being conducted.

4.1.3 Assuring that all emergency procedures are well documented.

4.2 The Radiation Safety Officer (RSO), Alternate RSO, or designee is responsible for:

4.2.1 Assuring that the procedures comply with the Colorado Department of Public Health and Environment (CDPHE) regulations.

4.2.2 Assuring that the procedures are prepared and executed in accordance with the requirements of the Energy Fuels Radioactive Materials License.

4.2.3 Applying the guidance of the Nuclear Regulatory Commission Regulatory Guides where applicable and reasonably achievable.

4.2.4 Assuring that the procedures provide for maintaining radiation doses to employees and members of the public that are As Low As Reasonably Achievable (ALARA).

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

4.2.5 Processing all procedure change forms and incorporating approved changes into the procedures.

4.2.6 Distributing and controlling all procedures.

4.2.7 Issuing new numbers for procedures.

4.2.8 Maintaining a current master file of all procedures and an index of the current revisions.

4.2.9 Filing and retaining procedures for at least 3 years.

4.3 Authors, Reviewers, and Editors of procedures are responsible for accurately describing the process or activity subject to procedures requirements.

5.0 PREREQUISITE INFORMATION

5.1 *FREQUENCY*

Health and Safety Plan procedures are modified on an as-needed basis in response to regulatory changes, Mill operating conditions, and observed trends. As such, existing procedures are updated (or deemed obsolete) and new procedures created to maintain current program needs.

6.0 PROCEDURE

6.1 All procedures require, at a minimum, signed approval by the RSO and the Plant Manager.

6.2 The procedures are divided into following four sections:

6.2.1 **Administrative Procedures –** Includes corporate policy, administration of the procedures manual itself, Mill organization, conduct of audits, recordkeeping, project evaluation, and material acceptance processes.

6.2.2 **General Health and Safety Procedures** – Include health and safety processes that do not necessarily include radiological materials such as safety meetings, occupational safety, trade safety, respiratory protection, confined space entry, and non-radiological air quality.

6.2.3 **Radiological Health and Safety Procedures –** Includes radiological training, bioassays, instrument calibration, occupational monitoring, radiological surveys of equipment and personnel, and calculation of occupational doses.

6.2.4 **Environmental Procedures –** Include sampling of environmental media including air, water, vegetation, and soil. The process for calculating environmental dose is also described in this section. These procedures are provided in the Operational Monitoring Plan.

6.2.5 **Security Procedures –** Include procedures that security personnel use for site access control, employee relations, yellowcake shipment, emergencies, and bomb threats. These procedures are provided in the Security Plan.

6.2.6 **Maintenance Procedures** – Include procedures for routine maintenance of facilities including mill process equipment, warehousing and chemical storage and grounds and roads.

6.3 Procedures are numbered in the following manner, where XXX signifies numbering from 001 to 999:

6.3.1	Administrative:	AD-XXX
6.3.2	General Health and Safety:	HS-XXX
6.3.3	Radiological Health and Safety:	RH-XXX
6.3.4	Environmental:	EV-XXX
6.3.5	Security:	SP-XXX
6.3.6	Maintenance:	MP-XXX

6.4 All personnel with a demonstrated need are issued copies of the procedures or have access to computer files containing the manual. The Alternate RSO is to keep a listing of the location of each manual.

6.5 The RSO or Alternate RSO will update all manual copies with new and/or revised procedures and with a revised table of contents showing current procedure revisions and dates of revision.

6.6 Procedures are generally organized in sections outlined in the procedure template presented in Appendix A, and as described below. If a section does not apply to a specific procedure, the section is omitted from the procedure.

6.6.1 PURPOSE: defines the objective of each procedure.

6.6.2 APPLICABILITY: defines the specific boundaries of each procedure and lists any exceptions.

6.6.3 OTHER DOCUMENTS: is a section heading for references, appendices and exhibits.

6.6.3.1 REFERENCES: lists documents that are referred to in the procedure, such as regulatory guides or user manuals.

6.6.3.2 APPENDICES: presents forms and support information for the procedure.

6.6.3.3 EXHIBITS: presents photographs and miscellaneous drawings pertinent to the procedure.

6.6.4 EQUIPMENT AND MATERIALS: lists in subsequent sections items used in the implementation of the procedure.

6.6.4.1 EQUIPMENT: lists equipment, such as instruments or logbooks.

6.6.4.2 MATERIALS: lists consumable materials, such as sample bottles or reporting forms.

6.6.5 RESPONSIBILITY: lists those responsible for supervising and implementing the procedure.

6.6.6 PREREQUISITE INFORMATION: is a section heading for definitions, safety and frequency.

6.6.6.1 DEFINITIONS: presents any words or acronyms that need to be defined to add to the clarity of the procedure.

6.6.6.2 SAFETY: presents any safety considerations unique to the procedure. Otherwise the Health and Safety Plan is listed.

6.6.6.3 FREQUENCY: presents recurring time periods when specific items in the procedure need to be performed (e.g. an instrument calibration).

6.6.7 PROCEDURE: details specific items to be implemented in the procedure.

6.7 Section and subsection headings are numbered, capitalized, and bold-faced according to the following scheme. If needed, 4 digits can be used for subsection headings.

1.0 SECTION HEADING

1.1 SUBSECTION HEADING

1.1.1 Subsection Heading

- Item presented

6.8 Appendices are numbered alphabetically as they are referenced in the procedure beginning with A.

6.9 Exhibits are numbered sequentially as they are referenced in the procedure beginning with 1.

6.10 The procedure number, page number, revision number, and revision date are entered in the heading on the first page of every procedure. Approval signatures are in the footer of page one of the procedure. Subsequent pages include a header only, with title, procedure number, and page number.

6.11 A new procedure is prepared as a draft using this procedure as a guideline. The author ensures that all applicable requirements, standards, and guidelines have been incorporated. The procedure is submitted to the RSO or Alternate RSO who distributes copies to all appropriate personnel for review.

6.12 A sequentially increasing revision number beginning with 0 is assigned to each revised procedure. The date on the procedure is the date of the revision or the date the revised procedure is issued, whichever is later.

6.13 When a procedure is changed, the person responsible for supervising the activities covered by the procedure fills out a Procedure Change Form AD-020A stating the reason for the change and submits it to the RSO or Alternate RSO for approval (See Appendix B). The completed form is given to the Alternate RSO, who inserts the form into the master copy of the procedure manual in front of the affected procedure. This form remains there until the final draft of the revised procedure replaces the earlier version.

6.14 The Alternate RSO is to file and retain prior revisions and obsolete procedures subsequent to their revision, replacement, and/or inactivation until termination of the license (6 CCR 1007-1 4.41.2).

Preparation, Control, and Distribution of Procedures Procedure AD-020

Appendix A

Procedure Template

Energy Fuels Resources Piñon Ridge Mill Montrose County, Colorado	PROCEDURE TEMPLATE	Number: Page 1 of 1 Revision: 0 Date: 08/31/09

1.0 PURPOSE

2.0 APPLICABILITY

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.2 *APPENDICES*

3.3 *EXHIBITS*

4.0 EQUIPMENT AND MATERIALS

4.1 *EQUIPMENT*

4.2 *MATERIALS*

5.0 RESPONSIBILITY

6.0 PREREQUISITE INFORMATION

6.1 *DEFINITIONS*

6.1.1 EFR – Energy Fuels Resources

6.2 *SAFETY*

6.3 *FREQUENCY*

7.0 PROCEDURES

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

Preparation, Control, and Distribution of Procedures Procedure AD-020

Appendix B

Procedure Change Form AD-020A

Procedure Change Form

DATE________________

PROCEDURE #________________________________

REV.___________________

PROCEDURE SUBJECT____

REVISION:
(list by section and paragraph number; attach extra pages as needed)

REASON FOR CHANGE:

EFFECTIVE DATE: ________________________

APPROVAL:_______________________________ DATE:__________________
RSO

Return to Alternate RSO

1.0 PURPOSE

This procedure describes the organization of the Piñon Ridge Mill staff and the responsibilities of the Health and Safety personnel.

2.0 APPLICABILITY

This procedure applies to the Mill staff.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 NRC Regulatory Guide 8.31, Information Relevant to Ensuring that Occupational Radiation Exposures at Uranium Recovery Facilities Will Be As Low As Is Reasonably Achievable.

3.2 *APPENDICES*

Appendix A – Health and Safety Organization Chart

4.0 RESPONSIBILITY

Responsibilities of the Health and Safety personnel are as follows:

4.1 Vice President of Regulatory Affairs: This person will be responsible for all health and safety and environmental permitting/compliance for the company and will report directly to the COO.

4.2 Radiation Safety Officer (RSO): This person will be responsible for health and safety and environmental compliance at the Mill and will report directly to the VP of Regulatory Affairs. The RSO will have extensive training and experience in radiation health physics. The RSO will be the primary contact between CDPHE/MSHA and the Mill and will consult directly with the VP of Regulatory Affairs as needed. The RSO's responsibilities and authorities will include:

4.2.1 The development and administration of the radiation protection and ALARA program in accordance with the As Low As Reasonably Achievable (ALARA) Procedure AD-080;

4.2.2 Sufficient authority to enforce regulations and administrative policies that affect many aspects of the radiological protection program;

4.2.3 Review and approve plans for new equipment, process changes, or changes in operating procedures to ensure that the plans do not adversely affect the protection program against uranium and its daughters;

4.2.4 Adequate equipment and laboratory facilities to monitor relative attainment of the ALARA objective;

4.3 Alternate RSO: This person will be responsible for directing the Radiation/Security Technicians (RSTs) in monitoring of radiation levels and other health and safety/environmental parameters throughout the Mill site. The

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

Alternate RSO will have similar training to the RSO and will fill in temporarily for the RSO when required.

4.4 **GIS/AutoCAD Technician:** This person will be responsible for entering all Mill-related health and safety/environmental monitoring data and generating health and safety and environmental compliance reports to CDPHE and MSHA.

4.5 **Radiation/Security Technicians (RST)**: These personnel will conduct monitoring throughout the Mill site for both health and safety and environmental purposes. They will also be responsible for security at the Mill, especially at the start and end of shifts when personnel are entering and leaving the facility. Mill security will include electronic pass cards and a turnstile at the entrance to the facility so that only authorized personnel may enter.

4.6 **Plant Manager:** The Plant Manager is responsible for authorizing the resources necessary to operate the plant in a safe and environmentally sound manner.

4.7 **Foreman:** These personnel are responsible for the health and safety of their workers and will work closely with the health and safety department to insure that health and safety procedures are implemented properly.

4.8 **Users:** Radiation workers who are authorized to use licensed material without supervision, with responsibilities that include:

4.8.1 Adhering to all rules, notices, and operating procedures for radiation safety established by management and the RSO;

4.8.2 Reporting equipment malfunctions, violations of standard practices, or procedures that could result in increased radiological hazard to any individual to the RSO and management in a timely manner;

4.8.3 Suggesting improvements for the radiation protection ALARA program.

5.0 PREREQUISITE INFORMATION

Qualifications – Education and/or Experience are as follows:

5.1 Users – Previous user experience or a B.S. in Physical Science or equivalent discipline or experience and training in the use of radioactive materials.

5.2 RSO – B.S. in Health Physics or equivalent discipline; Applied experience relevant to uranium mill operation - two years minimum; Initial classroom training specific to uranium mill radiation protection - four (4) weeks; Periodic retraining (See Section 6.2).

5.3 Alternate Radiation Safety Officer – A.A. in Health Physics or related discipline or applied experience in health physics or a related discipline - two years minimum; Periodic retraining (See Section 6.3).

5.4 Radiation Safety Technician – A.A. in Health Physics or related discipline or applied experience in health physics or a related discipline – two years minimum; Periodic retraining.

6.0 TRAINING REQUIREMENTS

6.1 Users – Annual ALARA review meeting to include review of the internal audit, the independent audit, the annual report, and the Radiation Protection Plan Procedures Manual.

6.2 Radiation Safety Officer – Attend 40 hours of classroom training and/or equivalent professional development in radiological, environmental or related discipline every two (2) years.

6.3 Alternate Radiation Safety Officer – Attend 40 hours of classroom training and/or equivalent professional development in radiological, environmental or related discipline every two years.

6.4 Radiation Security Technician - Attend classroom training in radiological, environmental or related discipline and in particular at least 8 hours in job specific sample procurement training per year.

6.5 Designated Assistants to the Radiation Safety Officer – The RSO or the Alternate RSO shall conduct an in-house seminar within one month of attendance at the aforementioned training for the personnel designated by the RSO.

7.0 PROCEDURES

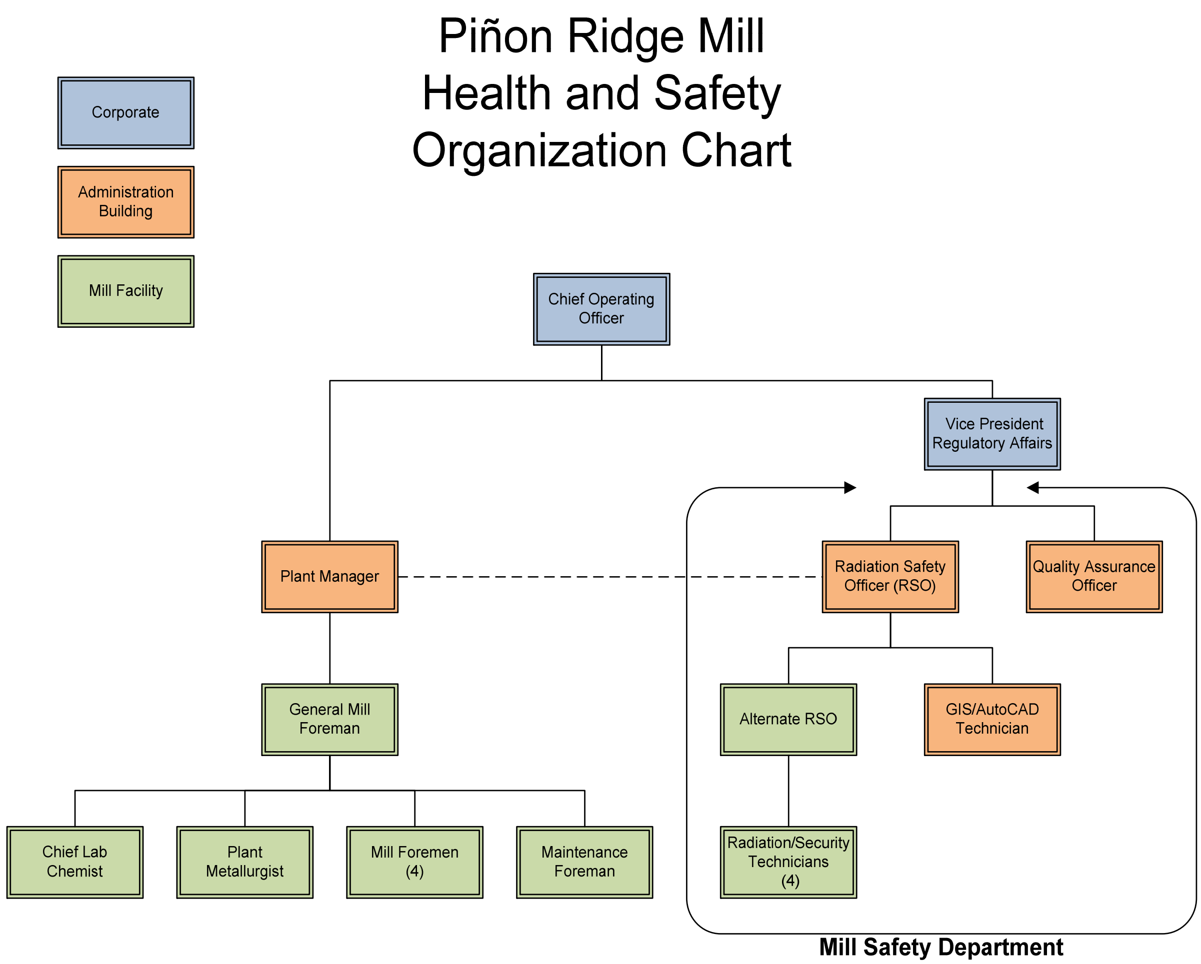
The Piñon Ridge Mill Health and Safety Organization Chart is presented in Appendix A.

Organization Procedure AD-030

Appendix A

Health and Safety Organization Chart

Health and Safety Organization Chart



1.0 PURPOSE

The purpose of Energy Fuels' Radiation Protection Program Performance Review is to assess key employee and public radiation protection performance indicators against the Facility's As Low As Reasonably Achievable (ALARA)-driven Performance Objectives, as well as appropriate regulatory standards. Accordingly, this performance based license review is presented as an addition to the license – procedure based reviews conducted by external auditors and CDPHE's compliance inspectors. Either a performance review or a license - procedure based annual review is intended to meet the requirement of CDPHE's regulation 6 CCR 1007-1 part 4 "Standards for Protection Against Radiation" which states in section 4.5.3:

> *"The licensee or registrant shall, at intervals not to exceed 12 months, review the radiation protection program content and implementation."*

The information derived from either type of review provides the Energy Fuels' senior management with critical information necessary to assure protection of the Company's workers and the public, and to provide additional controls where indicated.

2.0 APPLICABILITY

This procedure applies to all internal radiation protection program reviews conducted at the Piñon Ridge Mill.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Colorado Rules and Regulations Pertaining to Radiation Control (6 CCR 1007-1).

3.1.2 Nuclear Regulatory Commission Regulatory Guide 8.31, "Information Relevant to Ensuring that Occupational Radiation Exposures at Uranium Recovery Facilities will be As Low As is Reasonably Achievable, "Section 2.3.3, Radiation and ALARA Program Audit.

4.0 ADMINISTRATION

4.1 The Quality Assurance (QA) Officer is responsible for:

4.1.1 Scheduling and conducting the Radiation Protection Program Review.

4.1.2 Interacting, as necessary, with the Plant Manager, Safety Department staff, and the Vice President of Regulatory Affairs to determine appropriate Program modifications should program performance indicate corrective action needs.

4.1.3 Preparing the written report documenting the review findings.

4.1.4 Forwarding the findings to the Vice President of Regulatory Affairs.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

4.2 The Vice President of Regulatory Affairs is responsible for:

4.2.1 Where indicated, assuring that appropriate actions are taken to correct identified circumstances which have led to or could lead to inadequate Program performance.

4.2.2 When necessary, resolving issues arising from a difference in interpretation of performance indications.

5.0 PROCEDURE

5.1 *STRUCTURE OF THE RADIATION PROTECTION PROGRAM REVIEW*

The Radiation Protection Program Review may be conducted by an individual reviewer or a team, solely at the discretion of the QA Officer. The number of individuals assigned to conduct the review will be dependent upon the expected technical complexity and depth of the current review. The Company's policy pertaining to the selection of program review personnel balances the need for independence from the day-to-day operation of the Mill, and the need to employ review personnel who are familiar with the day-to-day operations and technical aspects of the Radiation Protection Program.

Prior to the commencement of the program review, the QA Officer will identify by memorandum the schedule for and personnel assigned to the current review.

5.2 *PROGRAM REVIEW SCOPE AND CONDUCT*

The scope of the program review includes determining whether critical program components are in place (and being implemented), whether measured and/or calculated performance indices conform to appropriate regulatory standards, and whether the facility's ALARA-driven Performance Objectives are being met. The Program review is explicitly defined to include an evaluation of Radiation Protection Plan components and the information derived from that program; however, other permitting and/or, licensing programs can be included in the review as well. Program review can include a review of the entire program or can be specifically focused toward a more detailed review of one or more program components and/or performance indicators, or as a means of follow-up on previously identified program needs and recommendations.

The scope of each review will be determined by the Vice President of Regulatory Affairs in consultation with the QA Officer and on the basis of current program review needs (e.g. previous program review findings, CDPHE inspection findings, emerging regulatory and/or plant operation changes, staff recommendations, etc.) Each Program Review's scope will be defined in the pre-audit memorandum issued by the QA Officer. Examples of program elements to be reviewed include:

5.2.1 Hands-on Mill activities such as observation of in-process work activities, radiological postings and performance surveys

5.2.2 Employee exposure records (external via personal TLD/OSL results and internal exposure via time-weighted air sampling results, related calculations of intake, bioassay results, etc.)

5.2.3 Bioassay results

5.2.4 Inspection log entries and summary reports of daily, weekly and monthly inspections

5.2.5 Documented training program activities

5.2.6 Radiation safety meeting reports

5.2.7 Radiological survey and sampling data

5.2.8 Reports on overexposure of workers and other notifications to the CDPHE required by 6 CCR 1007-1, Part 4, Section 4.53

5.3 *SELECTING ELEMENTS OF THE PROGRAM REVIEW*

The Radiation Protection Program indicators of performance have been embodied in site-specific Performance Objectives, which relate specifically to program implementation assessments, measurements of radiological conditions in the work place (and surrounding environs) and calculated indicators of worker and public dose. At a minimum, the program review will assess performance relative to these objectives. In addition, select Radiation Protection Program procedures, license requirements, and/or regulatory standards are elements of the Program Review. These Program elements are often subjected to Program Review in order to determine whether required Program activities, measurements and/or calculations are being conducted at specified frequencies, assuring that the basis of Performance Objective reporting is supported by sufficient program data. Detailed technical reviews of sample procurement, documentation, and quality assurance/quality control are not within the scope of Radiation Protection Program Reviews. These detailed technical assessments are the more appropriately addressed by Independent Audits, CDPHE inspections and internal quality assurance/quality control programs and are not duplicated by this review program. Finally, the Program Review assesses the need to add, eliminate and/or modify site Performance Objectives on the basis of previous program review findings, CDPHE inspection findings, emerging regulatory and/or plant operation changes, staff recommendations or other identified Program needs. The overall scope of each Program Review can be limited to accommodate needed follow-up on specific areas of concern and/or other program needs.

5.4 *RADIATION PROTECTION PROGRAM REVIEW AGENDA*

Prior to conducting a Radiation Protection Program Review, the QA Officer (and/or assigned Program Review personnel) will issue a Program Review Agenda to the Plant Manager and Radiation Safety Officer (RSO) outlining the scope of the forthcoming Program Review. The Agenda's purpose is to assure that appropriate program information and personnel are available during the Review, thus aiding in its proper completion.

5.5 *CONDUCT OF THE RADIATION PROTECTION PLAN REVIEW*

The sequence of steps followed during the Program Review process is as follows:

5.5.1 The QA Officer and/or designated Program Review personnel will prepare the Program Review Agenda as an attachment to the QA Officer's memo announcing the forthcoming Program Review.

5.5.2 The Program Review memo and attached Agenda are transmitted to the assigned Program Review personnel, the Plant Manager, and the RSO. The RSO will be responsible for further circulation to the impacted staff members.

5.5.3 Program Review personnel will proceed to the Mill on the pre-announced Program Review date. When multiple review personnel are assigned, the review team will convene at the Mill where the individual work assignments necessary to complete the Program Review agenda are determined.

5.5.4 Information needed to prepare for and to conduct a Radiation Protection Program Review is assured by:

5.5.4.1 The preparation of a Program Review Profile which includes specific information relative to each element under consideration for the current Program Review. The profile is prepared in tabular form including the following:

- A recitation of each review element
- The performance objective, standard, and or any other requirement to be met
- A space to document the review finding for each review element
- A space to document recommendations, needed corrective actions, and/or any other relevant comment pertinent to that elements review

Note: The Program Review Profile must include sufficient detail to establish clear criteria against which actual program practices are compared.

5.5.4.2 The ready availability of Program Review information. At a minimum the following information is assembled to conduct a Program Review:

- Current site Performance Objectives.
- Files and/or reports containing the information necessary to determine the status of performance for each objective.
- Current Radiation Protection Procedures
- Files and/or reports containing information relative to the status of each procedures implementation.
- Annual and semi-annual reports relevant to the time frame subject to the Program Review.
- Current Radioactive Materials License.
- Current Colorado Rules and Regulations Pertaining to Radiation Control.

5.5.4.3 In addition to reviewing company files and reports, other generic areas of inquiry will enable the auditor to more thoroughly complete the Program Review, determine root causes for identified areas of concern and identify measures necessary to improve the Program. These include but are not limited to:

- The reconciliation of ambiguous or conflicting information discovered as the result of file examination or personnel interviews
- Interviews with pertinent facility personnel
- Reviewing planned activities and programs that will be undertaken to meet program concerns (either required or for ALARA purposes)
- Evaluating information flow to ensure that all pertinent information is communicated in a timely manner and in a useful form to all persons who would authorize and/or complete the indicated change.

Note: In the event that a conflict in the interpretation of program requirements or objectives should arise; all information pertinent to the issue should be transmitted to the Vice President of Regulatory Affairs to affect a resolution to the conflict.

5.5.5 Following the Radiation Protection Program Review, the QA Officer will compile review notes and prepare the Review Report. The report will include a narrative discussion of the overall findings and any recommendations and needed follow-up. The report will be accompanied by a completed Program Review Profile indicating whether each Program element under review is meeting its objective or procedural requirement. The format of the report findings will be summarized into four categories:

5.5.5.1 Compliant: The objective or other element need is being met or exceeded.

5.5.5.2 Non-Compliant: The objective or other identified element need is not being met.

5.5.5.3 Item of Concern: The objective or other identified element is being met, but some improvement or change is recommended

5.5.5.4 Relevant information: The information that bears on the review element, the finding, or future review needs.

5.5.6 Copies of the Program Review Report will be distributed to the Vice President of Regulatory Affairs, the RSO, and the Plant Manager, involved program review personnel, and the Colorado Department of Public Health and Environment in accordance with license conditions.

1.0 PURPOSE

The purpose of this procedure is to describe the documentation and tracking of the Radiation Safety training of the Mill personnel and contractors.

2.0 APPLICABILITY

This procedure applies to all personnel, contractors, and visitors to the Piñon Ridge Mill.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Current Colorado Radioactive Materials License

3.1.2 Radiological Health and Safety Training Procedure RH-010

3.2 *APPENDICES*

Appendix A – Training Documentation Form AD-060A

4.0 RESPONSIBILITY

4.1 The Radiation Safety Officer (RSO) or Alternate RSO is responsible for:

4.1.1 Determining the need for safety training or specialized training.

4.1.2 Training of all Energy Fuels personnel, contractors, and visitors.

4.1.3 Documenting and tracking the required training in the areas of Radiation Safety, Radiation Work Permit (RWP), task-specific, and any other special training or certification. Training will be recorded on the Training Documentation Form AD-060A (Appendix A).

4.1.4 Scheduling the training with the appropriate personnel.

4.1.5 Placing copies of certification or other special training qualification documents in individual employees' personnel files as they are received.

4.2 Designated Training Personnel are responsible for:

4.2.1 Providing appropriate training to key individuals.

4.2.2 Documenting appropriate training or qualification of trained individuals.

5.0 PREREQUISITE INFORMATION

5.1 *DEFINITIONS*

5.1.1 Designated Training Personnel – An individual or group designated as being qualified to provide appropriate training to key individuals or to assess qualifications of key individuals.

5.1.2 Key Individual– A trained individual who performs monitoring, sample collection, or otherwise performs tasks requiring training. Also referred to as a trained "radiation worker."

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

5.2 *FREQUENCY*

5.2.1 Radiation Safety Training will be provided to all Mill personnel prior to work in restricted areas and specific on the job radiation training will be provided as specified by the RSO.

5.2.2 The RSO will schedule the Radiation Safety Training as necessary.

5.2.3 The RSO or Alternate RSO will circulate a schedule to all supervisors of the appropriate times of the training.

5.2.4 Refresher training will be provided at least annually to include topics of current relevance as determined by the RSO.

5.2.5 Successful completion of training is documented via achieving a grade of ≥ 70% on an exam developed and administered by the RSO.

6.0 PROCEDURES

6.1 *ROUTINE SCHEDULED RADIATION SAFETY TRAINING*

6.1.1 Each training session will be documented with the date, length of training, subjects discussed, signature of each employee attending, test score (if applicable), and the signature of the RSO or Alternate RSO.

6.1.2 New employees and contractors will be required to pass (70%) of a test. Those employees not passing the test will be retrained and re-tested.

6.2 *NON-ROUTINE TRAINING*

Basic Radiation Safety Training will be provided for: visitors, new employees, new contractors, and as specified in Radiation Work Permits (RWP). Those individuals will be required to pass (70%) of a test. Documentation will include the date, length of training, subjects discussed, signature of each employee attending, test score (if applicable), and the signature of the RSO or Alternate RSO.

Training Records, Documentation and Tracking Procedure AD-060

Appendix A

Training Documentation Form AD-060A

PERSONNEL TRAINING DOCUMENTATION

DATE: ___________________

TRAINING TOPICS: (Attach Course Syllabus if appropriate)______________________________

____

____

ATTENDEES:

1. ______________________________	11. ______________________________
2. ______________________________	12. ______________________________
3. ______________________________	13. ______________________________
4. ______________________________	14. ______________________________
5. ______________________________	15. ______________________________
6. ______________________________	16. ______________________________
7. ______________________________	17. ______________________________
8. ______________________________	18. ______________________________
9. ______________________________	19. ______________________________
10. ______________________________	20. ______________________________

TRAINER: ___________________________________

TRAINER SIGNATURE: ____

1.0 PURPOSE

To establish a process to identify and evaluate opportunities for dose reduction for occupational personnel and members of the public. Review current protocols and implement improvements to plans, procedures, facilities, and equipment which conform to the tenets of the Colorado Department of Public Health and Environment 6 CCR 1007-1 Part 4 "Standards for Protection Against Radiation Section 4.5, and NRC Regulatory Guides 8.10, 8.31, and 8.37, as revised. This process is implemented through the Safety Committee.

2.0 APPLICABILITY

The As Low As Reasonably Achievable (ALARA) Program applies to all operations (processing, maintenance, construction, dismantling, and remedial activities), facilities (buildings, storage areas, tailings cells and evaporation ponds), equipment (stationary and mobile), and personnel (Energy Fuels Resources employees, contractors and visitors). Achievement of ALARA goals requires an integrated approach to the conduct of site activities, which have an impact on dose to workers or the public. Each activity must be justified, optimized, and doses limited. This means that consideration should be given to the lifecycle (short and long term) impacts from process and equipment modifications, manpower utilization, and changes to operating procedures and maintenance programs. This also requires a tracking and feedback system, including inspections, reviews, audits, communications, documentation, and training. ALARA will be integrated into all aspects of operations. This includes design, planning and execution of work using, to the extent practical, engineering controls (time, distance and shielding considerations) and administrative controls; and relying on PPE only when necessary.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Current Colorado Radioactive Materials License

3.1.2 NRC Regulatory Guide 8.10 Operating Philosophy For Maintaining Occupational Radiation Exposure As Low As Is Reasonably Achievable

3.1.3 NRC Regulatory Guide 8.31 Information Relevant To Ensuring That Occupational Radiation Exposures At Uranium Mills Will Be As Low As Reasonably Achievable

3.1.4 NRC Regulatory Guide 8.37 ALARA Levels For Effluents From Materials

3.1.5 Facility Operating Plan

3.1.6 Colorado Rules and Regulations Pertaining to Radiation Control (6 CCR 1007-1)

3.1.7 Health and Safety Plan and associated Procedures

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

4.0 ALARA PHILOSOPHY

A major purpose of the occupational radiation protection program at the Piñon Ridge Mill is to maintain radiation exposure ALARA for all employees, contractors, and visitors. The implementation and effectiveness of a successful ALARA program is the responsibility of everyone involved in the processing of uranium ores. Responsibilities for conducting an ALARA program are shared by licensee management, the Radiation Safety Officer (RSO), and all workers in the Piñon Ridge Mill.

4.1 *LICENSEE MANAGEMENT*

Mill management is responsible for developing, implementing, and enforcing the rules, policies, and procedures necessary for an effective ALARA program to ensure the health and safety of workers and visitors. Mill management shall provide the following:

4.1.1 A strong commitment to and continuing support for the development and implementation of the ALARA program;

4.1.2 Information and policy statements to employees, contractors, and visitors;

4.1.3 A periodic management audit program that reviews procedural and operational efforts to maintain exposures ALARA;

4.1.4 Continuing management evaluation of the radiation safety program, its staff, and its allocation of adequate space and money;

4.1.5 Appropriate briefings and training in radiation safety, including ALARA concepts for all employees and, when appropriate, for contractors and visitors.

4.2 *RADIATION SAFETY OFFICER*

The RSO has primary responsibility for the technical adequacy and correctness of the ALARA program and has continuing responsibility for surveillance and supervisory action in the enforcement of the program. The RSO is assigned the following:

4.2.1 Lead responsibility for the development and administration of the ALARA program;

4.2.2 Sufficient authority to enforce regulations and administrative policies that affect any aspect of the radiological protection program including authority to terminate any operation or activity if he/she believes it is unsafe or contrary to the principles and objectives of the ALARA program;

4.2.3 Responsibility to review and approve plans for new equipment, process changes, or changes in operating procedures to ensure that the plans do not adversely affect the radiation protection program;

4.2.4 Adequate equipment and laboratory facilities to monitor and measure attainment of the ALARA objective.

4.3 *EMPLOYEES*

Because an ALARA program is only as effective as the workers' adherence to the program, all employees at a Piñon Ridge Mill should be responsible for the following:

4.3.1 Adhering to all rules, notices, and operating procedures for radiation safety established by Mill management and the RSO;

4.3.2 Reporting promptly to the RSO and Mill management equipment malfunctions or violations of standard practices or procedures that could result in increased radiological hazard to any individual;

4.3.3 Suggesting improvements for the ALARA program.

5.0 ASPECTS OF ALARA

The following aspects of the ALARA program are implemented at the Piñon Ridge Mill to maintain occupational exposures ALARA.

5.1 *PROCEDURES*

5.1.1 Health Physics Authority and Responsibility – The RSO has responsibility for the ALARA program and the authority to suspend, postpone, or modify any work activity that is unsafe as is outlined in Section 4.2.

5.1.2 Operating Procedures – Operating procedures are established for activities performed at the mill on a routine basis. Non-routine activities are evaluated on a case-by-case basis in accordance with the Job Safety Analysis and Radiation Work Permit Procedures AD-100 and RH-060, respectively.

5.1.3 Surveillance: Audits and Inspections – Inspections of the facility are conducted periodically in accordance with this procedure. Audits of the ALARA Program are performed in accordance with the Radiation Protection Program Performance Review Procedure AD-040.

5.1.4 Technical Qualifications of Health Physics Staff – The education, experience, training and knowledge of the RSO, Alternate RSO, Radiation/Security Technicians (RSTs) shall be in accordance with NRC Regulatory Guide 8.31.

5.1.5 Radiation Safety Training – All employees, contractors and visitors shall receive training in accordance with the Radiological Health and Safety Training Procedure RH-010 and with NRC Regulatory Guide 8.31.

5.1.6 Surveys – Surveys of the mill facilities shall be conducted periodically in accordance with exposure rate and contamination Procedures HS-140, RH-110, RH-120, RH-130, RH-140, and RH-150.

5.1.7 Respiratory Protection – Respiratory shall be used in appropriate areas and conditions in accordance with the Respiratory Protection Procedures HS-130, HS-131, and HS-132.

5.1.8 Bioassay Procedures – Bioassays shall be performed on a periodic basis in accordance with the Bioassay Procedure RH-050.

5.2 ***FACILITY AND EQUIPMENT DESIGN***

Significant consideration was given to maintaining occupational exposures ALARA when producing the Piñon Ridge Mill design and layout and included the following considerations:

5.2.1 Space Layout

5.2.2 Access Control

5.2.3 Ventilation Systems

5.2.4 Fire Control

5.2.5 Laboratory Design Features

5.2.6 Ore and Product Storage

5.2.7 General Equipment Considerations

5.3 ***CONTROL OF AIRBORNE URANIUM AND ITS DAUGHTERS***

Specific procedures and design aspects are implemented at the Piñon Ridge Mill to minimized airborne radionuclides in the following areas of the Mill:

5.3.1 Ore Storage, Handling, and Crushing Areas

5.3.2 Grinding, Leaching, and Concentrating Process Areas

5.3.3 Precipitation, Drying, and Packaging Areas

5.3.4 Miscellaneous Locations

6.0 RESPONSIBILITY

6.1 Safety Committee Membership consists of the Plant Manager, the Radiation Safety Officer (RSO), the Alternate RSO, a foreman, and an hourly employee from Operations or Maintenance. The responsibilities of the Safety Committee include:

6.1.1 Meeting monthly at a minimum and more frequently as needed and as requested by the Plant Manager and RSO. Review of radiation dose data and other indicators of abnormal exposure will be performed during meetings.

6.1.2 Reviewing new or significant projects and processes before they are implemented to ensure that ALARA practices are built into the projects/processes.

6.2 Each Safety Committee member is responsible for:

6.2.1 Performing periodic “walk-arounds” of the Mill work areas to observe and assess conditions.

6.2.2 Assessing conditions in the Mill to evaluate if actions can be taken to reduce personnel and environmental doses to levels that are reasonably achievable.

6.3 The Plant Manager is responsible for:

6.3.1 Assuring that the corrective actions identified by the Safety Committee are implemented in a timely manner.

6.3.2 Appointing members to the Safety Committee.

6.3.3 Providing resources necessary for the Safety Committee to function as defined herein.

6.4 The Radiation Safety Officer (RSO) or designee is responsible for:

6.4.1 Evaluation of the adequacy of efforts to maintain exposures ALARA.

6.4.2 Administering the ALARA Program and performing the following duties:

6.4.2.1 Review Safety Committee inspections, action items, and work orders.

6.4.2.2 Assure inspections are performed and actions followed up to closure.

6.4.2.3 Evaluate and approve proposed modifications and improvements to:

- Process changes such as reagent substitution or recycling of Mill fluids.
- Facilities and equipment.
- Procedures, such as duties of an operator.

6.4.2.4 Meet monthly or more frequently with the Safety Committee as necessary to:

- Establish and track Annual ALARA Goals.
- Review weekly and quarterly inspections.
- Review Radiation Work Permits (RWPs).
- Make recommendations regarding ALARA principles on proposed modifications or improvements to process, facilities, equipment, procedures or other aspects.

6.4.2.5 Schedule walk-arounds and assign to Safety Committee member(s).

6.5 The Alternate RSO is responsible for:

6.5.1 Preparing data summaries for Safety Committee meetings

6.5.2 Preparing minutes of Safety Committee meetings.

6.5.3 Documenting the Safety Committee Work Order Status.

6.5.4 Distributing and filing Safety Committee documentation.

6.5.5 Represent the RSO as designee in his/her absence

7.0 PREREQUISITE INFORMATION

7.1 *DEFINITIONS*

7.1.1 ALARA – "As Low As Reasonably Achievable" means making every reasonable effort to maintain exposures to radiation as far below the dose limits as is practical, consistent with the purpose for which the licensed or registered activity is undertaken. The ALARA process should take into account the state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations in relation to utilization of licensed sources of radiation in the public interest.

7.1.2 Justification – The expected benefits of the activity must exceed the predicted cost in terms of risk of adverse health effects.

7.1.3 Optimization – Radiation doses must be kept ALARA, economic and social factors being taken into account.

7.1.4 Limitation – Dose limits for individuals must be set to ensure that no individual or group of individuals receives a radiation dose which results in an unacceptable risk, exceeds regulatory criteria or violates license conditions.

7.2 *FREQUENCY*

7.2.1 Safety Committee meets at least monthly.

7.2.2 Walk-arounds will typically be scheduled weekly to monthly at the discretion of the RSO depending on the mill area and activities being performed.

7.2.3 Radiation dose data will be reviewed at least monthly prior to Safety Committee meetings.

8.0 PROCEDURES

8.1 *ALARA REVIEW PROCESS*

8.1.1 The Safety Committee will evaluate proposed or ongoing activities.

8.1.2 The overriding principles of justification of the activity, optimization of the activity in relation to potential dose and dose limitation will be used to evaluate ongoing and proposed activities, such as modifications and improvements to:

8.1.2.1 Operations

8.1.2.2 Facilities

8.1.2.3 Equipment

8.1.2.4 Personnel Utilization

8.1.3 This process will consist of aspect definition, listing pros and cons, screening the pros and cons using the regulatory guides, recommending action on an aspect, and follow up on a recommended action. Various tools such as checklists may be developed to assist this process.

8.2 DOCUMENTATION

8.2.1 Inspection reports will be completed within five working days of the walk-around by the Safety Committee member(s) and submitted to the Plant Manager with a copy circulated to other Safety Committee members. Work orders will be written for all action items even if the foreman or supervisor has been instructed to take immediate action.

8.2.2 Recommendation reports on changes to process, procedures, equipment or any other aspect of site activities will be submitted to the Plant Manager with a copy circulated to Safety Committee members.

8.2.3 Minutes of Safety Committee meetings will be addressed to the Plant Manager.

8.2.4 Annual ALARA Goals will be established during the first monthly meeting each year. These will be posted in the lunch room, the change house, and Mill office.

8.3 *TRAINING*

8.3.1 The RSO will provide annual training to Safety Committee members on regulatory guides and updates, changes to the Mill license, and changes to the radiation control regulations.

8.3.2 During initial employee training and at least once each year during a training session, a member of the Safety Committee will review this procedure, the ALARA philosophy, the annual ALARA goals, and accomplishments.

1.0 PURPOSE

The purpose of this procedure is to define the requirements and responsibilities for accident investigation, analysis of causal factors, development of corrective actions, and reporting of accidents and lessons learned.

2.0 SCOPE

This procedure is applicable to all company property, facilities, operations, and employees. EFR's Accident Investigation Program shall be used to find correctable problems that lead to implementation of effective corrective actions. A root cause analysis investigation shall be conducted on all serious accidents.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Mill Emergency Response Plan

3.2 *APPENDICES*

Appendix A – Accident Investigation Report Form AD-090A

4.0 RESPONSIBILITY

4.1 The Radiation Safety Officer (RSO) shall be responsible for:

4.1.1 Follow-up accident notification of appropriate regulatory agencies within the appropriate timeframe per the applicable regulations and/or the radioactive material license.

4.1.2 Immediate or short-term emergency or alert notification shall be conducted by the Mill Incident Commander in accordance with the Mill Emergency Response Plan.

4.2 Managers shall be responsible for:

4.2.1 Ensuring that employees are properly informed of this procedure and comply with its requirements.

4.2.2 Ensuring that employees who conduct accident investigations are trained in root cause investigation.

4.2.3 Reviewing, commenting as necessary, and approving reports of accidents within their area of responsibility.

4.2.4 Ensuring that accident investigation findings and corrective actions are addressed in a timely manner and information related to closure of corrective actions is forwarded to the Safety Department.

4.3 Supervisors shall be responsible for:

4.3.1 Notifying the Safety Department immediately of all serious accidents.

4.3.2 Communicating, as soon as possible, with the Safety Department to coordinate root cause accident investigations.

4.3.3 Conducting an accident investigation or participate on the investigation team in accordance with this procedure. If a serious accident occurs a root cause analysis will also be conducted.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

4.3.4 Ensuring that employees are informed of accident investigation findings, root causes, and lessons learned.

4.3.5 Notifying the Safety Department as soon as corrective actions are completed or that the completion date for corrective action needs to be revised.

4.4 Employees shall immediately report all accidents to their supervisor and cooperate fully with investigators during accident investigations.

4.5 The Safety Department shall be responsible for:

4.5.1 Maintaining the Accident Investigation Procedure.

4.5.2 Managing the root cause investigation program including accident investigation training, teaching of supervisors in accident investigations, coordination of the development of corrective actions, accident investigation reports, engaging the Safety Committee as necessary, and occurrence announcements on a Bulletin Board to keep all employees informed.

4.5.3 Providing accident investigation training (including root cause analysis) for Managers, Supervisors and other employees that will conduct accident investigations.

4.6 The Operations Manager or designee and the Safety Department shall be responsible for:

4.6.1 Initiating and participating in the Safety Committee.

4.6.2 Leading Safety Committee review and approval of accident investigation reports and corrective actions.

4.6.3 Submitting approved accident investigation reports and corrective actions to the Safety Department and HR/Risk Management for publication and tracking.

4.7 Safety Committee Membership consists of the Plant Manager, the RSO, the Alternate RSO, a foreman, and an hourly employee from Operations or Maintenance. The Safety Committee shall meet as necessary to review, recommend, and approve serious accident reports and corrective actions.

5.0 OBJECTIVE

The objectives of this procedure are to ensure that root-cause accident investigations are performed in a consistent manner to determine causal factors and root causes of accidents and potential accidents, and to ensure the development of corrective actions which minimize the likelihood of recurrence.

6.0 PROCEDURE

6.1 *SERIOUS ACCIDENTS (as defined in Section 7.4)*

6.1.1 All serious accidents shall be immediately reported by telephone to Safety Department, or HR/Risk Management if the Safety Department is unavailable.

6.1.2 In an emergency situation, the Mill Incident Commander will notify appropriate regulatory agencies of the emergency in accordance with the Mill Emergency Response Plan.

6.1.3 Follow-up notification to regulatory agencies will be conducted under the direction of the RSO.

6.1.4 Employees and supervisors shall complete and send to the Safety Department pages 1 and 2 of the Accident Investigation Report for all injuries which require medical treatment beyond first aid within 4 hours of an accident.

6.1.5 The Accident Investigation Report shall be completed and approved by the appropriate manager within 24 hours after notification and forwarded immediately to the Safety Department. The Safety Department shall provide HR/Risk Management with a copy of Accident Reports upon receipt.

6.1.6 HR/Risk Management shall advise if outside legal counsel or an outside investigator is necessary to assist in the investigation.

6.1.7 A root cause accident investigation process shall be used for all serious accidents. The level of investigation and report detail will depend on the specific accident. Generally, the more serious an accident or near miss, the more time necessary for the investigation process and more detail in the event and causal factor chart. Lost time injuries and forklift rollovers are examples of serious accidents that would require the full root cause investigation process and report. Minor injuries without lost time can usually be investigated quickly and corrective/preventive actions developed with no, or just a simple, event and causal factor chart.

6.1.8 The root cause investigation shall begin as soon as possible while the facts are still fresh in the minds of individuals involved with the accident. In no case should the investigation be delayed more than 48 hours after notification.

6.1.9 Supervisors are to conduct root cause investigations for serious accidents in their area of responsibility. This involves gathering all of the applicable facts and documents associated with the accident, including interviewing employees or other witnesses to determine the cause(s) and preventive measures, and creating an initial events and causal factors chart of the accident. Examples of required documents to support the investigation are:

6.1.9.1 Accident Investigation Report

6.1.9.2 Chart(s) of accident location

6.1.9.3 Employee Interviews/Statements

6.1.9.4 Photographs

6.1.9.5 Sketches

Supervisors shall identify causal factors which could have mitigated or prevented the unwanted act from occurring. This would include actions of the injured party that may have prevented their own injury or damages.

6.1.10 The Safety Department is available as a resource for investigation support and teaching during the root cause investigation process.

6.1.11 The Safety Department shall be contacted to assist in the identification of root causes and corrective and preventive actions. The establishment of root causes and corrective/preventive actions is a joint process between Operations and the Safety Department and can be accomplished by telephone or in person, depending on the severity of the accident. Root cause(s) for each causal factor shall be determined by the Safety Department. Operations shall identify the person(s) responsible for completing the corrective action and the completion date.

6.1.12 Investigators shall obtain approval of corrective/preventive actions from the appropriate level of management for the area involved with the accident and submit an electronic draft root cause investigation report to the Safety Department.

6.1.13 Supervisors shall implement immediate corrective/preventive measures within their scope of authority.

6.1.14 The Safety Department shall file copies of Accident Investigation Reports for review by the Safety Committee.

6.1.15 When legal counsel is assigned to lead an accident investigation, the Safety Department shall provide technical support on the root cause investigation process. Root cause investigation reports shall be prepared under the guidance of legal counsel and labeled “privileged and confidential” and “do not duplicate”. Distribution of these accident reports shall be on a need-to-know basis under guidance of legal counsel.

6.1.16 The Safety Department shall publish and distribute an occurrence announcement for Accident Investigation Reports approved by the Safety Committee to share lessons learned.

6.1.17 Persons responsible to complete corrective actions shall ensure timely closure and report completion to the Safety Department.

6.2 ***ALL OTHER ACCIDENTS (AS DEFINED IN Section 7.3)***

6.2.1 The Accident Investigation Report form shall be completed within 24 hours of the occurrence, approved by the appropriate supervisor, and forwarded to the Safety Department. The Safety Department shall provide HR/Risk Management with a copy of Accident Investigation Reports upon receipt.

6.2.2 If an investigation is conducted, the root cause accident investigation process shall be used.

6.2.3 HR/Risk Management shall obtain legal support if necessary.

6.3 ***SAFETY COMMITTEE***

6.3.1 The Safety Committee shall be convened by the Plant Manager or designee and the Safety Department for major losses or potential losses involving employees or equipment where:

6.3.1.1 An MSHA reportable accident resulting in a fatality or hospitalization or a vehicle being towed from the scene is involved.

6.3.1.2 An individual loss is estimated to exceed $500.

6.3.1.3 The loss, even though less than $500, represents an example of a repetitive loss.

6.3.1.4 The Safety Department or Plant Manager deems a Safety Committee to be necessary.

6.3.2 The Safety Committee shall consist of a cross-section of company disciplines including Safety/Risk Management and other employee representatives who have the knowledge and experience to investigate the casualty, identify root causes, and formulate corrective actions (see the ALARA Procedure AD-080).

6.3.3 The Safety Committee process shall follow the root cause investigation procedure as provided by training.

7.0 DEFINITIONS

7.1 Accident - An undesired event that results in injury to people, damage to property, or loss of service.

7.2 Near miss - An event which occurred (or could occur) but did not result in injury, damage to property or equipment over $500 or service loss.

7.3 All other accidents - Any damage or first aid case not classified as a serious accident or near miss.

7.4 Serious accidents - Accidents or accidents/near misses involving personnel, the public, and/or contractors on EFR’s property performing activities requested by EFR or activities supervised by EFR resulting in, or having the potential to result in:

7.4.1 MSHA reportable accidents that are immediately reportable to MSHA include the following:

7.4.1.1 Any injury that results in death.

7.4.1.2 Any injury that has a reasonable potential to cause death.

7.4.1.3 An entrapment of an individual for more than thirty minutes or which has the reasonable potential to cause death.

7.4.1.4 An unplanned ignition or explosion of a gas, dust, explosive or blasting agent.

7.4.1.5 An unstable condition or failure of any impoundment or soil pile.

7.4.2 MSHA reportable accidents that are required to be reported to MSHA within 10 days of occurrence:

7.4.2.1 A non-fatal injury that results in lost workdays.

7.4.2.2 A non-fatal injury without lost workdays in which the employee cannot perform all job duties on any day after injury, or which result in transfer to another job or termination of employment, requires medical treatment (other than first aid)*, or involves loss of consciousness. This category would also include any diagnosed occupational illnesses which are reported, but are not reported as fatalities or lost workday cases.

7.4.3 Fires.

7.4.4 Equipment Damages over $500.

7.4.5 Property damages over $500.

7.4.6 Incidents requiring reporting to the CDPHE within 24 hrs per 6 CCR 1007-1, part 4, section 4.5.2 and/or the radioactive material license.

7.5 Root cause - The most basic cause(s) that can be reasonably identified and that management has control to fix. These are the fixable causes of an occurrence that when corrected will prevent recurrence or prevent the potential event causes from occurring.

7.6 Medical treatment - Includes treatment administered by a physician or registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment, even when provided by a physician or registered professional personnel.

7.7 Lost workdays - The number of days (consecutive or not) after, but not including, the day of the injury or illness during which the employee would have worked but could not do so.

Accident Investigation Procedure AD-090

Appendix A

Accident Investigation Report Form AD-090A

Accident Investigation Report

Instructions: Pages 1 and 2 of this report shall be completed by employees and supervisors and sent to the Safety Department within 4 hours of an accident. This report shall be completed by the Safety Department within 24 hours of an accident that results in serious injury or illness.

General Incident Information

This is a report of a: ❑ Death ❑ Lost Time ❑ Dr. Visit Only ❑ First Aid Only ❑ Near Miss ❑ Other

Date of incident:	Employee(s) involved:

Type of Incident:
Check One:
- ❑ Accident- no apparent injuries
- ❑ Accident- possible injuries
- ❑ Property Damage
- ❑ Equipment failure/damage

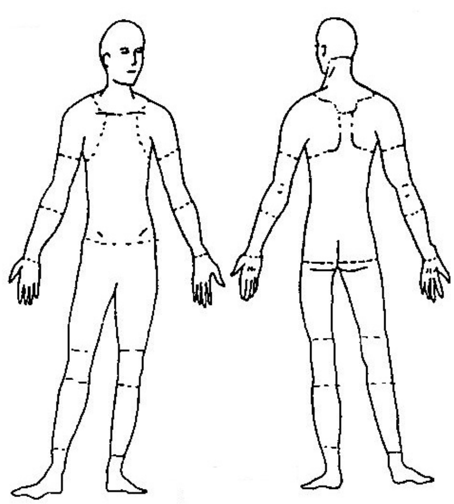
* If no apparent of possible injury, proceed to Step 2.

Step 1: Injured employee (complete this part for each injured employee)

Name:	Sex: ❑ Male ❑ Female	DOB:
Address:	Phone Number: SSN:	

Job Title:

Part of body affected: (shade all that apply)



Nature of injury: (most serious one)
- ❑ Abrasion, scrapes
- ❑ Amputation
- ❑ Broken bone
- ❑ Bruise
- ❑ Burn (heat)
- ❑ Burn (chemical)
- ❑ Concussion (to the head)
- ❑ Crushing Injury
- ❑ Cut, laceration, puncture
- ❑ Hernia
- ❑ Illness
- ❑ Injection injury involving radioactive material
- ❑ Potential inhalation of radioactive material
- ❑ Potential radiological skin contamination
- ❑ Sprain, strain
- ❑ Damage to a body system: (e.g.: nervous, respiratory, or circulatory systems) ____________________
- ❑ Other ___________

This employee works:
- ❑ Regular full time
- ❑ Regular part time
- ❑ Seasonal
- ❑ Temporary

Months doing this job:

Step 2: Describe the incident			
Exact location of the incident:			Exact time:
What part of employee's workday? ❑ Entering or leaving work ❑ Doing normal work activities ❑ During meal period ❑ During break ❑ Working overtime ❑ Other			
Names of witnesses (if any):			

Number of attachments:	Written witness statements:	Photographs:	Maps / drawings:
What personal protective equipment was being used (if any)?			
Describe, step-by-step the events that led up to the injury. Include names of any machines, parts, objects, tools, materials and other important details. Description continued on attached sheets: ❑			

Step 3: Why did the incident happen?	
Unsafe workplace conditions: (Check all that apply) ❑ Inadequate guard ❑ Unguarded hazard ❑ Safety device is defective ❑ Tool or equipment defective ❑ Workstation layout is hazardous ❑ Unsafe lighting ❑ Unsafe ventilation ❑ Lack of needed personal protective equipment ❑ Lack of appropriate equipment / tools ❑ Unsafe clothing ❑ No training or insufficient training ❑ Other: ______________________________	Unsafe acts by people: (Check all that apply) ❑ Operating without permission ❑ Operating at unsafe speed ❑ Servicing equipment that has power to it ❑ Making a safety device inoperative ❑ Using defective equipment ❑ Using equipment in an unapproved way ❑ Unsafe lifting by hand ❑ Taking an unsafe position or posture ❑ Distraction, teasing, horseplay ❑ Failure to follow procedure requirements ❑ Failure to follow radiation work permit requirements ❑ Failure to wear personal protective equipment ❑ Failure to use the available equipment / tools ❑ Human error ❑ Other: ___________________________________
Why did the unsafe conditions exist?	
Why did the unsafe acts occur?	
Is there a reward (such as "the job can be done more quickly" or "the product is less likely to be damaged") that may have encouraged the unsafe conditions or acts? ❑ Yes ❑ No If yes, describe:	
Were the unsafe acts or conditions reported prior to the incident? ❑ Yes ❑ No	
Have there been similar incidents or near misses prior to this one? ❑ Yes ❑ No	

Step 4: How can future incidents be prevented?

What changes do you suggest to prevent this injury/near miss from happening again?

❑ Stop this activity ❑ Guard the hazard ❑ Train the employee(s) ❑ Train the supervisor(s)

❑ Redesign task steps ❑ Redesign work station ❑ Write a new policy/rule ❑ Enforce existing policy

❑ Routinely inspect for the hazard ❑ Personal Protective Equipment ❑ Other: ____________________

What should be (or has been) done to carry out the suggestion(s) checked above?

Description continued on attached sheets: ❑

Employee Signature: ____________________________Date: ________________

Supervisor Signature: ___________________________ Date: ________________

Step 5: Who completed and reviewed this form? (Please Print)

Written by: Department:	Title: Date:
Names of investigation team members:	
Reviewed by:	Title: Date:

1.0 PURPOSE

This procedure identifies non-radiological job hazards and provides a method to prevent injury or equipment damage utilizing a Job Safety Analysis.

2.0 SCOPE

This procedure applies to all employees, supervisors, contractors and subcontractors on the Mill site. Work or components of work that involve radiological materials will be evaluated by the Radiation Work Permit Procedure (RH-060) in conjunction with this procedure.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Radiation Work Permit Procedure No. RH-060

3.2 *APPENDICES*

Appendix A – Job Safety Analysis Form AD-100A

4.0 RESPONSIBILITY

4.1 Supervisors will:

4.1.1 Complete a job safety analysis prior to work beginning on the job site which is of a non-routine nature.

4.1.2 Initiate the RWP procedure (RH-060) if it is applicable (i.e. involves work with radioactive materials)

4.1.3 Sign off on the job analysis prior to commencing work.

4.1.4 Discuss the approved job safety analysis with the employees, contractors and/or subcontractors performing and the work.

4.2 The Radiation Safety Officer (RSO) will:

4.2.1 Review the analysis and revise or add to the analysis as required by a specific portion of the job including determination of the applicability of a RWP.

4.2.2 Approve the analysis if it is sufficiently protective.

4.2.3 Review the job safety analysis at project completion and determine if further risk controls should be implements for similar work activities.

4.2.4 Assign an employee to record the job safety analysis in the Master Job Safety Analysis database.

4.3 The employees, contractors and/or subcontractors performing the work activities will:

4.3.1 Discuss the job safety analysis with the supervisor.

4.3.2 Be responsible for understanding the risk controls in the job safety analysis and implementing them in the work activities.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

4.4 The person(s) responsible may be the RSO, supervisor, or contractor/ subcontractor supervisor and will:

4.4.1 Observe the implementation of the risk controls.

4.4.2 Signoff on completion of the work activity.

5.0 OBJECTIVE

The hazard analysis will serve as a guide to preventing hazards in daily operations and to be used in weekly safety meetings to highlight potential hazards to employees.

6.0 PROCEDURE

6.1 Prior to the start of each shift and as necessary during each shift, the Supervisor will prepare a job safety analysis for any non-routine work anticipated to be performed utilizing the Job Safety Analysis Form AD-100A included in Appendix A. The job safety analysis will include review of:

6.1.1 Work activities associate with the job broken down into individual steps.

6.1.2 The hazards associate with each work activity.

6.1.3 The risk controls that can be implanted to minimize the hazards.

6.1.4 The persons responsible to verify that the risk controls are being implemented.

6.1.5 Any potential radiological hazards associated with the work activities. If any radiological hazards are present the supervisor will implement the RWP procedure in conjunction with this procedure.

6.2 The Supervisor will submit the job safety analysis to the RSO who will:

6.2.1 Review the job safety analysis prepared by the Supervisor.

6.2.2 Amend or revise the analysis as necessary.

6.2.3 Ensure the analysis has considered and is consistent with requirements specified in the associated RWP (if applicable)

6.2.4 Approve, sign and date the job safety analysis on Form AD-100A when the analysis is sufficient.

6.3 The RSO will return the job safety analysis to the Supervisor who will:

6.3.1 Review, sign and date the job safety analysis.

6.3.2 Discuss the job safety analysis with the appropriate employees, contractors and subcontractor that will be performing the work.

6.4 The appropriate employees, contractors and subcontractors responsible for performance of the work activity will review the job safety analysis with the Supervisor and sign and date the form.

6.5 Following completion of each work activity the person designated as being responsible for implementation of the job safety analysis will date and initial each activity on the Job Safety Analysis form.

6.6 Following completion of the job the RSO will make observations or notes on the form that may be helpful for performing the job again or performing similar jobs and will assign an employee to enter the job safety analysis into the Master Job Safety Analysis database maintained to record the hazards that may be encountered for specific activities.

Job Safety Analysis Procedure AD-100

Appendix A

Job Safety Analysis Form AD-100A

Job Safety Analysis Form

Name of organization:	**Job name:**
Task:	**Job number:**
Principal contractor:	**Job location:**
This JSA was prepared by (signature): Date	This JSA has been reviewed by (signature): Date
This JSA has been discussed with:	
Principal Contractor or Representative (signature)	Employee/subcontractor (signature)
Position Date	Position Date

Item	**Work activity** Break the job down into steps	**Hazard** What could harm someone?	**Risk control** What can be done to make the job safe?	**Persons responsible** Who will make sure it happens?	**Completion** Date and initial

Form AD-100A

Item	**Work activity** Break the job down into steps	**Hazard** What could harm someone?	**Risk control** What can be done to make the job safe?	**Persons responsible** Who will make sure it happens?	**Completion** Date and initial

Form AD-100A

1.0 PURPOSE

The purpose of this procedure is to identify the minimum safety and environmental requirements for EFR contractors.

2.0 SCOPE

This procedure applies to all contractors and their employees who work at the Piñon Ridge Mill.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Mill Health and Safety Plan including all programs and procedures

3.1.2 Radioactive Materials License

3.1.3 Colorado Rules and Regulation Pertaining to Radiation Control (6 CCR 1007-1)

4.0 RESPONSIBILITY

All contractors shall comply and ensure compliance by its employees and subcontractors with all applicable federal, state and local safety and environmental regulations, laws, and standards, as well as this procedure.

5.0 PROCEDURE

5.1 *JOB PLANNING*

5.1.1 Understanding of the safety and environmental requirements of the job is critical to the overall success of the project. The job planning process includes a review of all activities conducted by the Contractor for the job prior to arrival at the Mill site to perform the work.

5.1.2 The Contractor shall review the Mill Health and Safety Plan, including all programs and procedures that are applicable to the work to be performed.

5.1.3 Job Safety Analyses and Radiation Work Permits may be required for one or several tasks to be performed by the Contractor. Review of these documents should occur during the job planning process to ensure that the Contractor is prepared to meet all the conditions included. Job Safety Analysis should include both the Contractor personnel involved in performing the work and EFR personnel familiar with the operations and systems involved.

5.1.4 Requirements of safety and personal protective equipment shall be determined prior to beginning work. The contractor shall contact the RSO or the Safety Department to discuss the safety and personal protective equipment required for the tasks. Generally, the Contractor will be responsible for providing equipment for its employees. However, some

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

equipment may be supplied by the Mill to ensure compatibility with Mill equipment and systems.

5.2 *PRE-JOB MEETING*

5.2.1 Contractors shall be required to attend a pre-job meeting to discuss Contractor safety and environmental requirements and jobsite safety/hazard and environmental protection information. The pre-job meeting shall be documented in accordance with the Safety Meetings Procedure HS-010.

5.2.2 The independent contractor register requirements under 30 CFR part 45 must be met by providing the following information to EFR:

5.2.2.1 The trade name, business address, and business telephone for the independent contractor.

5.2.2.2 The independent contractor's MSHA ID Number, if any.

5.2.2.3 The independent contractor's address of record for service of citations or other documents by MSHA involving the independent contractor.

5.2.2.4 EFR will maintain the independent contractor register information and make it available to a designated representative of the Secretary of Labor upon request.

5.3 *REPORTING TO WORK*

5.3.1 Contractor supervisory personnel shall report to the appropriate EFR supervisor upon arrival at the work location.

5.3.2 Contractor management shall ensure that Contractor personnel have received appropriate MSHA required training before performing work at the job site. Certificates of training should be available upon request of the Safety Department.

5.3.3 EFR will provide Contractor Training including radiological and non-radiological health and safety and environmental training for familiarization with Colorado Rules and Regulations Pertaining to Radiation Control, the Radioactive Material License, EFR programs and procedures, potential jobsite hazards, emergency procedures, and environmental protection. Safety Training is provided in accordance with the Radiological Health and Safety Training Procedure RH-010.

5.4 *ACCIDENT, INJURY AND ILLNESS, AND SPILL REPORTING*

All work related accidents, injuries and illnesses, and spills shall be reported immediately or as soon as safely possible to the appropriate EFR representative. It is the responsibility of the Contractor's designated person-in-charge to ensure that all accidents on jobsites or at facilities involving personnel injury or illness, fire and/or explosions, property damage, hazardous materials spills and vehicles are reported to EFR and to all applicable federal, state and local governments having jurisdiction.

5.5 *CONTRACTOR RESPONSIBILITIES*

5.5.1 Contractor shall ensure that all Contractor personnel are qualified and trained to perform the contracted services.

5.5.2 Contractor shall adhere to all applicable federal, state and local regulations pertaining to a particular operation for which its services are contracted, and appropriate EFR procedures.

5.5.3 Contractor shall be responsible for ensuring that all operations are conducted in a safe and pollution free manner, and for promptly correcting and reporting to EFR and to Contractor's employees and subcontractors all known or suspected hazards or unsafe conditions.

5.5.4 Contractor personnel violating any of EFR's safety or environmental policy, practice or procedure, or applicable governmental regulation shall be subject to immediate removal from EFR property.

5.5.5 Contractors and contractors' employees that will be performing work within the restricted area shall attend site-specific Radiological Health and Safety Training to a level at the discretion of the RSO or Alternate RSO dependent on the type and location of work to be performed.

5.5.6 Contractors and contractors' employees who perform work within or enter the restricted area for any reason shall comply with all radiological safety procedures.

5.6 *PERSONAL PROTECTION EQUIPMENT (PPE) REQUIREMENTS*

5.6.1 Head Protection

A non-conductive hard hat that meets the requirements of ANSI Z89.1 shall be worn at all times while performing work on EFR jobsites or facilities.

5.6.2 Foot Protection

Safety shoes or full shelled boots or work shoes in good condition, with slip resistant and oil resistant soles, that meet ANSI Z41.1 requirements shall be worn at all times while performing work on EFR jobsites or facilities.

5.6.3 Eye/Face Protection

Eye protection shall be worn while performing work that may pose a hazard to your eyes on EFR jobsites or while at EFR facilities. Minimum protective eyewear shall be safety glasses with side shields. All eye/face protection shall meet ANSI Z87.1.

5.6.4 Hearing Protection

5.6.4.1 Contractors must comply with MSHA 30 CFR part 62 regulations and the EFR Hearing Conservation Procedure HS-030

5.6.4.2 Hearing protection devices that meet the standards of MSHA 30 CFR part 62 shall be worn in all posted high noise areas.

5.6.4.3 Hearing protection is required in all known or suspected areas with noise levels of 85 dBA.

5.6.5 Protective Clothing

Protective clothing shall be worn when handling hazardous materials or chemicals, when such is specified by the applicable Material Safety Data Sheet (MSDS).

5.6.6 Hand Protection

Appropriate protective gloves shall be worn where there is risk of exposure to high temperatures, sharp edges, chemicals or any other conditions or materials which may cause injury to the hands.

5.6.7 Fall Protection

5.6.7.1 All Contractors performing work requiring fall protection shall be in accordance with the EFR Fall Protection Procedure HS-080.

5.6.7.2 All work performed over 6 feet above ground, or where a fall hazards of 6 feet or more exist shall use fall protection.

5.6.8 Respiratory Protection Equipment

Personal respiratory protection equipment shall be selected, inspected, maintained and used in accordance with the Mill Respiratory Protection Health and Safety Procedures HS-130, HS-131 and HS-132.

5.7 ***SAFE WORK PRACTICES***

The following items recognize basic safe work practices:

5.7.1 Alcohol and Illegal Drugs

5.7.1.1 All contractors and subcontractors must comply with applicable local state and federal drug laws and the EFR Drug Policy Procedure AD-120 including drug testing.

5.7.1.2 The manufacture, distribution, dispensing, possession, use, or being under the influence of a controlled substance is strictly prohibited.

5.7.2 Smoking

5.7.2.1 Smoking is prohibited within the entire restricted area, indoors and outdoors.

5.7.2.2 Smoking is prohibited in all indoor .enclosed areas on the mill property in compliance with the Colorado Clean Indoor Air Act.

5.7.2.3 Smoking is allowed in outdoor areas outside of the restricted area such as parking lots and in vehicles (provided the vehicle is outside the restricted area).

5.7.3 Hand and Power Tools

5.7.3.1 All Contractors performing work using hand and/or power tools shall be in accordance with the EFR Hand and Power Tools Procedure HS-120.

5.7.3.2 Power tools include tools using electrical, pneumatic or hydraulic power and powder-actuated tools

5.7.4 Ladders and Scaffolding

All Contractors performing work requiring ladders and/or scaffolding shall be in accordance with the EFR Ladders and Scaffolding Procedure HS-100.

5.7.5 Signs

All contractors shall be familiar with and comply with all signs posted throughout EFR's facilities.

5.7.6 Lockout/Tagout

All contractors shall comply with MSHA 30 CFR part 56 lockout/tagout procedures and the EFR Lockout/Tagout Procedure HS-110 while working on powered equipment, when performing confined space entry operations or when engaged in other work activities where the control of potentially hazardous energy is necessary to ensure personal safety.

5.7.7 Confined Space Entry

All Contractors performing work involving confined space entry shall be in accordance with applicable federal and state regulatory standards and the Confined Space Entry Procedure HS-050.

5.7.8 Electrical Safety

All Contractors performing work using or on electrical equipment, including powered hand tools and lighting, shall be in accordance with the EFR Electrical Safety Procedure HS-060.

5.7.9 Hot Work

All welding, cutting, and brazing shall be done in accordance with 30 CFR (MSHA) and local Fire Department regulations. Where hot work involves other contaminants such as radioactive materials, internal EFR procedures and the Radioactive Materials License shall be reviewed for additional requirements.

5.7.10 Excavation and Trenching

All Contractors performing work involving excavation and/or trenching shall be in accordance with the EFR Excavation and Trenching Procedure HS-070.

5.7.11 Flammable Materials

All Contractors performing work involving flammable materials shall be in accordance with the EFR Flammable Materials Storage Procedure HS-090.

5.7.12 Hazard Communication (HazCom)

5.7.12.1 Contractor personnel shall be familiar with EFR's HazCom procedure.

5.7.12.2 EFR shall provide, upon request, an appropriate Material Safety Data Sheet (MSDS) for hazardous chemicals or materials maintained at each location.

5.7.12.3 Contractor shall maintain an on-site appropriate MSDS for any hazardous material or chemical which Contractor brings on-site. Such hazardous materials or chemicals shall be properly stored and labeled in accordance with MSHA and local Fire Department regulations.

5.7.13 Vehicle Operations

Contractors shall operate vehicles in full compliance with all applicable federal, state and local regulations and the EFR Vehicles and Mobile Equipment Procedure HS-040.

5.7.14 Training

Contractor employees shall be appropriately trained in accordance with MSHA regulations to perform the assigned task.

5.8 ***ENVIRONMENTAL PROTECTION***

Contractor shall perform work on EFR facilities in a manner that protects the environment and fully complies with federal, state, and local pollution prevention laws, as well as EFR procedures.

5.9 ***CONTRACTOR WASTE***

5.9.1 Contractor shall notify the appropriate EFR representative of any waste generated on the Mill property.

5.9.2 Contractor shall place waste in a waste storage area.

5.9.3 Contractor shall be responsible for appropriate waste disposal unless otherwise stated by Contract.

1.0 PURPOSE

The purpose of this procedure is to develop a policy on drug use in the workplace and to keep current with Federal and State Drug Free Workplace policies and contractual obligations.

2.0 SCOPE

This policy applies to all employees of EFR and to all subcontractors that may work on the site.

3.0 RESPONSIBILITY

3.1 Managers will be responsible for implementing the Drug Policy at the work site.

3.2 Supervisors are responsible for enforcing the policy and recognizing problems with alcohol or drug abuse in the workplace.

3.3 The Safety Department will maintain the policy and implement the procedures for carrying out the policy on the work site.

3.4 Employees must comply with the following:

3.4.1 The manufacture, distribution, dispensing, possession, use, or being under the influence of a controlled substance at the work site is strictly prohibited.

3.4.2 Notify the Safety Manager of any criminal drug statute conviction for a violation occurring in the workplace no later than 5 days after the conviction.

4.0 OBJECTIVE

The objective of this policy is to assure that use of controlled substances in the workplace will not occur in order to keep the workplace as safe as possible from the inherent danger associated with persons working under the influence of drugs.

5.0 PROCEDURE

5.1 Drug testing of employees will be employed for the following reasons:

5.1.1 Prior to employment

5.1.2 Following a lost time injury

5.1.3 To meet Department of Transportation (DOT) requirements for a commercial driver's license

5.1.4 Following an incident/accident that occurs while operating company vehicles or equipment

5.1.5 An indication of use because of a change in behavior or workmanship is observed

5.1.6 Reasonable suspicion

5.1.7 Random sampling

5.2 Any person testing positive for drugs or registering 0.04 percent or higher on a random job site blood alcohol breath test will be subject to dismissal and rehabilitation treatment will be recommended. Future employment may be

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

considered after the employee successfully completes an approved drug or alcohol rehabilitation program and certifies that further drug use will not occur.

5.3 Refusal to participate in testing will result in termination of employment or termination of an application for employment.

5.4 Any modification of the sample or use of an adulterant will be considered as a refusal to participate in testing.

5.5 An EFR-approved drug testing center will be utilized and all samples will be taken and analyzed according to standard laboratory procedures.

5.6 Testing for the following substances will occur at a minimum:

5.6.1 Amphetamines

5.6.2 Barbiturates

5.6.3 Cocaine

5.6.4 Marijuana

5.6.5 Opiates

5.7 If a test for drugs or alcohol is positive the results will be sent to the corporate Human Resources Department for evaluation. Human Resources will call the affected employee for an interview within 48 hours of receiving the test results. An employee will not be allowed to return to the worksite following a positive test.

5.8 If there is a reasonable doubt that the test results are true, Human Resources or the employee may request a retest of the sample. If the retest is positive the employee will be terminated and charged for the cost of the retest. If the retest is negative, the employee will be allowed to return to work and be compensated for expenses.

5.9 Upon written request, the results of the test will be sent to the employee within five days of receiving the request. The written request must be submitted within six months of the test date. If requested, and if reasonable, the employee may also be afforded a meeting to discuss the positive test results.

5.10 All drug and alcohol test results are confidential and information will only be disclosed to the following personnel and then only to the extent necessary:

5.10.1 The tested person or someone that person designates in writing.

5.10.2 The Radiation Safety Manager (RSO), for evaluation of the test results.

5.10.3 Human Resources, in the case of a positive test result, for review and interview purposes.

5.10.4 Persons necessary as ordered by a court of law or regulatory agency.

Attachment C

General Health and Safety Procedures

1.0 PURPOSE

This procedure outlines basic procedures for safety meetings.

2.0 SCOPE

This procedure applies to all EFR employees, contractors and subcontractors.

3.0 OTHER DOCUMENTS

3.1 ***APPENDICES***
Appendix A – Safety Meeting Attendance Form HS-010A

4.0 RESPONSIBILITY

4.1 Supervisors shall ensure adherence to this procedure.

4.2 The Safety Department may provide supervisors with a list of safety topics.

5.0 PROCEDURE

5.1 Safety Meetings shall be held at least once a month; or whenever a special hazardous operation is to be conducted.

5.2 The Safety Meeting Attendance Form HS-010A will be filled out with each attending employee's signature. A list of topics discussed will also be included.

5.3 Contractors attendance to safety meetings is not required unless specifically requested by the Safety Department. The Safety Department requests for Contractors to attend safety meetings will be determined on a case-by-case basis and is dependent on a variety of factors including, but not limited to, the length of the contract, applicability to the contracted work, and performance of the Contractor. Requests may be for attendance of all Contractors' personnel or supervisory personnel only.

5.4 Contractors' internal safety meetings do not need to be conducted in accordance with this procedure.

6.0 RECORDS

Each department shall keep a record of their safety meetings and the facility will keep the record on file until termination of license. A copy of the safety meeting minutes shall be submitted to the Safety Department.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

Safety Meetings Procedure HS-010

APPENDIX A

Safety Meeting Attendance Form HS-010A

SAFETY MEETING ATTENDANCE

DATE: __________________

SAFETY MEETING TOPICS: ____

____

____

MEETING PRESENTOR (PRINT/SIGN): ____

ATTENDEE SIGNATURES:

____________________________________	____________________________________
____________________________________	____________________________________
____________________________________	____________________________________
____________________________________	____________________________________
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1.0 PURPOSE

The purpose of this procedure is to provide specific instructions to reduce workers risk by minimizing or eliminating employees' exposure to bloodborne pathogens, such as the Hepatitis B Virus (HBV), non-A and non-B hepatitis, and Human Immunodeficiency Virus (HIV).

2.0 SCOPE

This procedure is designed for EFR's employees and contractors (personnel) when the hazard of blood or Other Potentially Infectious Material (OPIM) is encountered.

3.0 RESPONSIBILITY

3.1 Managers or Supervisors shall be responsible for the implementation of this program.

3.2 Employees shall comply with the following procedures:

3.2.1 When blood or OPIM are encountered wear the appropriate PPE.

3.2.2 Inform their supervisors of consumable First Aid and personal protective equipment that needs to be replaced following an event in which they are used.

3.2.3 Inform their supervisors if they have been exposed.

4.0 OBJECTIVE

4.1 The objectives of this procedure are to:

4.1.1 Provide guidance when occupational exposure or potential occupational exposure to blood and OPIM occurs.

4.1.2 Provide procedures to eliminate or minimize employee exposure.

5.0 PROCEDURE

5.1 EFR will use universal precautions to prevent contact with blood or OPIM.

5.2 Employees shall wash their hands and skin with soap and water or flush mucous membranes with water immediately after contact with blood or OPIM and PPE removal.

5.3 Contaminated needles and other contaminated sharps shall not be bent, recapped, removed, sheared, or purposely broken.

5.4 Sharps shall be properly disposed of immediately after they are used.

5.5 Eating, drinking, smoking, applying cosmetics or lip balm, or handling contact lenses shall not be permitted where exposure to blood or OPIM may occur.

5.6 ***PERSONAL PROTECTION EQUIPMENT (PPE)***

5.6.1 Employees shall wear PPE when they may be exposed to infectious or potentially infectious materials.

5.6.2 Protective Gloves (latex, nitrile or similar) are required for any activities involving potential bloodborne pathogens. Protective gloves must be clean and unused to avoid contamination of the wound. Protective gloves are available in all First Aid kits on the mill site.

5.6.3 Eye and/or face protection shall be used when splashes, sprays, spatters, or droplets of blood or OPIM pose a hazard to the eye, nose, or mouth. Safety goggles and face shields are available throughout the mill site, at the on-site First Aid station in the change house, and in the ambulance at the Administration Building.

5.6.4 PPE shall be worn to prevent contaminating a work surface or when helping a fellow employees dress a wound.

5.6.5 Contaminated PPE shall be removed immediately and placed in an approved container. The Safety Department shall be contacted for disposing the container.

5.6.6 Contaminated saturated clothing shall not be laundered.

5.6.7 Contaminated PPE shall not be reused.

5.7 ***DISPOSAL***

5.7.1 Biohazard labels shall be affixed to regulated waste containers; refrigerators and freezers containing blood and OPIM; and other containers used to store, move, or ship blood or OPIM. Tags can also be used to label containers or equipment.

NOTE: Red bags or red containers may be substituted for labels.

5.7.2. If applicable, place biohazard contaminated materials in biohazard waste containers as soon as possible. The Safety Department will contact the emergency service office for disposal assistance.

5.7.3 Biohazard waste shall be disposed in compliance with applicable federal and state regulations.

5.8 ***HOUSEKEEPING***

Employees shall clean and decontaminate the area immediately when first aid procedures are performed in which blood or OPIM are encountered.

5.9 ***POST-EXPOSURE EVALUATION AND FOLLOW-UP***

5.9.1 Exposures shall be reported, investigated, and documented.

5.9.2 After a reported exposure, the exposed employee shall immediately receive a confidential medical evaluation and follow-up.

5.9.3 Information shall be provided to the healthcare professional as required.

5.9.4 Within 15 days after the evaluation is completed, the employee shall receive a copy of EFR’s medical consultant's written opinion.

5.10 ***TRAINING AND INFORMATION REQUIREMENTS***

Training shall be given to employees impacted by this procedure.

5.11 ***EVALUATION AND REVIEW***

This program shall be reviewed annually to evaluate its effectiveness and updated as needed.

6.0 DEFINITIONS

6.1 Blood - Human blood, human blood components, and products made from human blood.

6.2 Bloodborne Pathogens - Pathogenic microorganisms present in human blood that can cause disease in humans, including, but not limited to, the Hepatitis B virus (HBV) and human immunodeficiency virus (HIV).

6.3 Contamination - The presence or the reasonably anticipated presence of blood or OPIMs on an item or surface.

6.4 Decontamination - The use of physical or chemical means to remove, inactivate, or destroy bloodborne pathogens on a surface or item to the point where they are no longer capable of transmitting infectious particles and the surface or item is rendered safe for handing, use, or disposal.

6.5 Exposure Incident - Denotes a specific eye, mouth or other mucous membrane, non-intact skin, or parenteral contact with blood or other potentially infectious materials resulting from the performance of an employee's duties. An incident in which an employee has been exposed to blood or other OPIM.

6.6 Licensed Healthcare Professional - A person whose legally permitted scope of practice allows him or her to independently perform the required activities under the subsection of Hepatitis B Vaccination and Post-Exposure Evaluation and Follow-up, found in this plan.

6.7 HBV - Hepatitis B virus.

6.8 HIV - Human immunodeficiency virus.

6.9 Occupational Exposure - Reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or OPIM that may result from the performance of an employee's duties (potential exposure).

6.10 Other Potentially Infectious Material (OPIM) - Blood, semen, vaginal secretions, vessel sanitation systems, saliva (if bloody), joint fluids, organs, and other body fluids which may appear to be visibly tainted with blood.

6.11 Parenteral – Piercing of mucous membrane or the skin barrier with needle, stick, human bite, cut, or abrasion.

6.12 Personal Protection Equipment (PPE) - Specialized clothing worn by an employee for protection against a hazard. General work clothes (pants, shirts, or blouses) not intended to function as protection against a hazard are not considered to be PPE.

6.13 Regulated Waste - Liquid or semi-liquid blood or OPIM; contaminated items that would release blood or OPIM in a liquid or semi-liquid state if compressed; items that are caked with dried blood or OPIM and are capable of releasing these materials during handling; contaminated sharps; and pathological and microbiological wastes containing blood or OPIM. Feminine napkins are not considered a regulated waste as long as they are not squeezed to the point that blood would drip or flake out. They are to be treated as infected but are not a regulated waste; therefore, they do not have to be labeled or containerized.

6.14 Sharps - Articles that can penetrate the skin, such as needles, scalpels, broken glass, and saw blades.

6.15 Source Individual - Any individual, living or dead, whose blood or OPIM may be a source of occupational exposure to the employee.

6.16 Universal Precautions - An approach to infection control. According to the concept of universal precautions, human blood, and certain human body fluids are treated as if known to be infectious for HIV, HBV, and other bloodborne pathogens.

1.0 PURPOSE

This procedure establishes Energy Fuels requirements to protect employees and contractors from risk of permanent hearing impairment resulting from exposure to potentially hazardous levels of workplace noise. The procedure is designed to be compliant with the Mine Safety & Health Administration (MSHA) occupational noise standard.

2.0 SCOPE

This procedure is applicable to all employees and contractors (personnel) who are exposed to noise levels above 85 dBA over an 8-hour period.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Training Records Documentation and Tracking Procedure No. AD-060

4.0 RESPONSIBILITY

4.1 Managers shall ensure employees and contractors follow this procedure.

4.2 Supervisors shall assist employees, contractors and the Safety Department in identifying noisy areas.

4.3 Employees and contractors (personnel) shall identify potential noisy areas and report them to their supervisor, participate in hearing conservation training, and wear hearing protection when required.

4.4 The Radiation Safety Officer (RSO) or Alternate RSO shall identify personnel and contractors exposed above the action level, facilitate noise level sampling, post signs as appropriate, provide audiometric exams, provide a selection of hearing protection, facilitate training, provide personnel with the opportunity to observe any noise measurements and otherwise maintain the Hearing Conservation Program (HCP).

5.0 OBJECTIVE

The objective of this procedure is to provide guidelines and procedures for limiting noise exposure to all personnel.

6.0 PROCEDURE

6.1 *HEARING CONSERVATION*

6.1.1 Protection against the effects of noise must be provided when sound levels exceed the Action Level (AL) of 85 dBA over an 8-hour Time Weighted Average (TWA).

6.1.2 EFR will use all feasible engineering and administrative noise controls to reduce personnel noise exposures to within the Permissible Exposure Limit (PEL) of 90 dBA over an 8-hour TWA without adjustment for the use of hearing protection.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

6.1.3 If personnel noise exposure exceeds the PEL despite the use of all feasible engineering and administrative controls EFR will implement the Hearing Conservation Program in accordance with MSHA regulations

6.2 ***NOISE MONITORING***

6.2.1 A baseline sound level survey of noise sources will be conducted in noisy areas either with a sound level meter or personal noise dosimeters.

6.2.2 Once baseline noise levels have been established for EFR operations, monitoring shall be repeated whenever a change in production, process, equipment or controls has the potential to increase noise exposures.

6.2.3 Each new project will be evaluated by the RSO or Alternate RSO to determine if baseline monitoring is required.

6.2.4 EFR will notify, in writing, personnel exposed above the 85 dBA level, of their exposure and of their inclusion in the Hearing Conservation Program as required by MSHA standards.

6.3 ***HEARING PROTECTION***

6.3.1 EFR will provide hearing protection to any personnel whose noise exposure equals or exceeds the action level.

6.3.2 A choice of hearing protection will be provided, including at least two muff types and two plug types at no cost to personnel.

6.3.3 If personnel noise exposure exceeds the dual hearing protection level, both a muff type and a plug type will be provided.

6.4 ***AUDIOMETRIC TESTING PROGRAM***

6.4.1 EFR will require and provide at no cost, a baseline and subsequent annual audiogram for personnel enrolled in the HCP.

6.4.2 The baseline audiogram will be provided within 6 months of enrolling personnel in an HCP, or 12 months if a mobile test van is used.

6.5 ***TRAINING***

6.5.1 EFR will provide personnel with specific, noise related training within 30 days of enrollment in the HCP.

6.5.2 The training will be repeated at least every 12 months for as long as personnel noise exposure continues to equal or exceed the action level.

6.5.3 The training will include instruction that addresses the following:

6.5.3.1 Effects of noise on hearing.

6.5.3.2 Purpose and value of wearing hearing protection.

6.5.3.3 Various types of hearing protection offered by EFR and the care, fitting, and use of each type.

6.5.3.4 Advantages and disadvantages of the hearing protection offered.

6.5.3.5 General requirements of MSHA’s noise rule.

6.5.3.6 EFR and personnel respective tasks in maintaining noise controls.

6.5.3.7 Purpose and value of audiometric testing and a summary of the procedures.

6.6 ***DOCUMENT AND RECORDKEEPING REQUIREMENTS.***

6.6.1 EFR will retain the following records as they relate to this HCP:

6.6.1.1 Personnel exposure monitoring

6.6.1.2 Audiometric test measurements and related documentation

6.6.1.3 Training records (see the Training Records Documentation and Tracking Procedure AD-060)

6.6.2 Records will be retained in accordance with the MSHA Occupational Noise Standard, 30 CFR Part 62.

6.6.3 Copies of records required under 30 CFR Part 62 will be provided upon request to personnel, former personnel, or a personnel representative.

7.0 DEFINITIONS & ACRONYMS

7.1 Action Level (AL) – An 8-hour time-weighted average exposure of 85 dBA.

7.2 dBA – A non-dimensional unit used to express sound levels. It is a logarithmic expression of the ratio of a measured quantity to a reference quantity. The dBA designation indicates specific weighting to an A-weighted scale.

7.3 Permissible Exposure Limit (PEL) – An 8-hour time-weighted average exposure of 90 dBA.

7.4 TWA – Time Weighted Average.

1.0 PURPOSE

The purpose of this procedure is to identify specific instructions for the safe operations of vehicles and mobile equipment.

2.0 SCOPE

This procedure is designed for EFR's employees and contractors (personnel) whose job assignments require them to operate vehicles and mobile equipment. Vehicles leaving the restricted area must also be surveyed for radiological contamination and, if necessary, decontaminated in accordance with the Release of Equipment to Unrestricted Areas and Decontamination Procedures.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 HazCom Program (Attachment A to the Health and Safety Plan)

3.1.2 Release of Equipment to Unrestricted Areas Procedure RH-070

3.1.3 Decontamination Procedure RH-020

3.1.4 Shipment of Yellowcake, Ore or Contaminated Equipment by Truck Procedure RH-100

4.0 RESPONSIBILITY

4.1 Managers shall be responsible for implementing the Vehicle and Mobile Equipment Safety Procedure.

4.2 Supervisors shall ensure that employees comply with the Vehicle and Mobile Equipment Safety Procedure.

4.3 Personnel shall comply with this procedure.

4.4 The Safety Department shall develop and maintain the Vehicle and Mobile Equipment Safety Procedure.

5.0 PROCEDURE

5.1 *SMALL VEHICLES*

5.1.1 Only personnel with a valid driver's license shall be authorized to operate company vehicles.

5.1.2 The parking brake shall be set whenever a vehicle is parked.

5.1.3 Seatbelts shall be worn at all times.

5.1.4 Personnel shall not ride in the bed of pickup trucks unless they are provided with seats and seatbelts.

5.1.5 Drivers shall not move their vehicle until all riders comply with all safety precautions.

5.1.6 Vehicles shall not be allowed to park in active work areas.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

5.2 *LARGE EQUIPMENT/MOBILE EQUIPMENT*

5.2.1 Personnel shall be task trained in accordance with the MSHA Training Plan for operation of heavy/mobile equipment prior to being allowed to operate the equipment alone. The training shall be given by a competent person experienced in the operation of the equipment.

5.2.2 Self propelled mobile equipment to be used during a shift shall be inspected by the equipment operator before being placed into operation on that shift.

5.2.3 Defects on any equipment that affect safety shall be corrected in a timely manner to prevent the creation of a hazard to persons.

5.2.4 When defects make continued operation hazardous to persons, the equipment shall be taken out of service and placed in a designated area for that purpose, or a tag or other effective method of marking the defective items shall be used to prohibit further use until the defects are corrected.

5.2.5 Defects on self-propelled mobile equipment affecting safety, which are not corrected immediately, shall be reported to, and recorded by, the Foreman. The records shall be kept at the Mill from the date the defects are recorded, until the defects are corrected. These records must be made available to an authorized representative of the Secretary of Labor (MSHA).

5.2.6 Equipment parked on an incline should have the wheels chocked.

5.2.7 Personnel are prohibited from riding on loads, fenders, running boards or tailgates of any vehicle, or with any legs or arms dangling over the sides of any vehicle.

5.2.8 Personnel shall not back up any vehicle or equipment when the view of the rear is obstructed unless:

5.2.8.1 It is equipped with an operating backup alarm which is audible above the surrounding noise, or

5.2.8.2 An observer signals it is safe to do so, or

5.2.8.3 The driver physically checks the area at the rear of the vehicle.

5.2.9 All equipment and vehicles shall be shut down when refueling.

5.2.10 Personnel are not allowed to ride on heavy equipment unless a seat, equipped with a seat-belt, is available.

5.2.11 Equipment and vehicles are not allowed to be left running without operators or drivers in the vehicle.

5.2.12 Raised items such as forklift forks, dozer blades and loader buckets shall be lowered prior to the operator leaving equipment and at shift end.

5.2.13 Windows in mobile equipment shall be maintained to provide visibility for safe operation.

5.2.14 Operator's cabs of mobile equipment shall:

5.2.14.1 Be free of materials that could created a hazard to persons by impairing the safe operation of the equipment.

5.2.14.2 Not be modified in a manner that obscures visibility necessary for safe operation of the equipment.

5.2.15 Roll-over protective structures designed to meet the requirements of the Society of Automotive Engineers publications and seat belts shall be provided on the following equipment:

5.2.15.1 Crawler tractors and crawler loaders.

5.2.15.2 Graders

5.2.15.3 Wheel loaders and wheel tractors.

5.2.15.4 The tractor portion of semi-mounted scrapers, dumpers, water wagons, bottom dump wagons, rear dump wagons, and towed fifth wheel attachments.

5.2.15.5 Skid-steer loaders

5.2.15.6 Agricultural tractors

5.2.15.7 Forklifts

5.2.16 Persons shall not work on top of, under, or on mobile equipment in a raised position until the equipment has been blocked or mechanically secured to prevent it from rolling or falling accidentally.

5.3 ***HAZARDOUS/RADIOACTIVE MATERIALS***

5.3.1 Operation of vehicles may include the handling, moving, or transportation of hazardous and/or radioactive materials such as process chemicals or yellowcake product.

5.3.2 Vehicle and equipment operators handling hazardous/radioactive materials shall not do so unless trained specifically in the handling of those materials. Training specific to handling of hazardous/radioactive materials shall include:

5.3.2.1 Load capacity, stability and preparation

5.3.2.2 Handling techniques

5.3.2.3 Limitations of the equipment

5.3.2.4 Material Hazards

5.3.2.5 Engineering Controls and Personal Protective Equipment

5.3.2.6 Spill response

5.3.3 DOT placarding and labeling standards do not apply to vehicles and equipment used exclusively for on-site use. Vehicles that will travel off-site require placarding and labeling in accordance with the HazCom Program and the Shipment of Yellowcake, Ore or Contaminated Equipment by Truck Procedure RH-100.

1.0 PURPOSE

The purpose of this procedure is to provide specific instructions for safe confined space entry operations.

2.0 SCOPE

This procedure is designed for EFR's employees and contractors whose job assignments require entering confined spaces. The work to be performed may also be subject to the Job Safety Analysis and/or Radiation Work Permit Procedures (Section 6.4).

3.0 OBJECTIVE

3.1 The objective of this procedure is to identify areas of confined space hazards and provide guidelines and procedures for safe confined space entry operations.

3.2 All confined space entries shall be performed in accordance with this procedure and MSHA requirements.

4.0 OTHER DOCUMENTS

4.1 *REFERENCES*

4.1.1 Job Safety Analysis Procedure AD-100

4.1.2 Radiation Work Permit Procedure RH-060

4.2 *APPENDICES*

Appendix A – Confined Space Entry Permit Form HS-050A

5.0 RESPONSIBILITY

5.1 Managers and Supervisors shall be responsible for ensuring compliance with the following procedures:

5.1.1 Selection of Company-Approved Competent Persons (CACP) for the job.

5.1.2 Utilize a Qualified Individual to issue safe for welding and safe for entry certificates.

5.1.3 If an exemption to the procedure and/or work instructions is necessary, they shall approve such request ensuring that the work instructions, deviations, and exemptions are followed.

Any emergency exceptions to this section of the procedure <u>shall</u> be approved by the Radiation Safety Officer (RSO) or his/her designated representative.

5.1.4 Keep trained attendants on site during confined space entry, hot work, or gas-freeing activities.

5.1.5 Ensure that individuals including contractors in the area are aware of the hazards and their responsibility to correct the hazards and emergency procedures.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

5.1.6 Upon receipt of the EFR's Confined Space Entry Permit, sign his/her name to the certificate to give authorization for work to be initiated.

5.1.7 Ensure that the approved instrumentation, Personal Protection Equipment (PPE), and operational equipment are available.

5.1.8 Ensure employees and contract personnel understand how to notify the on-site and off-site responders in the event of an emergency.

5.1.9 Maintain records of EFR's confined space entry permits for one year.

5.1.10 Ensure that entrance openings are properly guarded to prevent an accidental fall.

5.2 Entry Attendant ("Safety Watch") personnel shall:

5.2.1 Be a Company-Approved Competent Person.

5.2.2 Be assigned for each confined space entry.

5.2.3 Receive training as a confined space attendant.

5.2.4 Maintain and keep accurate account of those workers entering confined spaces.

5.2.5 Perform no other duties that interfere with the attendant's primary duties.

5.2.6 Remain on site at the confined space area throughout the duration of the operation while the space is occupied or until the attendant is relieved properly.

5.3 Entrants shall be:

5.3.1 A Company-Approved Competent Person.

5.3.2 Capable of recognizing hazards.

5.3.3 Authorized to stop work, if such an action is warranted, and provide recommendations to supervisors.

5.3.4 Trained as a Competent Person. They must also be trained in EFR's Confined Space Entry Procedure.

5.3.5 Approved as a Competent Person by the Safety Department.

5.3.6 Given medical exams if exposed to carcinogens or highly toxic materials and waste on a routine basis.

5.3.7 Required to complete the EFR's Confined Space Entry Permit, and/or Competent Person log as appropriate.

5.4 The Qualified Individual shall:

5.4.1 Be a Company-Approved Competent Person.

5.4.2 Have authority to stop work, if such action is warranted, and provide recommendations or requirements for supervision and re-inspection.

5.4.3 Conduct all appropriate atmospheric testing to determine that the confined space is safe for entry.

5.4.4 Ensure the appropriate systems are in place to ensure the confined space has a continuous safe environment.

Any emergency exception to this section of the procedure shall be approved by the RSO or his designated representative.

5.5 The Safety Department shall develop and maintain the Confined Space Entry Procedure and maintain a current list of EFR's-approved Competent Persons.

5.6 Contractor work in confined spaces

All contractor and subcontractor employees who will enter EFR's equipment or jobsites/facilities to perform work in confined spaces shall be briefed on the hazards, safety rules and emergency procedures concerning those spaces.

6.0 PROCEDURE

6.1 *PERMIT-REQUIRED CONFINED SPACES*

6.1.1 The confined space shall be evaluated to determine if an entry certificate is required. Spaces that require a permit are:

6.1.1.1 Tanks or void spaces of any kind that contain or have contained flammables, combustibles, or other chemicals.

6.1.1.2 Confined spaces where work activity will introduce flammables, combustibles, or other air contaminants, such as welding, painting, and grinding.

6.1.1.3 Confined spaces where there are mechanical hazards, such as machinery which has not been locked or tagged out. A confined space containing equipment that has been locked or tagged is not a permit-required confined space.

6.1.1.4 Storage tanks, silos, process vessels, or bins, except as noted below, adjacent to tanks that contain or have contained flammables, combustible liquids, or other toxic chemicals, shall be permit-required confined spaces.

6.1.1.5 If a space cannot be categorized in the above groups and there is any concern for safety, contact the Safety Department for assistance before entering the space.

6.1.1.6 For spaces that do not require an entry permit, see Section 6.2.

6.1.2 A Qualified Individual must be assigned to each permit-required confined space entry and shall prepare the entry permit for that space.

6.1.3 A Qualified Individual shall certify permit-required confined spaces as safe for entry. The Qualified Individual shall develop and post an entry permit. A Competent Person may perform the duties of a Qualified Individual when the entry is approved by the RSO or their designated representative.

6.2 *NON-PERMIT CONFINED SPACE ENTRY*

6.2.1 There are many confined spaces where no mechanical, physical, radiological or chemical hazard is present. There is, however, the remote possibility that oxygen deficiencies may occur.

6.2.2 Before the entrance cover to the confined space is removed, the area around the entrance shall be inspected and all unsafe conditions eliminated.

6.2.3 After removal of the entrance cover, the opening, if applicable, shall be guarded by a railing, temporary cover or other temporary barrier that will prevent an accidental fall through the opening or inadvertent entry, and to protect the employee(s) working in the space from objects that may fall into the space.

6.2.4 Before an employee is allowed to enter the space, the internal atmosphere shall be tested with a calibrated direct-reading instrument for the following in the order given:

6.2.4.1 Oxygen content - between 19.5% and 23.5%.

6.2.4.2 Flammable gases and vapors - Not more than 10% of the Lower Explosive Limit (LEL).

6.2.4.3 Potential toxic air contaminants.

6.2.5 Continuous forced air ventilation from a clean, uncontaminated source shall be maintained during the entry.

6.3 ***PERMIT-REQUIRED CONFINED SPACE ENTRY***

6.3.1 Follow procedure per non-permit-required confined space entry above.

6.3.2 All spaces shall be opened and ventilated via forced air or natural air flow and test for sufficient atmospheric oxygen levels prior to entry.

6.3.3 Forced air ventilation of a confined space shall be maintained for a minimum of five (5) minutes before atmospheric testing is conducted, safe levels are confirmed, and entry is permitted.

6.3.4 Natural ventilation of a confined space shall be maintained for a minimum of thirty (30) minutes before atmospheric testing is conducted and entry is permitted.

6.3.5 Atmospheric testing shall be performed and documented at regular intervals to ensure safe levels of oxygen are maintained.

6.3.6 Respiratory protection shall be made available and worn where required.

6.4 The work activity shall be evaluated for applicability of the Job Safety Analysis Procedure AD-100 for non-routine work and the Radiation Work Permit Procedure RH-060 for work involving radiological or radiologically contaminated materials. These procedures shall be adhered to when applicable.

6.5 A pre-job safety meeting will be held with all EFR and contractor personnel involved with the permit-required confined space entry.

7.0 RECORDS

7.1 A copy of the entry permit and/or entry records shall be maintained at the jobsite/facility where the confined space entry was made.

7.2 Training records shall be maintained by the Safety Department for three years.

7.3 Inspection records shall be maintained by managers for three years at the jobsite/facility where the confined space entry was made.

8.0 DEFINITIONS

8.1 Adjacent Space - A space which borders a confined space in any direction, including all points of contact, corners, diagonals, decks, tank tops, and bulkheads.

8.2 Confined Space - Enclosed space that is large enough that an employee can enter and perform assigned work, has limited means of egress, and is not intended for continuous occupation.

8.2.1 Confined spaces are further classified as permit-required and non-permit required. Air monitoring must be performed to determine if the confined space is a permit or non-permit required confined space. For a permit-required confined space, in addition to the provisions in Section 6.1.1, one or more of the following apply:

8.2.1.1 Flammable gas, vapors, or mist are present at or above 10% of the LEL.

8.2.1.2 The atmospheric oxygen (O_2) concentration is less than 19.5%, or more than 23.5%.

8.2.1.3 Other toxic chemicals are present at or above their Permissible Exposure Limit (PEL).

8.2.1.4 Material that can trap, surround, cover or cause unconsciousness is present.

8.2.2 A non-permit required confined space does not have the conditions listed in section 6.1.1 or 8.2.1. The space is large enough and so configured that an employee can bodily enter and perform assigned work. The space is not designed for continuous occupancy.

Table 1: Types of Confined Spaces and Requirements for Entry

Type of Tank Condition and/or Operations	Entry Permit	Qualified Individual	Competent Person
Tanks with flammables or other chemical hazards.	Yes	Yes (a)	No
Tanks or spaces without flammables, chemical, radiological or mechanical hazards.	No (b)	Yes (c)	No
	No	Yes (d)	Yes
Hot work inside	Yes	Yes (a)	No
Hot work (outside of confined spaces)	Yes	Yes (a)	No

(a) Only qualified individuals can issue an entry or hot work permit.
(b) If a qualified individual is not reasonably available, a Company-Approved Competent Person may be used.
(c) Whether such confined spaces require a certificate depends upon the testing results. If the test results indicate that the space is a certificate required space, a qualified individual should be called in, if possible, to issue the certificate.
(d) At the direction of the manager or supervisor, these confined spaces shall be opened and "forced air" ventilated, and an entry attendant shall be assigned to the spaces prior to entry. Air monitoring shall be performed by a Company-Approved Competent Person prior to entry.

8.3 Company-Approved Competent Person (CACP) - A person capable of recognizing and evaluating employee exposure to hazardous substances or unsafe conditions. The individual has satisfactorily completed the confined space entry training class and accompanying examination, and records have been completed for the individual and transmitted to the Safety Department. These competent persons are approved by the RSO.

8.4 Cold Work - Any construction, alteration or repairs that do not involve heat, fire, or spark-producing operations.

8.5 Dangerous Atmosphere - An atmosphere which may expose employees to the risk of death, incapacitation, impairment of the ability to self-rescue, injury, or acute illness.

8.6 Entry - An action by which a person passes through an opening into a space. Entry is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

8.7 Entry with Restrictions - Entry is permitted only if engineering controls, PPE, clothing, and time limitations are specified on the permit by the Qualified Individual (hot and cold work).

8.8 Hazardous Substance - A substance which, by reason of being explosive, flammable, poisonous, corrosive, oxidizing, irritating or otherwise harmful, is likely to cause injury.

8.9 Hot Work - Any work which may produce or require flame, spark, or sufficient heat to cause auto-ignition. Examples include burning, welding, riveting, cutting, drilling, sanding, abrasive blasting, and space heating. Hot work entry permits are required.

8.10 Lower Explosive Limit (LEL) - The minimum vapor concentration of a combustible gas or vapor in air which will ignite if an ignition source is present. The term Minimum Explosive Concentration (MEC) is used for dusts.

8.11 Not Safe for Workers - Denotes a space where an employee may not enter because conditions do not meet safe for workers conditions.

8.12 Qualified Tester - An employee who inspects and tests permit-required confined spaces prior to entry.

8.13 Safe for Workers - Denotes a space meeting the following requirements:

8.13.1 The oxygen content of the atmosphere is between 19.5% and 23.5%.

8.13.2 The concentration of flammable vapors is below 10% of the LEL.

8.13.3 Toxic materials in the atmosphere are below their respective PEL.

8.13.4 Any residues or work materials will not produce uncontrolled releases of toxic materials under existing conditions while maintained as directed.

8.14 Safe for Hot Work - Denotes a space in which the following conditions are met:

8.14.1 The oxygen content in the atmosphere does not exceed 23.5% by volume.

8.14.2 The concentration of flammable vapors in the atmosphere is less than 10% of the LEL.

8.14.3 Any residue in the space is not capable of producing an oxygen concentration in the atmosphere greater than 23.5% or a flammable vapor concentration greater than 10% of the LEL under existing conditions in the presence of hot work and as maintained by the Entry Certificate/Permit.

8.14.4 All adjacent spaces have been cleaned, rendered inert, or treated sufficiently to prevent the spread of fire.

Confined Space Entry Procedure HS-050

Appendix A

Confined Space Entry Permit Form HS-050A

CONFINED SPACE ENTRY PERMIT
(to be filled out by Qualified Individual)

Location: ______________________ Date: ______________ Time In: ________

Tank/Tank Contents: ______________________ Time Out:__________________

Type of Work: ______________________ Permit Expires: ______________________

Instrument Used: ____________ Type: ____________ ID #: ____________ Calibration Date: ________

Calibration Results: ______________________

O_2: ____________ Combustible Gas: ______________ CO: ____________ H_2S: ________

Other Physical, Mechanical or Radiological Hazards (Describe - Complete JSA per AD – 100): ______________________

____

____

Test Gas/Vapor	Confined Space 1	Confined Space 2	Confined Space 3	Confined Space 4	Confined Space 5	Confined Space 6	Confined Space 7	Confined Space 8
Confined Space ID								
Oxygen (< 19.5% or > 23.5%)								
Flammables (> 10% LEL) *								
Benzene (> 1 ppm) *								
Total Hydrocarbon (> 100 ppm) *								
H_2S (> 10 ppm) *								
Carbon Monoxide (> 50 ppm) *								
Other Toxic								

* If monitoring results exceed values noted, appropriate respiratory protection shall be used.

SPECIAL REQUIREMENTS

Required?	Yes	No	Required?	Yes	No
Job Safety Analysis (Procedure AD-100)			First Aid Kit with Oxygen		
Radiation Work Permit (Procedure RS-060)			Explosion Proof Equipment		
Ventilation			Fire Extinguisher (Type:_________)		
Lock-Out/Tag-Out			Communication Equipment		
Rescuers Trained in CPR/First Aid			Lighting		
Lines Broken, Capped, or Blanked			SCBAs/Airlines		
Chemical/Splash Suits			Area Posting/Security		
Eye/Face Protection			Rescue Personnel		
Air Purifying Respirators			Qualified Individual Certificate		
Harness and Lifeline					

Other:

Qualified Person's Signature: ______________________Date: ____________Time: ____________

PERSONNEL (This section to be filled out and approved by supervisor)

Attendant:

Authorized Entrants:

Rescue:

Supervisor (all above conditions satisfied): Date:

Safety and Health Manager (if required): Date:

Send copy to Safety Department,

Form HS-050A

1.0 PURPOSE

The purpose of this procedure is to identify specific instructions for safe operations around electrical hazards and ensure that employees and contractors (personnel) are qualified as required by federal and state agencies.

2.0 SCOPE

This procedure is designed for EFR and contractor personnel whose job assignments expose them to hazards associated with electricity. The work to be performed may also be subject to the Job Safety Analysis, Lockout/Tagout or Radiation Work Permit Procedures (Section 5.1).

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Job Safety Analysis Procedure AD-100

3.1.2 Lockout/Tagout Procedure HS-110

3.1.3 Radiation Work Permit Procedure RH-060

4.0 RESPONSIBILITY

4.1 Managers shall be responsible for implementing the Electrical Safety Procedure.

4.2 Supervisors shall ensure that personnel comply with the Electrical Safety Procedure.

4.3 Personnel shall comply with this procedure.

4.4 The Safety Department shall develop and maintain the Electrical Safety Procedure and conduct hazard assessments of the work areas at each EFR facility for exposure determination.

5.0 PROCEDURE

5.1 *PROTECTION OF PERSONNEL*

5.1.1 The work activity shall be evaluated for applicability of the Job Safety Analysis Procedure AD-100 for non-routine work and the Radiation Work Permit Procedure RH-060 for work involving radiological or radiologically contaminated materials. These procedures shall be adhered to when applicable.

5.1.2 Prior to performing electrical work, all energized circuits shall be located and de-energized in accordance with the Lockout/Tagout Procedure HS-110. Proper warning signs shall be posted where such circuits exist. The personnel working in those immediate areas shall be advised of the locations, the hazards involved and the protective measures that need to be taken.

5.1.3 No personnel shall work adjacent to or on any part of an electric power circuit that they may come in contact with during the course of their work unless the personnel is protected against electric shock by de-energizing the circuit (Lockout/Tagout Procedure HS-110) and grounding it or by guarding it by effective insulation or other means. In work areas where the exact location of underground electric power is unknown, workers using jack-hammers, bars or other hand tools which may contact a line shall be provided with insulated protective gloves.

5.1.4 Only qualified electricians shall be permitted to install, repair or remove electrical wiring or equipment.

5.1.5 Dry wooden platforms, insulating mats, or other electrically nonconductive material shall be kept in place at all switchboards and power control switches where a shock hazard exists. However, metal plates on which a person may normally stand and which are kept at the same potential as the grounded, metal, non-current carrying parts of the power switches to be operated may be used.

5.1.6 Before an extension cord, drop light, or any other piece of electrical equipment is plugged in the plug shall be examined to ensure that the wires are not frayed where they are connected.

5.1.7 Personnel should run their hand along the cord to look for sharp kinks and ragged insulation, and examine the cord at the point where it enters the socket or tool to see that it isn’t frayed and is securely fastened.

5.1.8 As soon as the cord is plugged in, personnel shall ensure that it will be protected while it is being used. If a cord has to run across an aisle way, string it overhead if possible. If it must run along the floor, it shall be protected so it cannot be run over or jerked loose, become a tripping hazard, or be cut by metal framing material.

5.1.9 If a problems arises with a piece of electrical equipment while in use (e.g. if personnel get shocked, if it becomes damaged, or if the cord comes loose) the equipment shall be turned off and the problem reported at once.

5.2 ***PASSAGEWAYS***

Suitable barriers shall be provided to ensure that work space for electrical equipment will not be used as a passageway when energized parts of electrical equipment are exposed.

5.3 ***WORK SPACE AROUND EQUIPMENT***

5.3.1 Sufficient space shall be provided and maintained in the area of electrical equipment to permit ready and safe operation and maintenance of such equipment.

5.3.2 When parts are exposed, the minimum clearance for the work space shall not be less than 6-1/4 feet high nor less than a radius of 3 feet wide and there shall be a clearance sufficient to permit at least 90 degree opening of all doors or hinged panels. All working clearances shall be maintained in accordance with Article 110-16, National Electrical Code and NFPA 70-1980.

5.4 ***TEMPORARY WIRING AND LIGHTING***

5.4.1 All temporary wiring shall be effectively grounded in accordance with the National Electrical Code, NFPA No. 70-1980, Articles 300-23 and 310.

5.4.2 Temporary lights shall be equipped with guards and or lenses to prevent accidental contact with the bulb.

5.4.3 Temporary lights shall be equipped with heavy duty electric cords with connection and insulation maintained in safe condition. Temporary lights shall not be suspended by their electric cords unless cords and lights are designed for this means of suspension. Splices shall have insulation equal to that of the cable.

5.4.4 Cords shall be kept clear of working spaces and walkways or other locations in which they are readily exposed to damage.

5.4.5 Portable electric lighting used in moist and/or other hazardous locations, such as drums, tanks and vessels, shall be operated at a maximum of 12 volts.

5.4.6 Temporary light cords must not be used as a power source for operations other than temporary lighting.

5.4.7 All temporary cords must be kept off the ground to protect them from damage and prevent tripping hazards.

5.5 ***FLEXIBLE CABLE AND EXTENSION CORDS***

5.5.1 Receptacles for attachment plugs shall be of approved, concealed contact type with a contact for extending ground continuity and shall be so designed and constructed that the plug may be pulled out without leaving any live parts exposed to accidental contact.

5.5.2 Where different voltages, frequencies or types of current (AC or DC) are to be supplied by portable cords, receptacles shall be of such design that attachment plugs used on such circuits are not interchangeable.

5.5.3 Attachment plugs or other connectors supplying equipment at more than 300 volts shall be of the skirted type or otherwise so designed that arcs will be confined.

5.5.4 Attachment plugs for use in work areas shall be so constructed that they will endure rough use and be equipped with a suitable cord grip to prevent strain on the terminal screws.

5.5.5 Flexible cords shall be used only in continuous lengths without splices, except where suitable molded or vulcanized splices used are properly made and the insulation equal to the cable being spliced and wire connections soldered.

5.5.6 Trailing cables shall be protected from damage.

5.5.7 Splices in trailing cable shall be mechanically strong components and insulated to retain the mechanical and dielectric strength of the original cable.

5.5.8 Cable passing through work areas shall be covered or elevated to protect it from damage which would create a hazard to personnel.

5.5.9 Portable hand lamps shall be of the molded composition or other type approved for the purpose. Brass-shell, paper-lined lamp holders shall not be used. Hand lamps shall be equipped with a handle and a substantial guard over the bulb and attached to the lamp holder or the handle.

5.5.10 Worn or frayed electric cables shall not be used.

5.5.11 Extension cords used with portable electric tools and appliances shall be of the three-wire type.

5.5.12 Extension cords shall be protected against potential damages that may be caused by traffic, sharp corners, projections and pinching in doors or elsewhere.

5.5.13 Extension cords shall not be fastened with staples, hung from nails or suspended by wire.

5.6 ***OVERCURRENT PROTECTION***

5.6.1 Overcurrent protection shall be provided by fuses or circuit breakers for each feeder and branch circuit and shall be based on the current-carrying capacity of the conductors supplied and the power load being used.

5.6.2 No overcurrent device shall be placed in any permanently grounded conductor, except where the overcurrent device simultaneously opens all conductors of the circuit or for motor running protection.

5.6.3 When fuses are installed or removed with one or both terminals energized, special tools insulated for the voltage shall be used.

5.7 ***SWITCHES, CIRCUIT BREAKERS AND DISCONNECTING MEANS***

5.7.1 Each disconnecting means for motors and appliances, and each service feeder or branch circuit at the point where it originates shall be legibly marked to indicate its purpose unless located and arranged so the purpose is evident.

5.7.2 Disconnection means shall be located or shielded so that personnel will not be injured.

5.7.3 Boxes for disconnecting means shall be securely and rigidly fastened to the surface upon which they are mounted and fitted with covers.

5.7.4 Boxes and disconnecting means installed in a damp or wet location shall be waterproof to the extent that water does not enter or accumulate.

5.8 ***TRANSFORMERS***

5.8.1 Energized transformers over 150 volts to ground shall be provided with enclosures. Enclosures made of metal shall be grounded.

5.8.2 Entrances to such locations shall be kept locked.

5.8.3 Signs indicating danger and prohibiting unauthorized access shall be displayed at entrances.

5.9 ***CRANES: GENERAL REQUIREMENTS***

5.9.1 Except where electrical distribution and transmission lines have been de-energized and visibly grounded at point of work or where insulating barriers not a part of or an attachment to the equipment or machinery have been erected to prevent physical contact with the lines, equipment or machines shall be operated proximate to power lines only in accordance with the following:

5.9.1.1 For lines rated 50 kV or below, minimum clearance between the lines and any part of the crane or load shall be 10 feet;

5.9.1.2 For lines rated over 50 kV, minimum clearance between the lines and any part of the crane or load shall be 10 feet plus 0.4 inch for each 1 kV over 50kV or use twice the length of the line insulator but never less than 10 feet;

5.9.1.3 In transit with no load and boom lowered, the equipment clearance shall be a minimum of 4 feet for voltages less than 50 kV and 10 feet for voltages over 50 kV up to and including 345 kV and 16 feet for voltages up to and including 750 kV;

5.9.2 A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means;

5.9.3 Cage-type boom guards, insulating links or proximity warning devices may be used on cranes, but the use of such devices shall not alter the requirements of any other regulation of this part even if such device is required by law or regulation;

5.9.4 Any overhead wire shall be considered to be an energized line unless and until the person owning such line or the electrical utility authorities indicate that it is not an energized line and has been visibly grounded;

5.9.5 Prior to work near transmitter towers where an electrical charge can be induced in the equipment or materials being handled, the transmitter shall be de-energized or tests shall be made to determine if electrical charge is induced on the crane. The following precautions shall be taken when necessary to dissipate induced voltages:

5.9.5.1 The equipment shall be provided with an electrical ground directly to the upper rotating structure supporting the boom; and,

5.9.5.2 Ground jumper cables shall be attached to materials being handled by boom equipment when electrical charge is induced while working near energized transmitters. Crews shall be provided with nonconductive poles having large alligator slips or other similar protection to attach the boom.

5.10 *LOAD RATING*

In existing installations, no change in circuit protection shall be made to increase the load in excess of the load rating of the circuit wiring as specified in National Electrical Code, Article 310.

5.11 *GROUNDING*

5.11.1 Portable and/or Cord and Plug Connected Equipment

5.11.1.1 The noncurrent-carrying metal parts of portable and/or plug-connected equipment shall be grounded.

5.11.1.2 Portable tools and appliances protected by an approved system of double insulation or its equivalent need not be grounded. Where such an approved system is employed, the equipment shall be distinctively marked.

5.11.2 Fixed Equipment

Exposed noncurrent-carrying metal parts of fixed electrical equipment including motors, generators, frames and tracks of electrically operated cranes, electrically driven machinery, etc. shall be grounded.

5.11.3 Effective Grounding

The path from circuits, equipment, structures and conduit or enclosures to ground shall be permanent and continuous, have ample carrying capacity to conduct safely the currents liable to be imposed on it and have the impedance sufficiently low to limit the potential above ground and to result in the operation of the over current devices in the circuit.

NOTE: MSHA requires continuity and resistance testing of grounding systems immediately after installation, repair or modification and annually thereafter. A record of the most recent test must be made available.

5.11.4 Ground Resistance

Driven rod electrodes shall, be tested for and, have a resistance to ground not to exceed 25 ohms. Where resistance is not as low as 25 ohms, two or more electrodes connected in parallel shall be used.

5.11.5 Ground Testing

Use one of two methods in testing for proper ground:

5.11.5.1 On proper cords, use a 3-light test service check for proper functions.

5.11.5.2 On grounded power equipment, use an ohmmeter to check the continuity between the ground plug and the equipment casing.

NOTE: Double-insulated equipment does not have a ground connection so it can only receive a visual inspection for cord damage.

5.11.6 Cord Insulation

If cord insulation is damaged, repair or replace the cord. The cord end and the portion of the cord where it enters the power equipment are the two most likely places for damage. If a cord is damaged in the center, it is illegal to splice it. Make it into two shorter cords or throw it away. Cord insulation must be equal to or greater than manufacturer’s specifications.

1.0 PURPOSE

The purpose of this procedure is to identify specific instructions for safe operations in and around excavations and trenches and ensure that employees and contractors are aware of the hazards associated with excavations and trenches.

2.0 SCOPE

This procedure is designed for EFR's employees and contractors whose job assignments require them to be in or near excavations and trenches. The work to be performed may also be subject to the Job Safety Analysis, Lockout/Tagout or Radiation Work Permit Procedures (Section 5.1).

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Job Safety Analysis Procedure AD-100

3.1.2 Lockout/Tagout Procedure HS-110

3.1.3 Radiation Work Permits Procedure RH-060

4.0 RESPONSIBILITY

4.1 Managers shall be responsible for implementing the Excavation and Trenching Procedure.

4.2 Supervisors shall ensure that employees comply with the Excavation and Trenching Procedure.

4.3 Employees and contractors (personnel) shall comply with this procedure.

4.4 The Safety Department shall develop and maintain the Excavation and Trenching Procedure.

5.0 PROCEDURE

5.1 The work activity shall be evaluated for applicability of the Job Safety Analysis Procedure AD-100 for non-routine work, the Lockout/Tagout Procedure for work on or near energized lines (electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other), and the Radiation Work Permits Procedure RH-060 for work involving radiological or radiologically contaminated materials. These procedures shall be adhered to when applicable.

5.2 *SPECIFIC EXCAVATION REQUIREMENTS*

5.2.1 Prior to opening and excavation, efforts shall be made to determine whether underground installations such as sewer, telephone, water, fuel, electric lines, etc. are present, and where they are located (see Section 5.4).

5.2.2 The walls and faces of all excavations in which personnel are exposed to danger from moving ground shall be guarded by a shoring system, sloping of the ground, or some other equivalent means.

5.2.3 The determination of the angle of repose and design of the supporting system shall be based on careful evaluation of pertinent factors such as:

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

depth of cut, material properties, and possible variation in the water content of the materials from exposure to air, sun, water, or freezing.

5.2.4 All slopes shall be excavated to at least the angle of repose except for areas where solid rock allows for line drilling or pre-splitting.

5.2.5 The angle of repose shall be flattened when an excavation has water conditions, silty materials, loose boulders, and areas where erosion, deep frost action and slide planes appear.

5.2.6 In excavations which personnel may be required to enter, excavated or other materials shall be effectively stored and retained at least 2 feet or more from the edge of the excavation.

5.2.7 Banks more than 5 feet high shall be shored, sloped for stability, or some other equivalent means of protection shall be provided.

5.2.8 When personnel are required to be in trenches 5 feet deep or more, an adequate means of exit, such as a ladder or steps, shall be provided and located so as to require no more than 25 feet of lateral travel.

5.3 ***INSPECTIONS***

5.3.1 Daily inspections of excavations and trenches shall be made by the Competent Person. If evidence of possible cave-ins or slides is apparent, all work in the excavation or trench shall cease until the necessary precautions have been taken to safeguard the employee. In addition, all open trenches require high visibility perimeter flagging.

5.3.2 All excavations and trenches shall be inspected by the Competent Person after every rainstorm or other hazard-increasing occurrence and the protection against slides and cave-ins shall be increased if necessary.

5.4 ***UNDERGROUND EXCAVATION AND TRENCHING PROCEDURES***

5.4.1 Prior to excavating anywhere on our jobsite, including areas outside the fence line and in the parking lot, a drawing detailing the proposed excavation route must be submitted to the Manager in charge.

5.4.2 The Manager will review and locate all underground utilities on the proposed drawing, make final approval and sign off.

5.4.3 Any changes in excavation routing must be approved and signed off by the Manager prior to work commencing.

5.4.4 A copy of the approved drawing must be reviewed with and in the possession of the operator actually performing the work.

5.4.5 If the excavation is constructed by a contractor, as-built drawings locating all newly installed piping and utilities will be submitted to the Manager once the excavation and installation is complete.

1.0 PURPOSE

The purpose of this procedure is to provide specific instructions for the use of fall protection, and to ensure that affected employees and contractors are trained and made aware of the safety provisions which are required by federal and state agencies.

2.0 SCOPE

This procedure is designed for EFR employees and contractors whose job assignments expose them to fall hazards above six feet.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Job Safety Analysis Procedure AD-100

4.0 RESPONSIBILITY

4.1 EFR shall be responsible for providing fall protection equipment.

4.2 Managers shall be responsible for ensuring compliance with this procedure.

4.3 Supervisors shall ensure that employees comply with this procedure.

4.4 Employees and contractors (personnel) shall:

4.4.1 Follow the Fall Protection Procedure.

4.4.2 Wear the Personal Protection Equipment (PPE) assigned to them.

4.4.3 Ensure that their fall protection equipment is in safe operating condition.

4.5 The Safety Department shall develop and maintain the Fall Protection Procedure.

5.0 OBJECTIVE

The objective of this procedure is to identify guidelines and procedures for safe operations which involve the risk of employees falling more than 6 feet.

6.0 PROCEDURE

6.1 *SITE-SPECIFIC FALL PROTECTION WORK PLAN*

The supervisor and personnel that participate in activities where a fall hazard of 6 feet or more exists shall perform a Job Safety Analysis (Procedure AD-100) before commencing work in a work area. The fall protection work plan shall be discussed for each task and documented on the Job Safety Analysis form. If possible, the supervisor shall review and approve fall restraint and anchor points with personnel.

6.2 Personnel traveling or working in an elevated area wherever a fall exposure exists shall make use of fall protection by securing their safety lanyard whenever feasible to an available substantial anchoring point.

6.3 *ANCHOR POINTS*

6.3.1 Anchor points shall be selected based on force and load requirements.

6.3.2 The use of anchor points shall be discussed during the safety meeting.

6.3.3 The selection of the anchorage point shall reduce free fall to the shortest distance possible (a maximum of 6 feet).

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6.3.4 Anchor points may be the equipment structure in some cases.

6.3.5 Guardrails and railings shall be used only as anchor points if they have been designated as such.

6.4 ***WALKING AND WORKING SURFACES***

Personnel on a walking/working surface six feet or more above lower levels shall be protected from falling by a guardrail system (a safety net system or personal fall arrest/restraint system may also be used), whenever feasible.

6.5 ***ACCESS AND EGRESS WITH LADDERS***

A body harness and restraint system shall be used when climbing ladders greater than 25 feet in height, unless the ladder is enclosed with a protective case.

6.6 ***FALL PROTECTION EQUIPMENT***

6.6.1 Personal fall protection devices shall meet ANSI requirements.

6.6.2 Full body harnesses shall be used for fall arrest purposes and fall restraint.

6.6.3 Fall protection equipment shall be inspected prior to use. These inspections shall include visually observing that the load stitches are intact and belts and lanyards are not deteriorated or frayed. Any equipment found defective shall be removed from service.

6.7 ***ELEVATED PLATFORMS***

6.7.1 Safety harness and lanyard will be the approved manner of fall protection while on any elevated platform.

6.7.2 All anchorage points will meet the 5000 lb. rating as required.

6.7.3 All anchorage points will have the approval of EFR Management or Safety.

7.0 DEFINITIONS

7.1 Anchorage - A secure point of attachment for lifelines, lanyards, or deceleration devices. The anchorage point strength for fall arrest shall be capable of supporting 5000 pounds. The anchorage point strength for fall restraint shall be capable of supporting four times the intended load.

7.2 Body Harness - Straps which may be secured about the employee in a manner that will distribute the fall arrest forces over at least the thighs, pelvis, waist, chest, and shoulders with means for attaching them to other components of a personal fall arrest system.

7.3 Connector - A device which is used to couple (connect) parts of the personal fall arrest system and positioning device systems together. It may be an independent component of the system, such as a carabineer, or it may be an integral component of part of the system (such as a buckle or D-ring sewn into a body belt or body harness, or a snap hook spliced or sewn to a lanyard or self retraction lanyard).

7.4 Free Fall - The act of falling before a personal fall arrest system begins to apply force to arrest the fall.

7.5 Guardrail System - A barrier erected to prevent employees from falling to lower levels.

7.6 Infeasible - Impossible to perform the work using a conventional fall protection system (i.e. guardrail system, safety net system, or personal fall arrest system) or technologically impossible to use any one of these systems to provide fall protection.

7.7 Lanyard - A flexible line of rope, wire rope, or strap which generally has a connector at each end for connecting the body belt or harness to a deceleration device, lifeline, or anchor point.

7.8 Personal Fall Arrest System - A system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors, and a body harness and may include a lanyard(s), deceleration device, lifeline, or suitable combinations of these.

7.9 Personal Fall Restraint System - A system used to prevent an employee from falling. It consists of anchorages, connectors, body belt/harness. It may include lanyards, lifelines, and rope-grabs designed for the purpose.

7.10 Self-Retracting Lifeline/Lanyard - A deceleration device containing a drum-wound line which can be slowly extracted from, or retracted onto, the drum under slight tension during normal employee movement, and which, after onset of a fall, automatically locks the drum and arrests the fall.

7.11 Work Area - That portion of a walking or working surface where job duties are being performed.

7.12 Walking or Working Surface - Any surface, whether horizontal or vertical, on which an employee walks or works, including, but not limited to, floors, roofs, ramps, bridges, tanks, silos, but not including ladders, vehicles, or trailers, on which employees must be located in order to perform their job duties.

1.0 PURPOSE

The purpose of this procedure is to provide specific instructions for the safe storage of flammable or combustible materials as required by federal and state agencies.

2.0 SCOPE

This procedure is designed for EFR employees and contractors whose job assignments involve handling, using, and storing flammable materials.

3.0 RESPONSIBILITY

3.1 Managers shall ensure employees and contractors (personnel) follow this procedure.

3.2 Supervisors shall ensure that flammable materials are stored in a safe manner.

3.3 Personnel shall comply with this procedure.

3.4 The Safety Department shall develop and maintain the Flammable Materials Storage Procedure.

4.0 OBJECTIVE

The objective of this procedure is to provide guidelines and procedures for the safe storage of flammable material.

5.0 PROCEDURE

5.1 *CONTAINERS*

5.1.1 Flammable or combustible liquids shall be stored in approved containers and portable tanks.

5.1.1.1 Small quantities of flammable liquids drawn from storage shall be kept in safety cans labeled to indicate contents.

5.1.2 Each portable tank shall be provided with one or more devices installed in the top with sufficient emergency venting capacity to limit internal pressure under fire exposure conditions to 10 psig, or 30% of the bursting pressure of the tank, whichever is greater.

5.1.3 Flammable and combustible liquid containers shall be in accordance with Table 1, except that glass or plastic containers of no more than one gallon capacity may be used for certain Class IA or IB flammable liquids specified in 29 CFR 1910.106.

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Table 1: Maximum Allowable Size of Containers and Portable Tanks

Container Type	Flammable Liquids			Combustible Liquids	
	Class IA	Class IB	Class IC	Class II	Class III
Glass or Approved Plastic	1 pt.	1 qt.	1 gal.	1 gal.	1 gal.
Metal (Other Than DOT Drums)	1 gal.	5 gal.	5 gal.	5 gal.	5 gal.
Safety Cans	2 gal.	5 gal.	5 gal.	5 gal.	5 gal.
Metal Drums (DOT Specifications)	60 gal.	60 gal.	60 gal.	60 gal.	60 gal.
Approved Portable Tanks	660 gal.	660 gal.	660 gal.	660 gal.	660 gal.
Approved Fixed Tanks	No Limit				

5.2 *FLAMMABLE MATERIAL STORAGE LOCKERS AND CABINETS*

5.2.1 Quantities of flammable and combustible liquids in excess of 25 gallons shall be stored in an acceptable or approved cabinet meeting the following requirements:

5.2.1.1 Acceptable wood cabinets shall be constructed in the following manner:

5.2.1.1.1 The bottom, sides, and top shall be constructed of an approved grade of plywood at least one inch in thickness, which shall not break down or delaminate under standard fire test conditions.

5.2.1.1.2 Joints shall be rabbeted and fastened in two directions with flathead wood screws.

5.2.1.1.3 When more than one door is used, there shall be a rabbeted overlap of not less than one inch.

5.2.1.1.4 Steel hinges shall be mounted in such a manner as not to lose their holding capacity due to loosening or burning out of the screws when subjected to the fire test.

5.2.1.1.5 Cabinets shall be painted inside with a fire retardant paint.

5.2.1.2 Approved metal cabinets shall be constructed in the following manner:

5.2.1.2.1 The bottom, top, door, and sides of the cabinet shall be at least No. 18 gage sheet iron and double walled with a one and one-half-inch air space.

5.2.1.2.2 Joints shall be riveted, welded, or made tight by some equally effective means.

5.2.1.2.3 The door shall have a three-point lock.

5.2.1.2.4 The door sill shall be raised at least two inches above the bottom of the cabinet.

5.2.1.3 Storage cabinets shall be designed and constructed to limit the internal temperature to not more than 325°F.

5.2.1.4 Labels or signs with the appropriate warning such as "DANGER FLAMMABLE MATERIALS-NO SMOKING OR OPEN FLAMES" shall be adhered to flammable material storage lockers and cabinets.

5.2.2 Not more than 60 gallons of flammable (Class I or Class II) liquids, nor more than 120 gallons of Combustible (Class III) liquids may be stored in a storage cabinet.

NOTE: Quantities exceeding these amounts shall be stored in an inside storage room.

5.2.3 Open containers other than spray cans shall be stored in an approved flammable material storage locker.

5.3 ***STORAGE INSIDE BUILDINGS***

5.3.1 Flammable or combustible liquids shall not be stored so as to limit use of exits, stairways, or areas normally used for the safe egress of people.

5.3.2 Storage of flammable or combustible liquids shall be prohibited in occupied offices except that which is required for maintenance and operation of building and operation of equipment. Such storage shall be kept:

5.3.2.1 In closed metal containers stored in a storage cabinet.

5.3.2.2 In safety cans.

5.3.2.3 In an inside storage room not having a door that opens into the portion of the building used by the public.

5.4 ***STORAGE NEAR BUILDINGS***

5.4.1 A maximum of 1,100 gallons of flammable or combustible liquids may be adjacent to (i.e. within 10 feet of) buildings located on the same premises and under the same management.

5.4.2 If the quantity stored exceeds 1,100 gallons, a minimum distance of 10 feet between buildings and the nearest container of flammable or combustible liquid shall be maintained.

5.5 ***SPILL CONTAINMENT***

5.5.1 The storage area shall be graded to divert possible spills away from buildings or other exposures or shall have containment for the entire capacity of the largest tank.

5.5.2 When curbs are used, provisions shall be made for draining ground or rain water accumulations or flammable or combustible liquid spills.

5.5.3 Drains shall terminate at a safe location and shall be accessible in the event of fire.

5.6 *SECURITY*

5.6.1 The storage area shall be protected against tampering or trespassers where necessary.

5.6.2 The storage area shall be kept free of weeds, debris, and other combustible material not necessary to storage.

5.7 *FIRE CONTROL*

5.7.1 Suitable fire control devices, such as a small hose or portable fire extinguishers, shall be available at locations as required where flammable or combustible liquids are stored.

5.7.2 Open flames and smoking shall not be permitted in flammable or combustible liquid storage areas and the areas shall be posted with appropriate signage.

5.7.3 The quantity of unopened liquid that may be located outside of an inside storage room or storage cabinet in a building or in any one fire area of a building shall not exceed:

5.7.3.1 25 gallons of Class IA liquids in containers

5.7.3.2 120 gallons of Class IB, IC, II, or III liquids in containers

5.7.3.3 660 gallons of Class IB, IC, II, or III liquids in a single portable tank

5.7.4 The amount of material in or around a flammable material storage area shall meet local fire codes.

5.8 *TRAINING*

Training shall be given to affected employees.

6.0 RECORDS

Training records shall be maintained by the Safety Department for three years.

7.0 DEFINITIONS

7.1 *FLAMMABLE LIQUID CLASSES*

7.1.1 Class IA – Liquids having a Flash Point below 73^o and a Boiling Point below 100^o F.

7.1.2 Class IB – Liquids having a Flash Point below 73^o F and a Boiling Point at or above 100^o F.

7.1.3 Class IC – Liquids having a Flash Point at or above 73^o F and below 100^o F.

7.2 *COMBUSTIBLE LIQUID CLASSES*

7.2.1 Class II – Liquids having a Flash Point between 100^o and 139^o F

7.2.2 Class IIIA – Liquids having a Flash Point between 140^o and 199^o F.

7.2.3 Class IIIB – Liquids having a Flash Point of 200° F or above.

7.3 Flashpoint – The lowest temperature of a flammable liquid at which it can form an ignitable mixture with air and produce a flame when a source of ignition is present.

1.0 PURPOSE

The purpose of this procedure is to provide specific instructions for the safe use and care of ladders and scaffolding.

2.0 SCOPE

This procedure is designed for EFR employees and contractors whose job assignments require the use of a ladder and/or scaffolding. The work to be performed may also be subject to the Fall Protection Procedure and/or the Electrical Safety Procedure (Section 6.1).

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Fall Protection Procedure HS-080

3.1.2 Electrical Safety Procedure HS-060

4.0 RESPONSIBILITY

4.1 Managers shall be responsible for implementing the Ladder and Scaffolding Safety Procedure.

4.2 Supervisors shall ensure that ladders and scaffolds are used in a safe manner.

4.3 Employees and contractors (personnel) shall ensure the Ladder and Scaffolding Safety Procedure is followed.

4.4 The Safety Department shall develop and maintain the Ladder and Scaffolding Safety Procedure.

5.0 OBJECTIVE

The objective of this program is to provide guidelines and procedures for the safe use and maintenance of ladders and scaffolding.

6.0 PROCEDURE

6.1 Any work that exposes workers to fall hazards above six feet shall also comply with the Fall Protection Procedure HS-080. Any ladder or scaffolding work that is near a potential electrical hazard shall also comply with the Electrical Safety Procedure HS-060.

6.2 *PROPER USE OF LADDERS*

6.2.1 Ladders shall be inspected before each use. If a ladder is broken, cracked, or defective in any way, it shall be tagged for disposal immediately and removed from the work area.

6.2.2 Ladders shall be secured at the top or bottom to prevent slippage. Safety shoes shall be placed on ladders.

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6.2.3 Portable ladders shall never be used horizontally as substitutes for scaffold planks, runways, or any other service for which they have not been designed.

6.2.4 When a task can only be done while standing on a portable ladder, the length of the ladder shall be such that the worker stands on a rung no higher than the fourth from the top. The ladder shall also be secured.

6.2.5 Unless suitable barricades have been erected, ladders shall not be set up in passageways, doorways, driveways, or other locations where they can be struck or displaced by persons or vehicles using the access route.

6.2.6 Only one person at a time shall be allowed on a single-width ladder.

6.2.7 Ladders shall not be placed against flexible or movable surfaces.

6.2.8 Three-point contact shall be maintained when climbing up or down a ladder. That means two hands and one foot or two feet and one hand shall be on the ladder at all times. This is especially important when getting on or off a ladder at heights.

6.2.9 When working from a ladder, the center of gravity shall be kept between the side rails. A person's center of gravity is approximately in the center of the body at belt height. The location of the center of gravity can shift when reaching out to either side of a ladder, especially with material, tools, or equipment in the hands. As the body’s center of gravity and hand-held objects move beyond the side rails, the ladder tends toward instability.

6.2.10 Hands shall be used only for climbing ladders. Tools, equipment, and materials shall be placed in a container and raised or lowered by rope, if necessary.

6.2.11 Workers shall not straddle the space between a ladder and another object.

6.2.12 Ladders shall be placed on secure footings.

6.2.13 Ladder shall not be rested on any of its rungs. Ladders shall rest on their side rails.

6.2.14 Personnel shall watch for overhead power lines before attempting to erect any ladder.

6.2.15 Personnel will only ascend/descend ladders while facing the ladder and holding the side rails with both hands.

6.2.16 Single portable ladders over 30 feet in length shall not be used.

6.2.17 All ladders, except stepladders, must be tied off or secured for stability.

6.3 *STRAIGHT LADDERS*

6.3.1 When a straight ladder is used for access from one work level to another, the side rails shall extend a minimum of three feet above the landing.

6.3.2 The base of straight ladders should be placed at a one-to-four ratio from the vertical surface.

6.3.3 Before setting up straight ladders, the area shall be checked for overhead power lines.

6.3.4 Straight ladders shall be used only for their intended purpose.

6.4 ***STEP LADDERS***

6.4.1 The top step of ordinary types of step ladders shall not be used as a step.

6.4.2 When working from a step ladder over five feet high, workers shall not stand on a step higher than the third step from the top of the stepladder.

6.4.3 Step ladders shall not be used as straight ladders.

6.5 ***INSPECTION AND MAINTENANCE***

Ladders found to be defective shall be removed, tagged, and scrapped.

6.6 ***STORAGE AND TRANSPORTATION***

6.6.1 Storage areas shall permit easy access.

6.6.2 Ladders shall be stored on their sides, as practicable.

7.0 SCAFFOLDING

7.1 Erection crews must check each scaffold member during erection. Defective parts are not to be used for scaffold fabrication.

7.2 All working decks of scaffolds shall be provided with proper handrails, midrails, and toeboards. If this is not possible, then safety belts must be worn by personnel working on the scaffold.

7.3 Planks shall extend over their end supports no less than 6 inches or more than 12 inches.

7.4 Tube and frame scaffolds must be tied to the structure at intervals of 30 feet horizontally and 25 feet vertically.

7.5 The height of mobile scaffolds shall not exceed four times the base dimension, and the casters shall have positive locking devices. No person shall be allowed on a mobile scaffold while it is being moved.

7.6 Provisions should be made to protect passersby from falling objects.

8.0 DEFINITIONS

8.1 Ladder – An appliance, usually consisting of two side rails joined at regular intervals by crosspieces called steps, rungs, or cleats, on which a person may step in ascending or descending.

8.2 Step Ladder – A self-supporting portable ladder, non-adjustable in length, having flat steps and a hinged back.

8.3 Single Ladder – A non-self-supporting portable ladder non-adjustable in length, consisting of but one section. Its size is designated by the overall length of the side rail.

8.4 Extension Ladder – A non-self-supporting portable ladder adjustable in length. It consists of two or more sections traveling in guides or brackets arranged to permit length adjustment.

8.5 Fixed Ladder **–** A ladder permanently attached to a structure, building, or equipment.

1.0 PURPOSE

The purpose of this procedure is to establish procedures ensuring that machines or equipment are isolated and inoperative before employees perform any servicing or maintenance.

2.0 SCOPE

This procedure applies to EFR employees and contractors who are authorized to perform maintenance service activities on equipment or processes which present energy hazards and to any employees and contractors who are affected by these activities. This procedure may frequently be used in conjunction with the Job Safety Analysis, Confined Space Entry, Electrical Safety, and Excavation and Trenching Procedures.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Job Safety Analysis Procedure AD-100

3.1.2 Confined Space Entry Procedure HS-050

3.1.3 Electrical Safety Procedure HS-060

3.1.4 Excavation and Trenching Procedure HS-070

4.0 RESPONSIBILITY

4.1 Managers shall be responsible for ensuring employees and contractors (personnel) comply with this procedure.

4.2 Supervisors shall:

4.2.1 Ensure that personnel who are authorized to service equipment have received general lockout/tagout training, as well as specific training on any individual piece of equipment or machine that is to be locked or tagged.

4.2.2 Assign locks, if applicable or tags to authorized personnel.

4.2.3 Coordinate activities of contractors that may affect lockout/tagout and energy control procedures within the facility or on equipment.

4.2.4 Ensure that only authorized personnel's service equipment or machinery requiring lockout/tagout.

4.2.5 Forward copies of the training forms to the Safety Department.

4.3 Personnel shall be responsible for:

4.3.1 Complying with this procedure.

4.3.2 Following safe shutdown and start-up procedures.

4.3.3 Communicating activities to affected personnel and other authorized personnel, as appropriate.

4.3.4 Ensuring the security of their own lock and key.

4.3.5 Advising their supervisor when equipment needs servicing and following the directions of the authorized personnel affecting the use of that equipment.

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4.4 The Safety Department shall develop and maintain the Lockout/Tagout (Energy Control) Procedure.

5.0 OBJECTIVE

General company procedure is that lockout is the preferred method of isolating machines or equipment from energy sources and shall be used whenever possible. If tags are used, additional steps shall be taken as necessary to provide the equivalent safety available from the use of a lockout device. This procedure identifies the hazards of uncontrolled energy and establishes procedures for safe lockout/tagout operations.

6.0 PROCEDURE

6.1 *METHODS OF LOCK AND TAG IDENTIFICATION*

6.1.1 Lockout/tagout devices shall be standardized within each facility in at least color, shape or size, and shall be durable for withstanding the environment to which they are exposed for the maximum period of time exposure is expected.

6.1.2 Identifiable lockout/tagout devices shall indicate the identity of the:

6.1.2.1 Locks, which are numbered sequentially (1, 2, 3, etc.), will be used, if available. If locks are used, one key shall be issued to the personnel and the second key may be maintained by his/her supervisor.

6.1.2.2 Tags - For tagout devices, a standardized print and format shall be used. The print shall be legible and understandable to employees. The name shall be placed on the tag permanently. Tags shall be secured by a nylon self-locking tie, which requires cutting the nylon self-locking tie in order to remove.

6.2 *INSPECTIONS*

Periodic inspections shall be conducted at least annually and shall be performed by authorized personnel other than those utilizing the energy control procedure under inspection. The purpose of each inspection shall be to:

6.2.1 Identify and correct any deviations or inadequacies observed.

6.2.2 Review authorized personnel responsibilities under the Lockout/Tagout (Energy Control) Procedure.

6.2.3 Review the limitations of tags if tagouts are used.

6.3 *ACQUIRING LOCKS AND TAGS*

Supervisors shall provide the necessary equipment to perform lockout and tagout procedures.

6.4 *LOCKOUT/TAGOUT PROCEDURES - SHUTDOWN*

6.4.1 All electrically powered equipment or power circuits shall be deenergized before work is done. All circuits shall be locked out or other measures taken which shall prevent the equipment from being energized without the knowledge of the individual(s) working on it.

6.4.2 Authorized personnel shall make a survey to locate and identify isolating devices to be certain which switch(es), or other energy-isolating devices apply to the equipment to be locked out or tagged out.

6.4.3 Affected personnel shall be notified that a lockout/or tagout system will be utilized and the reason.

6.4.4 If the machine or equipment is operating, it shall be shut down by the normal stopping procedure. This shall usually be done by depressing the stop button, opening the toggle switch, etc. In addition, the personnel shutting down the machine shall ensure that stored energy is dissipated or properly restrained.

6.4.5 The switch, valve, or other energy isolating device(s) shall be operated to assure that the equipment is isolated from its energy source(s).

6.4.6 Lockout/Tagout device application

6.4.6.1 Locks or tags shall be affixed to each energy-isolating device only by authorized personnel.

6.4.6.2 Locks and tags shall be singularly identified.

6.4.6.3 Locks shall be affixed in a manner that will hold the energy isolating devices in a safe or off position.

6.4.6.4 Tags that cannot be affixed directly to the energy-isolating device shall be located as safely as possible to the device in a position that will be immediately obvious to anyone attempting to operate the device.

6.4.7 For general notification, the name and description of the equipment that has been locked or tagged out shall be recorded on a bulletin board.

6.5 *LOCKOUT/TAGOUT PROCEDURES - START-UP*

6.5.1 After the servicing and/or maintenance is complete and equipment is ready for normal production operations, the area around the machines or equipment shall be checked to ensure that no one is exposed to an uncontrolled energy source.

6.5.2 After tools have been removed from the machine or equipment, guards have been reinstalled, and personnel are in the clear, lockout or tagout devices shall be removed and the affected employees shall be notified of the removal.

6.5.3 Lockout/Tagout devices shall be removed from all energy isolating devices by personnel, who applied it, except: Lockout/Tagout devices may be removed by the supervisor when the authorized personnel who applied it are unavailable and it is verified that the authorized personnel who applied the device is not at the facility.

6.5.4 The energy-isolating devices shall be operated to restore energy to the machine or equipment.

6.6 *TESTING OR POSITIONING MACHINES, EQUIPMENT, OR COMPONENTS*

In situations where lockout or tagout devices are temporarily removed from the energy isolating device and the machine equipment energized to test or position the machine, equipment or component, this sequence of actions shall be followed:

6.6.1 The machine or equipment shall be cleared of tools and materials.

6.6.2 Personnel shall be removed from the machine or equipment area.

6.6.3 Lockout or tagout devices shall be removed.

6.6.4 Energizing shall be completed and testing or positioning shall be conducted.

6.6.5 Systems shall be deenergized and energy control measures shall be reapplied in accordance with the shutdown procedures described in this section.

6.7 ***INFORMING OUTSIDE CONTRACTORS***

The supervisor shall inform outside contractors of the elements of this program and obtain information regarding their lockout/tagout program. This information shall then be conveyed by the supervisor to affected EFR personnel.

7.0 DEFINITIONS

7.1 Affected Personnel – An employee or contractor whose job requires him or her to operate or use a machine or piece of equipment on which service or maintenance is being performed under lockout/tagout, or whose job requires him or her to work in an area in which such service or maintenance is being performed. Affected employees must be informed when lockout/tagout is being performed.

7.2 Authorized Personnel – An employee or contractor who performs service or maintenance on machines and equipment. Lockout or tagout is used by these personnel for their self-protection.

7.3 Energized – Machines and equipment are energized when they are connected to an energy source or they contain residual or stored energy.

7.4 Energy – The movement or possibility of movement in equipment or machinery. Whether the power switch is on or off, energy always is present in any powered equipment.

7.5 Energy-Isolating Device – Any mechanical device that physically prevents the transmission or release of energy. These include, but are not limited to, manually operated electrical circuit breakers, disconnect switches, line valves and blocks.

NOTE: Push buttons, selector switches, and other control circuit type devices are not energy isolating devices.

7.6 Energy Source – Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other energy.

7.7 Energy Control Procedure – A written document that contains those items of information an authorized employee needs to know in order to safely control hazardous energy during servicing or maintenance of machines or equipment.

7.8 Lockout – The placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

7.9 Lockout Device – Any device that uses positive means, such as a lock with either a key or combination, to hold an energy isolating device in a safe position, thereby preventing the energizing of machinery or equipment. When properly installed, a blank flange or bolted slip blind are considered equivalent to lockout devices.

7.10 Normal Production Operations – The utilization of machine or piece of equipment to perform its intended production function.

7.11 Servicing and/or Maintenance – Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming machines or equipment, and making adjustments or tool changes, where the employee may be exposed to the unexpected energization or start-up of the equipment or release of hazardous energy.

7.12 Setting Up – Any work performed to prepare a machine or piece of equipment to perform its normal production operation.

7.13 Tagout – The placement of a tagout device on any energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

7.14 Tagout Device – Any prominent warning device, such as a tag and a means of attachment that can be securely fastened to an energy isolating device in accordance with an established procedure. The tag indicates that the machine or equipment to which it is attached is not to be operated until the tagout device is removed in accordance with the energy control procedure.

1.0 PURPOSE

The purpose of this procedure is to provide specific instructions for the use of hand and power tools, and to ensure that affected employees are trained and made aware of the safety provisions which are required by federal and state agencies.

2.0 SCOPE

This procedure is designed for EFR employees and contractors (personnel) whose job assignments require the use of hand and power tools. The work to be performed may also be subject to the Job Safety Analysis or Radiation Work Permit procedures (Section 6.1.1).

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Job Safety Analysis Procedure AD-100

3.1.2 Radiation Work Permit Procedure RH-060

4.0 RESPONSIBILITY

4.1 Managers shall be responsible for ensuring compliance with this procedure.

4.2 Supervisors shall ensure that personnel comply with this procedure.

4.3 Personnel shall:

4.3.1 Follow the Hand and Power Tools Procedure.

4.3.2 Wear the Personal Protection Equipment (PPE) assigned to them.

4.3.3 Ensure that their hand and power tools are in safe operating condition and used properly for the job they were designed for.

4.4 The Safety Department shall develop and maintain the Hand and Power Tools Procedure.

5.0 OBJECTIVE

The objective of this procedure is to identify guidelines and procedures for safe operations of hand and power tools used by EFR employees.

6.0 PROCEDURE

6.1 *GENERAL REQUIREMENTS*

6.1.1 The work activity shall be evaluated for applicability of the Job Safety Analysis Procedure AD-100 for non-routine work and the Radiation Work Permit Procedure RH-060 for work involving radiological or radiologically contaminated materials. These procedures shall be adhered to when applicable.

6.1.2 All hand and power tools shall be maintained in a safe condition and used only for the purpose for which they were designed. Wood handled tools shall be inspected monthly and before each use for cracks and other obvious defects. Tape shall not be used to repair cracks, the tool shall be taken out of service and the handle replaced.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

6.1.3 Power operated tools designed to accommodate guards shall only be used when such guards are in place.

6.1.4 Personnel shall be provided with and use the particular personal protective equipment necessary to protect them from hazards.

6.1.5 Switches

6.1.5.1 Hand-held powered platen sanders, grinders with 2 inch or less diameter wheels, routers, planers, laminate trimmers, nibblers, shears, scroll saws and jigsaws with blade shanks 0.25 inch wide or less may be equipped with only a positive on/off control.

6.1.5.2 Hand-held powered drills, tappers, fastener drivers, horizontal, vertical and angle grinders with wheels exceeding 2 inches in diameter, disk sanders, belt sanders, reciprocating saws and similar tools shall be equipped with a momentary contact on/off control. They may have a lock-on control provided the power can be shut off' by a single motion of the same finger(s) that turns it on.

6.1.5.3 All other hand-held power tools, such as chain saws, circular saws, and precision tools, shall be equipped with a constant pressure switch that will shut off the power when pressure is released.

6.1.6 Electric power operated tools shall either be of approved double-insulated type or effectively grounded

6.2 *PNEUMATIC TOOLS*

6.2.1 Pneumatic power tools and hose sections shall be secured by threaded couplings, quick disconnect couplings or by 100 pound tensile strength safety chain or equivalent across each connection to prevent the tool or hose connections from being accidentally disconnected.

6.2.2 Safety clips or retainers shall be securely installed and maintained to prevent tools from being accidentally discharged.

6.2.3 Pneumatically driven nailers, staplers and other similar equipment provided with automatic fastener feed, shall have a safety device on the nozzle to prevent the ejection of the fasteners, unless the muzzle is in contact with the work surface.

6.2.4 Compressed air shall not be used at the nozzle for cleaning purposes except when reduced to less than 30 pounds per square inch (psi) and the operator is protected by personal protective equipment. The 30 psi requirement does not apply to sandblasting, green cutting, removal of mill scale, cleaning concrete forms and similar cleaning operations.

6.2.5 The manufacturer's safe operating pressure for hoses, pipes, valves, and fittings shall not be exceeded. Defective hoses, valves and fittings shall be removed from service.

6.2.6 Air hoses shall not be used for hoisting or lowering tools. Hoses shall not be laid on ladders, steps, scaffolds, or walkways in a manner creating a tripping hazard.

6.2.7 Airless spray guns of the type which atomize paints and fluids at pressures of 1,000 psi or more shall be equipped with automatic or visible manual safety devices which will prevent pulling of the trigger and prevent release of the paint or fluid until the safety device is manually released. In lieu of the above, a diffuser nut to prevent high pressure release when the nozzle tip is removed and a nozzle tip guard to prevent the tip from contacting the operator or other equivalent protection shall be provided.

6.3 ***GRINDING TOOLS***

6.3.1 The installation, guarding, use, and care of grinding tools shall comply with the standards set forth in the current ANSI B7.1-1978, Safety Code for the Use, Care and Protection of Abrasive Wheels. Grinding tools shall not be used without the safety guards, protective flanges, and tool rest installed and maintained in proper adjustment.

6.3.2 Safety guards used on machines known as right angle head vertical portable grinders shall have a maximum exposure angle of 180 degrees and the guard shall be located between the operator and wheel when in use.

6.3.3 The maximum angular exposure of the grinding wheel periphery and sides for safety guards used on other portable grinding machines shall not exceed 180 degrees and the top half of the wheel shall be enclosed at all times.

6.3.4 Abrasive wheels and scratch brush wheels shall not be operated in excess of their rated safe speed. Cracked or defective abrasive wheels shall be removed from service immediately.

6.4 ***POWER SAWS***

6.4.1 Bench-type circular saws shall be equipped with spreaders, anti-kickback devices, and guards that automatically enclose the exposed cutting edges. Portable hand-held circular saws shall be equipped with guards above and below the base plate or shoe. The upper guard shall cover the saw to the depth of the teeth, except for the minimum arc required to permit the base to be tilted for level cuts. The lower guard shall cover the saw to the depth of the teeth, except for the minimum arc required to allow proper retraction and contact with the work. As the blade is withdrawn, the lower guard shall automatically and instantly return to the covering position.

6.4.2 The operating speed shall be permanently marked on all circular saws over 20 inches in diameter or operating speeds over 10,000 peripheral feet per minute. Only blades designed for use at the marked operating speed shall be used. When the saw is re-tensioned for a different speed, the marking shall be changed to indicate the new speed.

6.4.3 Radial arm saws and swing cutoff saws shall be equipped with:

6.4.3.1 Limit stops which prevent the leading edge of the blade from traveling beyond the edge of the table.

6.4.3.2 Hoods and/or guards that protect the operator from flying material direct the sawdust toward the back of the blade and enclose all parts of the blade not in contact with the material being cut.

6.4.3.3 Automatic brakes or automatic return devices.

6.5 ***HYDRAULIC-POWERED TOOLS***

6.5.1 The manufacturer's safe operating pressure hoses, valves, pipes, filters and fittings shall not be exceeded.

6.5.2 Fluid in hydraulic powered tools shall be fire resistant type approved by a recognized authority, such as Underwriters Laboratories.

6.6 ***POWDER-ACTUATED TOOLS***

6.6.1 Powder-actuated tools shall be designed, maintained and used in accordance with the standards set forth in the current edition of ANSI AlO.3, "Safety Requirements for Powder-Actuated Fastening Systems."

6.6.2 Powder-actuated tools shall be operated and serviced only by persons who have been trained and certified in the safe use of such tools. Operators must possess an operator's card issued by a firm or an authorized person.

6.6.3 Powder-actuated tools shall not be used in explosive or flammable atmospheres.

6.6.4 Only powder charges, studs or fasteners specified by the manufacturer for the specified tools shall be used.

6.6.5 Tools shall be designed to operate only when pressed against the work surface with a force at least 5 pounds greater than the weight of the tool. They shall be constructed so the tool cannot fire when dropped or during loading or preparation to fire.

6.6.6 Tools shall not be loaded until just prior to firing. Loaded tools shall not be left unattended. Tools shall not be pointed at any person, and all parts of the body shall be kept clear of the muzzle.

6.6.7 Tools shall be tested each day before loading to ensure that the safety devices are in proper working order. The test shall be conducted in accordance with the manufacturer's recommended test procedure.

6.6.8 Each tool shall bear a legible permanent model designation, which shall serve as a means of identification. Each tool shall also bear a legible, permanent manufacturer's unique serial number.

6.6.9 A lockable container shall be provided for each tool. The words "Powder Actuated Tool" shall appear in plain sight on the outside of the container. The following notice shall be attached on the inside cover of the container:

"WARNING- POWDER ACTUATED TOOL. TO BE USED ONLY BY A QUALIFIED OPERATOR AND KEPT UNDER LOCK AND KEY WHEN NOT IN USE."

6.6.10 Each tool shall be supplied with the following:

6.6.10.1 Operator's instruction and service

6.6.10.2 Power load chart

6.6.10.3 Tool inspection record

6.6.10.4 Service tools and accessories

6.7 ***HAND-POWERED WINCHES AND HOISTS***

6.7.1 Hand powered winches and hoists shall be used within the manufacturer's rated capacity, and the capacity shall be legibly marked on the winch or hoist.

6.7.2 The use of hand cranks is prohibited unless the winch or hoist is equipped with positive self locking dogs or of the worm gear type. Hand wheels shall not have projecting spokes or knobs.

7.0 DEFINITIONS

7.1 Powder Actuated Tool – A tool that utilizes the expanding gases from a power load to drive a fastener.

7.2 Power Load – The energy source used in powder actuated tools.

7.3 Qualified Operator – A person/employee who has received documented training on the manufacturer's recommended safe operating procedures of the tool and demonstrated competency in its use.

1.0 PURPOSE

This procedure describes the training of respirator users, how to use a respirator, selecting a respirator, and fit testing of respirators. The purpose of this procedure is to minimize the inhalation of radioactive materials and chemicals by humans to levels that are As Low As Reasonably Achievable (ALARA).

2.0 APPLICABILITY

This procedure applies to all personnel that use respirators and to the personnel that train and fit test respirator users.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Radioactive Materials License

3.1.2 Respirator Maintenance, Inspection, Cleaning, and Storing Procedure HS-131

3.1.3 Medical Evaluation for Respirator Use Procedure HS-132

3.1.4 Occupational General Air Particulate Survey Procedure RH-130

3.1.5 Occupational Breathing Zone Monitoring Procedure RH-150

3.1.6 U.S. Nuclear Regulatory Commission Regulatory Guide 8.15, Acceptable Programs for Respiratory Protection

3.1.7 American National Standard Practices for Respiratory Protection – Respirator Uses – Physical Qualifications for Personnel, ANSI Z88.6-1984

3.1.8 CDPHE 6 CCR 1007-1, Part 4, Section 4.24, Use of Individual Respiratory Protection Equipment

3.1.9 NRC 10 CFR 20, Subpart H, Respiratory Protection and Controls to Restrict Internal Exposure in Restricted Areas

3.2 *EXHIBITS*

3.2.1 Exhibit 1 – Appendix 4A to Part 4 of the Colorado Department of Public Health and Environment – Hazardous Materials and Waste Management Division Regulations, Assigned Protection Factors for Respirators

3.2.2 Exhibit 2 – Respirator Protection Equipment Selection

3.3 *APPENDICES*

3.3.1 Appendix A – Respiratory Protection Training Form HS-130A

3.3.2 Appendix B – Respirator Qualitative Fit Test Record Form HS-130B

4.0 EQUIPMENT AND MATERIALS

4.1 *EQUIPMENT*

4.1.1 Half-face Air-Purifying Respirators (APRs)

4.1.2 Full-face APRs

4.1.3 Powered APRs (Helmet style respirators and powered air respirators)

4.1.4 Respirators with supplied airline

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

4.1.5 Self Contained Breathing Apparatus (SCBA)

4.1.6 Respirator quantitative fit testing equipment, such as Portacount Plus model 8020 or equivalent

4.1.7 Respirator qualitative fit testing equipment (irritant smoke or banana oil) or the equivalent for helmet respirators and as a backup for the quantitative fit test

5.0 RESPONSIBILITY

5.1 The Radiation Safety Officer (RSO) or his designee is responsible for:

The respiratory protection program and providing technical assistance when needed. The RSO or his designee is the Respirator Program Administrator.

5.2 The Alternate RSO or his designee is responsible for:

Training of respirator users and administering the respirator fit tests.

5.3 The Radiation/Security Technician (RST) is responsible for:

5.3.1 Provide quantitative and qualitative fit testing.

5.3.2 Determine the appropriate respirators and cartridges for different areas in the mill.

5.3.3 Sample airborne radionuclides and other hazardous chemicals in the mill in accordance with the Occupational General Air Particulate Survey and Occupational Breathing Zone Monitoring Procedures RH-130 and RH-150, respectively.

5.4 A Physician or his designee is responsible for:

Determining if individuals are physically able to use respirators.

5.5 The respirator user has the ultimate responsibility for:

5.5.1 Using the respirator as instructed.

5.5.2 Inspecting the respirator before and after each use.

5.5.3 Ensuring that no one else uses their respirator while it is assigned to them.

5.5.4 Leaving a respirator area immediately if the respirator fails to provide proper protection.

5.5.5 Not wearing a respirator when conditions prevent a good face-piece to face seal (e.g. when facial hair intrudes into the respirator sealing surface).

5.5.6 Reporting any respirator malfunctions to a supervisor.

5.5.7 Returning respirators to the Safety Department when in need of cleaning or repair and as scheduled in accordance with the Respirator Inspection, Maintenance, Cleaning, and Storage Procedure HS-131.

5.5.8 Properly storing and maintain their assigned respirators in accordance with Procedure HS-131.

6.0 PREREQUISITE INFORMATION

6.1 *SAFETY*

6.1.1 Standby rescue persons are to be provided when workers wear supplied air hoods that are difficult to remove without assistance. Such standby persons are to be equipped with respirators that are appropriate for the potential hazards, must observe or otherwise be in direct communication with such workers, and must be immediately available to assist them in case of a failure of the air supply or other distress. The number and experience of the standby rescue personnel must be sufficient to render effective assistance if needed.

6.1.2 The RSO or his designee must approve SCBA use prior to use.

6.1.3 Any airline outlet installed for the exclusive use of constant flow airline respirators shall deliver Grade D air for breathing systems as defined by the Compressed Gas Association in publication G-7.1, "Commodity Specification for Air," 1997. Grade D quality air criteria include:

6.1.3.1 Oxygen content (v/v) of 19.5-23.5%;

6.1.3.2 Hydrocarbon (condensed) content of 5 milligrams per cubic meter of air or less;

6.1.3.3 Carbon monoxide (CO) content of 10 ppm or less;

6.1.3.4 Carbon dioxide content of 1,000 ppm or less; and

6.1.3.5 Lack of noticeable odor.

6.1.4 Any airline outlet installed for the exclusive use of constant flow airline respirators shall not be used for air tools, etc. To do so may contaminate the lines and adversely affect the health and safety of respirator users.

6.2 *FREQUENCY*

6.2.1 Medical evaluation of respirator users, at least once every 12 months. A grace period of up to 3 months may be granted if authorized by a physician or his designee.

6.2.2 Respirator user training and fit tests at least once every 12 months.

6.2.3 Respirator positive and negative pressure seal test each time a face-sealing respirator is used.

7.0 PROCEDURES

7.1 *POLICY STATEMENT*

Energy Fuels Resources respiratory use policy is presented as an attachment to this procedure. The policy addresses:

7.1.1 The use of process or other engineering controls, instead of respirators,

7.1.2 The routine, non-routine, and emergency use of respirators, and,

7.1.3 The length of periods of respirator use and relief from respirator use.

7.2 *ALARA EVALUATIONS*

7.2.1 The RSO or his designee conducts an “As Low As Reasonably Achievable” evaluation of radiation dose to respirator users prior to their use of respirators in the processing facility. The RSO or his designee is to evaluate whether the internal dose avoided by using the respirator is likely to be less than or greater than any additional external dose that may result from the respirator induced inefficiency and other factors including non-radiological factors. If the dose saved by using the respirator is greater than the extra external dose, then the respirator should be issued to a medically qualified, trained, and fit-test qualified individual. Items to be included in the evaluation include:

7.2.1.1 Environmental conditions of respirator use.

7.2.1.2 Worker efficiency using protective equipment.

7.2.1.3 User comfort.

7.2.1.4 Experience and skill of the user performing the work in the processing facility.

7.2.1.5 Process and engineering controls.

7.2.1.6 Radiological conditions of the work to be performed.

7.2.1.7 History with this or similar jobs.

7.2.2 Jobs or tasks that would result in a workers external deep dose equivalent (DDE) of less than 500 mrem do not need an ALARA evaluation (NRC Regulatory Guide 8.15 section 2.3).

7.3 ***ENGINEERING CONTROLS***

7.3.1 It is the policy of Energy Fuels Resources to prevent the contamination of the breathing atmosphere by harmful dusts, fogs, fumes, mists, gases, smokes, sprays or vapors as far as feasible by accepted engineering control measures (enclosure or confinement of operation, local control ventilation, baghouses, scrubber systems and water sprays). When such controls are not feasible, Energy Fuels Resources will require the use of respiratory protection in areas where necessary to protect the health of the employee.

7.3.2 Check that all practical engineering and administrative controls, e.g. ventilation controls, equipment seals, and emission controls, to keep airborne radionuclide concentrations to levels that are as low as reasonably achievable (ALARA) have been implemented before entering Airborne Radioactivity Areas. When the levels are not ALARA, the internal radiation doses to humans are to be limited using access controls, limited exposure times, respiratory protection devices or other means.

7.4 ***MEDICAL EVALUATION OF RESPIRATOR USERS***

7.4.1 All respirator users or intended users must be evaluated by a physician or his designee every 12 months, or at a frequency determined by the physician, to evaluate if the user is physically able to use the respiratory protection equipment. The physician's designee may include a registered nurse (RN), licensed practical nurse (LPN), or someone who, in the judgment of the physician, has adequate experience, education, training, and judgment to evaluate the individual. A grace period of up to 3 months may be granted per a physician or his designee.

7.4.2 The physician is to complete Form HS-132A (See Procedure HS-132) or its equivalent and designate on page 1 of the form whether or not the individual, in his opinion, is physically able to wear respirators. Individuals may receive an unrestricted or restricted approval from the physician to use respirators.

7.4.3 The respirator user is to sign the medical consent included on Form HS-132A (See Procedure HS-132).

7.5 ***TRAINING OF RESPIRATOR USERS AND SUPERVISORS***

7.5.1 Train the potential respirator users in the following topics:

7.5.1.1 The hazards to which the respirator user may be exposed.

7.5.1.2 The effects of contaminants on the wearer if the respirator is not worn properly.

7.5.1.3 The capabilities and limitations of each type of respirator to be used.

7.5.1.4 The proper use of spectacle adapters, and communication equipment.

7.5.1.5 Donning, using, and removing each type of respirator. Users must demonstrate competency in donning, using, and removing their respirators during the training session.

7.5.1.6 When and how to inspect each type of respirator to be worn.

7.5.1.7 Cleaning procedures to assure workers that they will receive a clean disinfected respirator.

7.5.1.8 How to perform user seal tests, i.e., positive and negative pressure tests. The user must demonstrate competency in performing seal tests during the training session.

7.5.1.9 The respirator user may leave the work area at any time for relief from respirator use in the event of equipment malfunction, physical or psychological distress, procedural or communications failure, significant deterioration of operating conditions, or any other condition that might necessitate such relief.

7.5.1.10 In case of respirator malfunction or wearer distress, the respirator may be removed as the respirator user exits the airborne contamination area.

7.5.1.11 ALARA evaluation of radiation doses to users with and without a respirator.

7.5.2 Train the supervisors of respirator users in the following topics:

7.5.2.1 The need for engineering controls in preference to the use of respirators.

7.5.2.2 The hazards to which the respirator user may be exposed.

7.5.2.3 The effects of contaminants on the user if the respirator is not worn properly.

7.5.2.4 The capabilities and limitations of each respirator to be used.

7.5.2.5 The respirator user is authorized to leave a respirator area whenever needed.

7.5.3 The RSO or his designee will have appropriate training to administer the respirator protection program and to provide technical assistance when needed.

7.5.4 Document the training provided, to whom, and when on Form HS-130A.

7.6 ***INSTRUCTOR TRAINING***

7.6.1 Qualifications for instructors providing respiratory protection training are:

7.6.1.1 On-the-job training in respiratory protection,

7.6.1.2 Training from an RSO, or his designee, in respiratory protection, or

7.6.1.3 Classroom training in respiratory protection.

7.6.2 Document the training of the instructors.

7.7 ***QUANTITATIVE FIT TESTING***

7.7.1 Only medically qualified and trained respirator users are to be quantitatively fit tested. Quantitative fit testing in the primary method of fit testing respirator users.

7.7.2 Quantitative fit testing is performed only in negative pressure mode of operation. Quantitative fit testing for negative pressure respirators should demonstrate an overall fit factor of at least 10 times the Assigned Protection Factor (APF) in the Colorado equivalent of Appendix 4A to Part 4 of the Colorado Department of Public Health and Environment Radiation Control Division regulations. Otherwise the APF cannot be used in the assessment of radiation dose to the individual.

7.7.3 The Portacount Plus model 8020 or equivalent quantitative respirator fit testing instrument compares the concentration of particles outside the respirator with the concentration of particles that have leaked into the respirator. The ratios of outside concentrations to inside concentrations are the respirator fit factors. The instrument not only determines the fit of the respirator but also determines if a respirator or cartridge is leaking. The Radiation/Security Technician is to place an adaptor between the cartridge and the respirator. Place the respirator on the person being fit tested and connect the Portacount or equivalent instrument to sample the air inside the respirator. Measure the particulate concentrations inside and outside the respirator as specified in the Portacount instruction manual. Determine if the respirator is well fitted to the user or not. Document the measurements and a pass/fail for the quantitative respirator fit test. Remove the adaptor and allow the user to use the respirator if he has passed the quantitative fit test. If the test is failed adjust the respirator size, fit, or exchange the respirator with a properly functioning respirator.

7.7.4 Documentation of the fit test shall be retained in the employee’s file. The fit testing instrument will provide a print-out of the quantitative fit test results, the wearer and the date. If the tester cannot provide a print-out for any reason, the test information may be written out for documentation and shall include at a minimum:

7.7.4.1 The employee name and signature

7.7.4.2 Date of the test

7.7.4.3 Respirator manufacturer, model and size used

7.7.4.4 Results of the test

7.7.4.5 Tester name, title and signature

7.8 ***QUALITATIVE FIT TESTING***

7.8.1 Limitations of qualitative fit testing:

7.8.1.1 Qualitative fit testing is acceptable if the method used is capable of verifying a fit factor of 10 times the APF for negative pressure respirators.

7.8.1.2 Qualitative fit testing is acceptable if the method used is capable of verifying a fit factor of 500 (not 500 times the APF) for positive pressure respirators.

7.8.1.3 Qualitative fit testing is only appropriate for testing respirators with an APF of 10 or less.

7.8.1.4 Respirators with an APF greater than 10 may be tested, but an APF of only 10 may be credited to the respirator for this testing method.

7.8.2 Conduct qualitative fit testing of respirator users when:

7.8.2.1 Quantitative fit test equipment is malfunctioning

7.8.2.2 Quantitative fit test equipment is not available when needed (e.g. during an emergency)

7.8.2.3 Helmet or other positive pressure type respirators are to be used

7.8.2.4 A seal test other than the positive or negative pressure test is needed

7.8.3 Verify that the respirator user can detect (smell, taste, or react to) the challenge atmosphere. Challenge agents may consist of stannic chloride (irritant smoke), or amyl acetate (or isoamyl acetate, or isopentyl acetate) commonly called banana oil, or the equivalent.

7.8.4 The technician administering the qualitative test needs to instruct the user that the test is for their own protection and the results will not be used in any way to evaluate their job performance. Proceed with the test only if the technician administering the test believes that the respirator user will answer the fit test questions truthfully.

7.8.5 Install a canister on the respirator that is capable of removing banana oil, or the equivalent challenge agent from the air. Be sure that both the person administering the test and respirator user are wearing respirators.

7.8.6 Moisten a cotton swab or paper towel with banana oil and wave the swab or towel under and around the respirator user's head and shoulders while the user performs a sequence of head, neck and body movements. Typical exercises which require a minimum of 2 minutes to complete include:

7.8.6.1 Normal breathing

7.8.6.2 Deep breathing

7.8.6.3 Turn head side to side

7.8.6.4 Move head up and down

7.8.6.5 Talk

7.8.6.6 Grimace

7.8.6.7 Bend at the waist

7.8.7 Ask if the user can detect the challenge agent. Have the user remove the respirator and ask if the user can then detect the challenge agent. If the user cannot detect the smell while the respirator is being worn but can detect the smell while the respirator is not being worn, the qualitative fit test is passed.

7.8.8 Document the type of qualitative fit test administered, to whom, the results and the date on Form HS-130B.

7.9 ***RETESTING***

7.9.1 Respirator fit tests are to be done every 12 months.

7.9.2 Retesting should be performed if the following has occurred since the last fit test:

7.9.2.1 The weight of the respirator user changes by 10% or more.

7.9.2.2 Significant facial injury or scarring in the area of the face piece seal.

7.9.2.3 Significant dental changes that could affect the face piece seal.

7.9.2.4 Reconstructive or cosmetic surgery that could affect the face piece seal.

7.9.2.5 Other conditions that could affect the face piece seal.

7.10 ***USER INSPECTIONS***

7.10.1 Respirators shall be inspected by the user before and after each use to insure that the respirator is in good condition. This inspection shall include the following checks:

7.10.1.1 Deformed or bent facepiece

7.10.1.2 Deformed or stretched headbands or straps

7.10.1.3 Deformed or misshaped facepiece to face sealing surface

7.10.1.4 Cracks, tears, or holes in the facepiece

7.10.1.5 Cartridge gaskets for defects or absence

7.10.1.6 Inhalation valves for defects or absence

7.10.1.7 Inhalation valve seats for damage or defects

7.10.1.8 Exhalation valve for defects or absence

7.10.1.9 Exhalation valve seats for damage or defects

7.10.1.10 Exhalation valve cover for absence

7.10.1.11 Obvious physical damage to cartridges

7.10.1.12 Incorrect or out-dated cartridges

7.10.1.13 Cleanliness

7.10.2 Further inspections are performed by the Safety Department on a periodic basis in accordance with the Respirator Inspection, Maintenance, Cleaning, and Storage Procedure HS-131.

7.11 ***USER SEAL CHECKS***

Each respirator user is to perform the following seal checks each time a face-sealing respirator is used:

7.11.1 **Positive-Pressure Test –** Close off the exhalation valve and exhale gently into the face piece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the face piece without any evidence of outward leakage of air at the seal. For most respirators this method of leak testing requires the user to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.

7.11.2 **Negative-Pressure Test –** Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or a thin latex or nitrile glove or the equivalent. Inhale gently so that the face piece collapses slightly, and hold the breath for 10 seconds. If the face piece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

7.11.3 If either test gives an unsatisfactory result, the headbands and straps for the respirator face-piece must be adjusted until leakage is not detected.

7.12 *OPERATIONAL CHECKS*

Non-face-sealing respirators should be operationally checked prior to use by allowing air to flow through the respirator for approximately one minute. During this time support personnel are to verify that the air pressure at the distribution manifold, if present, is within the proper range specified by the manufacturer and that the user feels that the airflow is adequate.

7.13 *COMMUNICATION*

The RSO or his designee is to ensure that respirator users can communicate well enough to work safely and to keep their radiation dose ALARA. If necessary, voice amplification devices may be used.

7.14 *VISION*

7.14.1 The RSO or his designee is to ensure that respirator users can see well enough to be able to work safely and to keep radiation dose ALARA. Spectacle adapter kits for respirators may be used. Contact lenses are permitted for use on site on a case-by-case basis as approved by the RSO or his designee and will be dependent on the contact lens wearers medical condition, areas to be accessed, materials to be used and PPE to be worn.

7.14.2 Consider the use of anti-fogging devices and agents especially when the respirators are used in low-temperature environments.

7.15 *HELMET RESPIRATORS*

7.15.1 Helmet respirators provide a stream of filtered air across the face of the user. No respirator to face seal is required for operation. This type of respirator is desirable when a good respirator to face seal is not possible, when fogging of the respirator is a problem, or psychological problems such as claustrophobia exist.

7.15.2 Quantitative fit tests are usually not possible to perform with the helmet type respirator. Use a qualitative fit test to determine that the respirator is providing the desired respirator protection.

7.16 *FACIAL HAIR*

7.16.1 Persons using face piece respirators shall not have any facial hair that interferes with the sealing of the respirator.

7.16.2 The prohibition of facial hair applies to respirators that seal on the users face. Helmet type respirators may be used with facial hair providing the RSO or his designee determines that the facial hair does not interfere with the operation of the respirator.

7.17 *SELECTION OF RESPIRATORY PROTECTION EQUIPMENT AND CARTRIDGES*

7.17.1 The Radiation/Security Technician must determine which respirators and cartridges are to be used in the different parts of the uranium processing facility and shall refer to Exhibit 2 attached. When in doubt the RSO or his designee is to make the determination based on the radiological conditions present at the work site, the APFs, and whether the job is routine, non-routine, or an emergency. When deciding which respirator is to be considered for a particular job the RSO or his designee will divide the average ambient concentration of radioactive material or other hazardous chemical in the work place air (or the estimated average) by the appropriate DAC value (or ACGIH TLV value as appropriate) for the contaminants present. The number obtained may be considered initially as an ideal minimum APF for the selected device. If the ALARA evaluation determines that use of a respiratory protection device might be justified, the RSO or his designee should consider a device with this APF or greater. If the selection of a respirator with this APF is inconsistent with ALARA, however, the RSO or his designee may select a device with a lower APF. Worker safety factors other than radiological and chemical exposure factors, such as heat stress, impaired vision, or resuspension of radioactive and/or hazardous materials are to be taken into account when performing such an ALARA evaluation.

7.17.2 Use only respiratory protection equipment that has been tested and certified or has certification extended by the National Institute for Occupational Safety and Health/Mine Safety and Health Administration (NIOSH/MSHA).

7.17.3 Supply adequate equipment or materials to reduce the likelihood that respirator use might contribute to workplace accidents or injury (e.g. spectacle adapters, voice amplifiers, defogging agents).

7.17.4 Supply safety equipment that do not interfere with the proper fit of operation or the respirator (e.g., welder’s shields, communication devices).

7.17.5 Appendix A to Part 4 of the Colorado Department of Public Health and Environment Radiation Control Division regulations is attached as Exhibit 1 and provides the APFs that can be used for respirators.

7.17.6 An open circuit self contained breathing apparatus (SCBA) operated in the pressure-demand mode with a minimum rated service of 30 minutes is to be used for emergency entry into an unassessed environment or into an area with high concentrations of a chemical hazard. Also acceptable are a combination full-face pressure demand supplied air respirator with an auxiliary self-contained air supply of at least 5 minute duration and a positive-pressure, closed-circuit (recirculating) SCBA with a minimum rated service life of 30 minutes.

7.18 *AIR SAMPLING*

The Radiation/Security Technicians are to sample the airborne radionuclides and other chemicals in the uranium processing facility (in accordance with the Occupational General Air Particulate Survey and Occupational Breathing Zone Monitoring Procedures RH-130 and RH-150, respectively) and to assess the radiological and chemical conditions present, or to use historical data to assess the radiological and chemical conditions, prior to the selection and issuance of respirators.

7.19 *RESPIRATOR PROTECTION PROGRAM AUDITS*

Audits of the respiratory protection program are conducted as part of the annual review of the radiation protection program.

7.20 *ENTRY INTO AN IDLH ENVIRONMENT*

7.20.1 Entries into Immediately Dangerous to Life and Health (IDLH) environments will be made only by individuals equipped with SCBAs operated in the pressure demand mode (or positive-pressure mode for closed-circuit SCBAs). Persons making such entries will use the “buddy system.” The buddies should always have one another in sight. The in-sight criterion might not be possible in a fire-fighting situation, so in this case, some other accountability system should be used.

7.20.2 There will be a standby rescue person equipped with SCBAs outside the IDLH area but immediately ready to enter the area to rescue a person who is in trouble. The number of standby rescue person should be sufficient to accomplish a rescue in a timely fashion if the occasion arises.

Respiratory Protection-Use and Fit Test Procedure HS-130

Exhibit 1

Appendix 4A to Part 4 of the Colorado Department of Public Health and Environment Hazardous Materials and Waste Management Division Regulations

Appendix 4A to Part 4 of the Colorado Department of Public Health and Environment Hazardous Material and Waste Management Division Regulations

Assigned Protection Factors for Respirators[a] (Format has been revised)

	Operating mode	**Assigned Protection Factors[a]**
I. Air Purifying Respirators [Particulate[b] only] [c]:		
Filtering facepiece disposable[d]	Negative Pressure	([d])
Facepiece, half [e]	Negative Pressure	10
Facepiece, full	Negative Pressure	100
Facepiece, half	Powered air-purifying respirators	50
Facepiece, full	Powered air-purifying respirators	1000
Helmet/hood	Powered air-purifying respirators	1000
Facepiece, loose-fitting	Powered air-purifying respirators	25
II. Atmosphere supplying respirators [particulate, gases and vapors[f]]:		
1. Air-line respirator:		
Facepiece, half	Demand	10
Facepiece, half	Continuous Flow	50
Facepiece, half	Pressure Demand	50
Facepiece, full	Demand	100
Facepiece, full	Continuous Flow	1000
Facepiece, full	Pressure Demand	1000
Helmet/hood	Continuous Flow	1000
Facepiece, loose-fitting	Continuous Flow	25
Suit	Continuous Flow	([g])
2. Self-contained breathing Apparatus (SCBA):		
Facepiece, full	Demand	[h]100
Facepiece, full	Pressure Demand	[i]10,000
Facepiece, full	Demand, Recirculating	[h]100
Facepiece, full	Positive Pressure Recirculating	[i]10,000
III. Combination Respirators:		
Any combination of air-purifying and atmosphere-supplying respirators	Assigned protection factor for type and mode of operation as listed above.	

[a] These assigned protection factors apply only in a respiratory protection program that meets the requirements of this part. They are applicable only to airborne radiological hazards and may not be appropriate to circumstances when chemical or other respiratory hazards exist instead of, or in addition to, radioactive hazards. Selection and use of respirators for such circumstances must also comply with department of labor regulations. Radioactive contaminants for which the concentration values in Table 4B1, Column 3 of Appendix 4B are based on internal dose due to inhalation may, in addition, present

external exposure hazards at higher concentrations. Under these circumstances, limitations on occupancy may have to be governed by external dose limits.

[b] Air-purifying respirators with APF <100 must be equipped with particulate filters that are at least 95 percent efficient. Air-purifying respirators with APF = 100 must be equipped with particulate filters that are at least 99 percent efficient. Air-purifying respirators with APFs >100 must be equipped with particulate filters that are at least 99.97 percent efficient.

[c] The licensee may apply to the commission for the use of an APF greater than 1 for sorbent cartridges as protection against airborne radioactive gases and vapors (e.g., radioiodine).

[d] Licensees may permit individuals to use this type of respirator who have not been medically screened or fit tested on the device provided that no credit be taken for their use in estimating intake or dose. It is also recognized that it is difficult to perform an effective positive or negative pressure pre-use user seal check on this type of device. All other respiratory protection program requirements listed in 4.24.1 apply. An assigned protection factor has not been assigned for these devices. However, an APF equal to 10 may be used if the licensee can demonstrate a fit factor of at least 100 by use of a validated or evaluated, qualitative or quantitative fit test.

[e] Under-chin type only. No distinction is made in this appendix between elastomeric half-masks with replaceable cartridges and those designed with the filter medium as an integral part of the facepiece (e.g., disposable or reusable disposable). Both types are acceptable so long as the seal area of the latter contains some substantial type of seal-enhancing material such as rubber or plastic, the two or more suspension straps are adjustable, the filter medium is at least 95 percent efficient and all other requirements of this part are met.

[f] The assigned protection factors for gases and vapors are not applicable to radioactive contaminants that present an absorption or submersion hazard. For tritium oxide vapor, approximately one-third of the intake occurs by absorption through the skin so that an overall protection factor of 3 is appropriate when atmosphere-supplying respirators are used to protect against tritium oxide. Exposure to radioactive noble gases is not considered a significant respiratory hazard, and protective actions for these contaminants should be based on external (submersion) dose considerations.

[g] No National Institute of Occupational Safety and Health (NIOSH) approval schedule is currently available for atmosphere supplying suits. This equipment may be used in an acceptable respiratory protection program as long as all the other minimum program requirements, with the exception of fit testing, are met (that is, 4.24.1).

[h] The licensee should implement institutional controls to assure that these devices are not used in areas immediately dangerous to life or health (IDLH).

[i] This type of respirator may be used as an emergency device in unknown concentrations for protection against inhalation hazards. External radiation hazards and other limitations to permitted exposure such as skin absorption shall be taken into account in these circumstances. This device may not be used by any individual who experiences perceptible outward leakage of breathing gas while wearing the device.

Respiratory Protection-Use and Fit Test Procedure HS-130

Exhibit 2

Respiratory Protection Equipment Selection

Respiratory Protection Equipment Selection

The selection of the proper respiratory protection equipment and cartridge shall the responsibility of the Radiation Safety Department and only NIOSH/MSHA approved respiratory protection equipment will be used.

As a general guideline, and unless these requirements are amended, the following respiratory protection equipment and cartridges are approved for use in the areas designated.

I. Any areas where airborne uranium ore dust is present - MSA Comfo II Respirator with Type H high efficiency cartridges, Survivair respirator with HEPA filter, or RACAL Airstream helmet with P3 HEPA filter or comparable respiratory protection equipment as supplied by the Company.

II. Yellowcake drying and barreling enclosure – Helmet-typed respirator with P3 HEPA filter or comparable respiratory protection equipment as supplied by the Company.

III. Vanadium product area (entire section during Vanadium operations) - MSA Ultra-Vue full facepiece respirator with type GMD-II combination cartridges or comparable respiratory protection equipment as supplied by the Company. Respiratory protection equipment must be used at all times while working in this area. All non-routine maintenance (baghouse, rotary kiln or fusion furnace) will require the use of constant flow airline respirators at all times.

IV. Other mill areas where respiratory protection may be required are:

   i. Grind and leach area for protection from acid mists, fumes, sulfur dioxide or radon progeny. MSA Comfo II, MSA Ultra-Vue full facepiece or Survivair respirator with chemical cartridges capable of filtering acid gases, etc. or comparable respiratory protection as provided by the Company.

   ii. Solvent Extraction Circuits - MSA Comfo II, MSA Ultra-Vue, or Survivair with chemical cartridges designed for ammonia and amines or comparable respiratory protection equipment as supplied by the Company.

   iii. Truck unloading area - MSA Ultra-Vue full face piece respirators with Type GMD chemical cartridges for ammonia and amines when unloading ammonia and type GMB chemical cartridges when unloading sulfuric acid or hydrogen peroxide or comparable respiratory protection equipment as provided by the Company.

When welding in any areas, the respiratory protection available is:

I. The Racal Airstream Welding helmet with various types of filter media available.

II. MSA constant flow airline respirator with matching filters for dust, mists, fumes and radionuclides and attached welding helmet.

III. Other comparable respiratory protection systems as supplied by the Company.

Respiratory Protection-Use and Fit Test Procedure HS-130

Appendix A

Respiratory Protection Training Form HS-130A

RESPIRATORY PROTECTION TRAINING

DATE:______________________________
TIME:_____________ TO ___________

TO: ______________________________
PLANT MANAGER

[ ] EFR EMPLOYEES
[ ] CONTRACTOR EMPLOYEES
COMPANY NAME(S) _________________

FROM: ______________________________

(Signature)_________________________

Employee Name	Employee Signature	Employee Number	Date	Company

THE FOLLOWING SUBJECTS WERE DISCUSSED:

____

____

____

____

____

____

TOTAL HOURS:______________________

RAD. SAFETY HOURS:________________

Form HS-130A

Respiratory Protection-Use and Fit Test Procedure HS-130

Appendix B

Respirator Qualitative Fit Test Record Form HS-130B

RESPIRATOR QUALITATIVE FIT TEST RECORD

________________________ _______________________________________

Date Employee Name

____

Signature

A. Respirator Selected:

1. Manufacturer ____
2. Model ____
3. Size ____
4. Approval Number ____

B. Testing Agent:

1. Isoamyl Acetate (Isopentyl Acetate) _______
2. Sodium Saccharin Solution _______
3. Irritant Fume (Stannic Chloride) _______
4. Other _______________________________________

C. Date of Last Medical Exam ____________

D. Due Date for Next Fit Test (annually) ____________

E. I have reviewed the Medical Examination Form for the person being fit tested and it is current. (Physical exams are required annually)

F. I attest that this ***Qualitative Respirator Fit Test*** was performed in compliance with proper procedures.

G. Fit Test Conductor Information:

1. Signature ____
2. Printed/Typed Name ____
3. Title ____
4. Telephone ____
5. Address ____

1.0 PURPOSE

This procedure describes the cleaning, maintenance, repair, inventory, control, storage, and issuance of respirators. The purpose of this procedure is to minimize the inhalation of radioactive materials and chemicals by humans to levels that are As Low As Reasonably Achievable (ALARA) through proper maintenance, inspection, cleaning and storage of respirators.

2.0 APPLICABILITY

This procedure applies to all personnel that clean, maintain, inventory, control, store, and issue respirators.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Regulatory Basis

Radioactive Materials Licenses normally state: "Personal protective equipment shall be used at all times in any area or for any activity designated by the RSO. The licensee shall maintain a record of respirator maintenance, fitting and training."

3.1.2 Other References

3.1.2.1 Respiratory Protection – Use and Fit Test Procedure HS-130.

3.1.2.2 U.S. Nuclear Regulatory Commission Regulatory Guide 8.15, Acceptable Programs for Respiratory Protection.

3.1.2.3 American National Standard Practices for Respiratory Protection – Respirator Uses – Physical Qualifications for Personnel, ANSI Z88.6-1984

3.2 *APPENDICES*

Appendix A – Respirator Inspection, Maintenance, Cleaning, and Storage Form HS-131A

Appendix B – Respirator Issuance Form HS-131B

Appendix C – Respiratory Supplied Air Checklist Form HS-131C

4.0 EQUIPMENT AND MATERIALS

4.1 *EQUIPMENT*

4.1.1 Half-face Air-Purifying Respirators (APRs)

4.1.2 Full-face APRs

4.1.3 Powered APRs (Helmet Style respirators and powered air respirators)

4.1.4 Respirators with supplied airline

4.1.5 Self-Contained Breathing Apparatus (SCBA)

5.0 RESPONSIBILITY

5.1 The Radiation Safety Officer (RSO) or his designee is responsible for the respiratory protection program and providing technical assistance when needed.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

5.2 The Radiation/Security Technician (RST) or his designee is responsible for cleaning, maintenance, control, storage and issuance of respirators.

6.0 PREREQUISITE INFORMATION

6.1 *DEFINITIONS*

6.1.1 dpm – Disintegrations per minute.

6.2 *FREQUENCY*

6.2.1 See section 7.1 for the frequency of inspections.

6.2.2 Cleaning of respirators shall be performed every six months or less, as required.

6.2.3 Cleaning of respirators used for emergencies shall be performed after each use.

7.0 PROCEDURES

7.1 *INVENTORY, INSPECTION AND STORAGE*

7.1.1 Half-face and full-face APRs:

7.1.1.1 Visually inspect at least once a month APRs that are routinely available for issue. If the respirators are stored in plastic bags, the respirators need not be removed from the bags for inspection. Evaluate if the respirators are ready for use. Respirator inspection usually includes a check for tightness of connections and the condition of face pieces, headbands, valves, connecting tubes and canisters. Rubber or elastomeric parts are inspected for pliability and signs of deterioration. Stretching and manipulating rubber or elastomeric parts with a massaging action will keep them pliable and flexible and prevent them from taking a set during storage.

7.1.1.2 Inventory and visually inspect all repair and replacement parts for respirators annually.

7.1.1.3 Store cleaned and monitored respirators in areas protected from dust, sunlight, heat, extreme cold, excessive moisture, damaging chemicals, or physical abuse.

7.1.1.4 Record the number, location, and date of inspections on Form HS-131A or the equivalent.

7.1.1.5 Record the inspection date on a tag or label and attach to the respirator or respirator bag.

7.1.2 Airline Respirators:

7.1.2.1 Visually inspect and inventory all equipment used in conjunction with airline respirators such as air-supply hoses, air regulators, and portable distribution manifolds prior to use.

7.1.2.2 Inventory and visually inspect all repair and replacement parts for respirators annually.

7.1.2.3 Store cleaned and monitored respirators in areas protected from dust, sunlight, heat, extreme cold, excessive moisture, damaging chemicals, or physical abuse.

7.1.2.4 Record the number, location, and date of inspections on Form HS-131A or the equivalent.

7.1.2.5 Record the inspection date on a tag or label and attach to the respirator or respirator bag.

7.1.3 Self Contained Breathing Apparatus (SCBA):

7.1.3.1 Visually inspect and operationally test all routine use SCBAs quarterly. The operational test includes pressurizing the regulator and testing the low-pressure alarm at a minimum.

7.1.3.2 Visually inspect SCBAs kept ready for use during emergencies monthly and operationally test quarterly.

7.1.3.3 Inventory and visually inspect all repair and replacement parts for respirators annually.

7.1.3.4 Permanently and legibly mark breathing air cylinders including SCBA cylinders as “Breathing Air” or “Compressed Breathing Air.”

7.1.3.5 Store cleaned and monitored respirators in areas protected from dust, sunlight, heat, extreme cold, excessive moisture, damaging chemicals, or physical abuse.

7.1.3.6 Record the number, location, and date of inspections on Form HS-131A or the equivalent.

7.1.3.7 Record the inspection date on a tag or label and attach to the respirator or respirator bag.

7.2 *CLEANING, MAINTENANCE AND REPAIR OF RESPIRATORS*

7.2.1 Respirators are to be cleaned, repaired and maintained by personnel who have received on-the-job training or other training on repairing and maintaining respirators. The training will be documented. The RSO or his designee will maintain a list of all personnel trained to clean, maintain, and repair respirators. SCBAs are to be repaired by personnel that have been specifically trained in SCBA repair. Repairs will follow manufacturer’s recommendations for repair.

7.2.2 Routinely used respirators are to be collected, cleaned and disinfected to ensure proper respiratory protection of the worker. Respirator users will return respirators for cleaning and/or repair when the interior of the respirator is dirty, when the respirator needs repair, when the cartridges appear to be clogged with debris, or for any reason that would cause the worker to question the use of the respirator. Respirators will be issued for a maximum of six months before being returned for cleaning and/or repair. Respirators maintained for emergencies are to be cleaned and disinfected after each use.

7.2.3 Clean, disinfect, and repair respirators by the following steps:

7.2.3.1 Remove filters cartridges, canisters, speaking diaphragms, and valve assemblies.

7.2.3.2 Wash face-pieces and breathing tubes in a warm cleaner-disinfectant solution such as a quaternary ammonium antibacterial disinfectant, or the equivalent, following instructions for dilution from the disinfectant manufacturer. Avoid water temperatures above 110 degrees Fahrenheit.

7.2.3.3 Use a stiff bristle (not wire) hand brush to facilitate removal of dirt.

7.2.3.4 Rinse completely in warm clean water to avoid user dermatitis.

7.2.3.5 Clean other respirator parts in a warm detergent solution or as recommended by the manufacturer.

7.2.3.6 Hand wipe valves and gaskets with damp, lint free cloth as needed to remove water residues and all foreign materials. Dry other parts.

7.2.3.7 Inspect valves, head-straps, or other parts and replace as needed.

7.2.3.8 Re-assemble the respirators. Install used filters cartridges or canisters if they appear in good clean working condition. The quantitative fit test which tests for leaking cartridges or canisters will be conducted on all used cartridges or canisters for negative pressure respirators prior to reuse. Otherwise use new parts. Make sure the seal is tight.

7.2.4 Ultrasonic cleaners and/or dishwashers may be used for cleaning but care must be taken to avoid tumbling, agitation, or exposure to temperature above those recommended by the respirator manufacturer, usually 110 degrees Fahrenheit.

7.2.5 Respirator cartridges may be reused only after they have been installed on a respirator, fit tested using the quantitative fit test, and determined not to be leaking.

7.2.6 All respirators used by more than one worker shall be thoroughly cleaned and sanitized after each use.

7.3 *MONITORING OF RESPIRATORS*

7.3.1 Monitor the inside of each cleaned respirator using a release-for-use level of 100 dpm/100 cm^2 above background for fixed alpha, background for removable alpha activity, and 5000 dpm 100 cm^2 above background for beta/gamma.

7.3.2 Document the number, location of storage, monitoring date and activity readings on the proper form. Record the fixed alpha, beta-gamma, and removable activity of all respirators rejected for use.

7.3.3 Place the cleaned and monitored respirators in plastic bags or the equivalent for storage.

7.4 ***ISSUE RESPIRATORS***

7.4.1 The RSO or his designee will issue respirators whenever work is to be done in Airborne Radioactivity Areas, when required by Radiation Work Permits, or when deemed necessary by the RSO or his designee.

7.4.2 Properly fitting respirators will only be issued to individuals who are medically able to wear the respirator, those that have been trained in respirator use, and have passed the respirator fit test within the last year. The respirator issuer will check the Safety Department records to verify that the user is qualified to wear the respirator.

7.4.3 The issuer, user and date of issuance will be recorded on the Respirator Issuance Form HS-131B and retained in the Safety Department records.

7.5 ***SUPPLIED AIR AND SCBA AIR QUALITY***

7.5.1 The air supplied to airline respirators and the air in SCBAs is to meet Grade D air quality standards. The input point for the breathing air compressor is located outside the process buildings and is equipped with filters to reduce any contaminants being drawn in. The air is routed to an air purifier designed to produce Grade D air.

7.5.2 Prior to using the supplied air check that:

7.5.2.1 The prefilter that removes solid particles, liquid oil and water has not changed color to indicate replacement.

7.5.2.2 The color strips on the desiccant towers have not changed color to indicate failure to remove water.

7.5.2.3 Carbon monoxide levels are less than 10 ppm using a colorimetric detector tube or a gas analyzer.

7.5.2.4 Objectionable odors or tastes are not detected by the user. If so, replace the activated charcoal filter.

7.5.2.5 The oxygen level is between 19.5 and 23.5 percent using a portable oxygen meter.

7.5.2.6 The carbon dioxide level is less than 1000 ppm using colorimetric tubes or gas analyzer.

7.5.2.7 The hydrocarbon (condensed) content is 5 milligrams per cubic meter of air or less using colorimetric tubes or gas analyzer.

7.5.3 Use the Respiratory Supplied Air Checklist Form HS-131C to make sure all the above items are checked.

7.5.4 Obtain a certificate or air analysis from the vendor filling the SCBA tanks stating that the fill air meets Grade D air.

Respirator Maintenance, Inspection, Cleaning and Storage
Procedure HS-131

Appendix A

Respirator Inspection, Maintenance, Cleaning and Storage Form HS-131A

Respirator Inspection, Maintenance, Cleaning, and Storage Form

Technician: ________________________________

Date Completed: _______________

Respirator Information

Type (circle one):

Half-face APR Full-face APR Powered APR Airline Respirator SCBA

Manufacturer/Model: ________________________________ Serial Number: __________________

Use (circle one): Routine Emergency

Service (circle all that apply): Inspection Repair Cleaning Operational Test

Radiological Screening

	_____________	_____________	_____________
	dpm /100 cm^2	dpm/100 cm^2	dpm /100 cm^2
	Fixed Alpha	Beta-Gamma	Removable Alpha
Limit:	100 dpm /100 cm^2	5000 dpm/100 cm^2	Background

Respirator Status (circle one)

Ready for Use Needs Additional Service Do Not Reuse Other ____________

Next Service Due: _______________ (date) __________________________ (type of service)

Comments/Other:

____

____

____

Technician Signature ______________________________

Respirator Maintenance, Inspection, Cleaning and Storage
Procedure HS-131

Appendix B

Respirator Issuance Form HS-131B

Respirator Issuance Form

Respirator User	Type Issued/Ser. No.	Date Issued	Issued By
Respirator User	Type Issued/Ser. No.	Date Issued	Issued By
Respirator User	Type Issued/Ser. No.	Date Issued	Issued By
Respirator User	Type Issued/Ser. No.	Date Issued	Issued By
Respirator User	Type Issued/Ser. No.	Date Issued	Issued By
Respirator User	Type Issued/Ser. No.	Date Issued	Issued By
Respirator User	Type Issued/Ser. No.	Date Issued	Issued By
Respirator User	Type Issued/Ser. No.	Date Issued	Issued By
Respirator User	Type Issued/Ser. No.	Date Issued	Issued By
Respirator User	Type Issued/Ser. No.	Date Issued	Issued By
Respirator User	Type Issued/Ser. No.	Date Issued	Issued By
Respirator User	Type Issued/Ser. No.	Date Issued	Issued By
Respirator User	Type Issued/Ser. No.	Date Issued	Issued By

Respirator Maintenance, Inspection, Cleaning and Storage
Procedure HS-131

Appendix C

Respiratory Supplied Air Checklist Form HS-131C

Respiratory Supplied Air Checklist

Date/Time	Is the prefilter working? (i.e. has not changed color) (Y/N)	Are the desiccant towers working? (i.e. have not changed color) (Y/N)	Is the activated charcoal filter working? (i.e. no objectionable odors or tastes reported by the user) (Y/N)	Carbon monoxide level (must be less than 10 ppm) (ppm)	Oxygen level (must be between 19.5 and 23.5 percent) (%)	Carbon dioxide level (must be less than 1000 ppm) (ppm)	Hydrocarbon content (must be 5 milligrams per cubic meter or less) (mg/m^3)	Inspector Initials

1.0 PURPOSE

This procedure provides for medical examinations of Energy Fuels Resources employees at the Piñon Ridge Mill.

2.0 APPLICABILITY

This procedure applies to all employees of the Mill.

3.0 ADMINISTRATION

3.1 REFERENCES

3.1.1 Respiratory Protection – Use and Fit Test Procedure HS-130.

3.2 APPENDICES

Appendix A – Medical Evaluation Questionnaire Form HS-132A

Appendix B – Medical Determination Form HS-132B

4.0 RESPONSIBILITY

4.1 The Vice President of Regulatory Affairs is responsible for determining the criteria for pre-employment physicals.

4.2 The Radiation Safety Officer (RSO) or designee is responsible for:

4.2.1 Determining the criteria for physicals for respirator users.

4.2.2 Evaluating the results of physicals of respirator users to determine if work restrictions for individual employees are warranted.

4.3 The Safety Officer is responsible for:

4.3.1 Evaluating the results of the pre-employment and employment physicals to determine if work restrictions for individual employees are warranted.

4.3.2 Assuring that personnel considered as key individuals relevant to this procedure are documented as properly trained and/or qualified to perform the required duties.

4.4 The Alternate RSO is responsible for maintaining occupational medical records of current employees.

5.0 PREREQUISITE INFORMATION

5.1 *FREQUENCY*

5.1.1 Pre-employment physical examination before beginning work.

5.1.2 Annual (at least every 12 months) medical evaluation of respirator users.

5.1.3 As needed physicals of current employees.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

6.0 PROCEDURES

6.1 *MEDICAL EXAMINATION CRITERIA*

6.1.1 Medical criteria for employment physicals are established by the Vice President of Regulatory Affairs in conjunction with a physician.

6.1.2 Medical criteria for physical exams of respirator users are established by the RSO or designee in conjunction with a physician.

6.2 *PHYSICAL EXAMINATIONS*

6.2.1 Personnel newly hired by Energy Fuels Resources at the Piñon Ridge Mill are to have a pre-employment physical by a licensed physician or his designee before beginning work.

6.2.2 Employment physicals of current employees by a licensed physician or his designee may be ordered by the RSO or designee or Safety Officer on an as needed basis.

6.2.3 The results of the pre-employment and employment physicals are to be reviewed by the Safety Officer or his designee for potential work restrictions. If warranted he will implement work restriction for specific individuals.

6.2.4 Annually (at least every 12 months) respirator users are to be evaluated by a licensed physician or his designee for their ability to wear a respirator using the Medical Determination Form HS-132B or its equivalent. A grace period of up to 3 months may be granted per a physician or his designee. However, three consecutive examinations shall not exceed 39 months.

6.2.5 The results of the medical evaluation of respirator users are to be reviewed by the RSO or designee for their ability to wear a respirator and for potential work restrictions. If warranted, the RSO or designee may not allow an individual to wear a respirator and/or implement work restrictions for the individuals.

6.3 *RECORDS*

6.3.1 Records of medical physical examinations are to be filed with the Safety Department and maintained until license termination.

6.3.2 Medical records and the results of medical screening tests shall be kept private. The only information that should be transmitted from the physician to the Mill Safety Department is whether or not an individual may use respirators, or which devices may be used and which may not be. A simple physician-issued medical-approval form is adequate.

Medical Evaluation for Respirator Use Procedure HS-132

Appendix A

Respirator Medical Evaluation Questionnaire Form HS-132A

Medical Evaluation Questionnaire

Your employer must allow you to answer this questionnaire during normal working hours, or at a time and place that is convenient to you. To maintain your confidentiality, your employer or supervisor must not look at or review your answers, and your employer must tell you how to deliver or send this questionnaire back to us.

PART A. SECTION 1 (MANDATORY)

The following information must be provided by every employee who has been selected to use any type of respirator (please print).

1. Today's Date:	2. Your Name:		
3. Your age (to nearest year):	4. Sex (circle one): Male Female	5. Your height: ft. in.	6. Your weight: lbs.
7. Your job title:			
8. A phone number where you can be reached by the health care professional who reviews this questionnaire (include the Area Code): ( )			
9. The best time to call:	10. Has your employer told you how to contact the health care professional who will review this questionnaire (circle one): Yes No		

11. Check the type of respirator you will use (you can check more than one category

☐ N, R or P disposable respirator (filter-mask, non-cartridge type only)

☐ Other type (for example, half- or full-facepiece type, powered-air purifying, supplied-air, self-contained purifying, supplied air, self-contained breathing apparatus)

12. Have you worn a respirator (circle one): Yes No If yes, what type(s):

PART A. SECTION 2 (MANDATORY)

Questions 1 through 9 below must be answered by every employee who has been selected to use any type of respirator (Please circle "yes" or "no")

1. Do you *currently* smoke tobacco, or have you smoked tobacco in the last month?	Yes	No
2. Have you *ever had* any of the following conditions?		
a. Seizures (fits):	Yes	No
b. Diabetes (sugar disease):	Yes	No
c. Allergic reactions that interfere with your breathing:	Yes	No
d. Claustrophobia (fear of closed-in places):	Yes	No
e. Trouble smelling odors:	Yes	No
3. Have you *ever had* any of the following pulmonary or lung problems?		
a. Asbestosis:	Yes	No
b. Asthma:	Yes	No
c. Chronic bronchitis:	Yes	No
d. Emphysema:	Yes	No
e. Pneumonia:	Yes	No
f. Tuberculosis:	Yes	No
g. Silicosis:	Yes	No
h. Pneumothorax (collapsed lung):	Yes	No
i. Lung cancer:	Yes	No
j. Broken ribs:	Yes	No
k: Any chest injuries or surgeries:	Yes	No
l. Any other lung problem that you've been told about:	Yes	No

4. Do you *currently* have any of the following symptoms of pulmonary or lung disease?		
a. Shortness of breath:	Yes	No
b. Shortness of breath when walking fast on level ground or walking up a slight hill or incline:	Yes	No
c. Shortness of breath when walking with other people at an ordinary pace on level ground:	Yes	No
d. Shortness of breath when walking at your own pace on level ground:	Yes	No
e. Have to stop for breath when washing or dressing yourself:	Yes	No
f. Shortness of breath that interferes with your job:	Yes	No
g. Coughing that produces phlegm (thick sputum):	Yes	No
h. Coughing that wakes you up early in the morning:	Yes	No
i. Coughing that occurs mostly when you are lying down:	Yes	No
j. Coughing up blood in the last month:	Yes	No
k. Wheezing:	Yes	No
l. Wheezing that interferes with your job:		
m. Chest pain when you breathe deeply:	Yes	No
n. Any other symptoms that you think may be related to lung problems:	Yes	No

5. Have you *ever had* any of the following cardiovascular or heart problems?		
a. Heart attack:	Yes	No
b. Stroke:	Yes	No
c. Angina:	Yes	No
d. Heart failure:	Yes	No
e. Swelling in your legs or feet (not caused by walking):	Yes	No
f. Heart arrhythmia (heart beating irregularly):	Yes	No
g. High blood pressure:	Yes	No
h. Any other heart problem that you've been told about:	Yes	No
6. Have you *ever had* any of the following cardiovascular or heart symptoms?		
a. Frequent pain or tightness in your chest:	Yes	No
b. Pain or tightness in your chest during physical activity:	Yes	No
c. Pain or tightness in your chest that interferes with your chest:	Yes	No
d. In the past two years, have you noticed your heart skipping or missing a beat:	Yes	No
e. Heartburn or indigestion that is not related to eating:	Yes	No
f. Any other symptoms that you think may be related to heart or circulation problems:	Yes	No
7. Do you *currently* take medication for any of the following problems?		
a. Breathing or lung problems:	Yes	No
b. Heart trouble:	Yes	No
c. Blood pressure:	Yes	No
d. Seizures (fits):	Yes	No
8. If you've used a respirator, have you *ever had* any of the following problems? (If you've never used a respirator, go to Question 9)		
a. Eye irritation:	Yes	No
b. Skin allergies or rashes:	Yes	No
c. Anxiety:	Yes	No
d. General weakness or fatigue:	Yes	No
e. Any other problem that interferes with your use of a respirator:	Yes	No
9. Would you like to talk to the health care professional who will review this questionnaire about your answers to this questionnaire?	Yes	No

Questions 10 to 15 below must be answered by every employee who has been selected to use either a full-facepiece respirator or a self-contained breathing apparatus (SCBA). For employees who have been selected to use other types of respirators, answering these questions is voluntary

10. Have you *ever lost* vision in either eye (temporarily or permanently)?	Yes	No
11. Do you *currently* have any of the following vision problems?		
a. Wear contact lenses:	Yes	No
b. Wear glasses:	Yes	No
c. Color blind:	Yes	No
d. Any other eye or vision problem:	Yes	No
12. Have you *ever had* an injury to your ears, including a broken ear drum?	Yes	No
13. Do you *currently* have any of the following hearing problems?		
a. Difficulty hearing:	Yes	No
b. Wear a hearing aid:	Yes	No
c. Any other hearing or ear problem:	Yes	No
14. Have you *ever had* a back injury?	Yes	No
15. Do you *currently* have any of the following musculoskeletal problems?		
a. Any weakness in your arms, hands, legs or feet:	Yes	No
b. Back pain:	Yes	No
c. Difficulty fully moving your arms or legs:	Yes	No
d. Pain or stiffness when you lean forward or backward at the waist:	Yes	No
e. Difficulty fully moving your head up or down:	Yes	No
f. Difficulty fully moving your head side to side:	Yes	No
g. Difficulty bending at your knees:	Yes	No
h. Difficulty squatting to the ground:	Yes	No
i. Climbing a flight of stairs or a ladder carrying more than 25 lbs:	Yes	No
j. Any other muscle or skeletal problem that interferes with using a respirator:	Yes	No

COMMENTS (IF ANY):

EMPLOYMENT EXAMINATION CONSENT

I, ____ understand that the information discovered during this examination will be considered confidential unless specifically released by me.

However, I also understand that certain information *must* be reported to my employer, to governmental agencies or to coworkers in situations similar to my own (for example, results of testing to determine my exposure to a hazardous chemical) Other than information for which there is a requirement to divulge, nothing which identifies me individually may be released, except as indicated below, without my specific permission.

I understand and hereby give my consent that information about my ability to perform my job safely may be reported to my employer or prospective employer. This information may include:

- Medical recommendations, based on my employment and periodic evaluations, regarding my work capability and any necessary work restrictions.
- Medical conditions that would directly affect my safety, the safety of others, or my job performance.
- The duration and extent of any medical restrictions placed on my work activities.

I understand that medical information revealed on this examination may be communicated to the physician(s) acting as corporate occupational medical director(s) for my employer. I do not give permission for any further or subsequent release of the information by the recipient.

I understand that my employer and my employer's workers' compensation carrier may review the information in my medical record at any time in the event I claim that an injury or illness is caused or worsened by my job.

____ ________________

Signature Date

____

Location

Medical Evaluation for Respirator Use Procedure HS-132

Appendix B

Medical Determination Form HS-132B

MEDICAL DETERMINATION

Name: ____ Date [mm/dd/yy]: ________________

Employee ID/SSN: _____________________________________ Date of Birth [mm/dd/yy]: ___________

Department: ____

[ ] This is an exit exam [ ] This is an initial exam [ ] This is an annual exam

Check type or types of respirator(s) to be used:

[ ] Air-Purifying (non-powered)
[ ] Powered Air Purifying Respirator (PAPR)
[ ] Continuous-Flow Air-Line Respirator
[ ] Pressure Demand Air-Line Respirator
[ ] Combination Continuous-Flow Air-Line and Air-Purifying Respirator
[ ] Combination Pressure Demand Air-Line and Air-Purifying Respirator
[ ] Combination Air-Line and SCBA
[ ] Open Circuit SCBA
[ ] Closed Circuit SCBA
[ ] Combination Air-Line and SCBA

Select Level of Work Effort:

[ ] Light
[ ] Moderate
[ ] Heavy
[ ] Strenuous

Duration and Frequency of Respirator Use:

[ ] On a daily basis
[ ] Occasionally - but more than once a week
[ ] Rarely - or for emergency situations only
Length of Time of Anticipated Effort (Hours):

Respirator Use:

[ ] No restrictions on respirator use
[ ] Some specific use restrictions (specify below)
[ ] No respirator use permitted
Follow-up evaluation needed [ ] Yes [ ] No

Hazardous Materials Work:

[ ] No restrictions on full participation in hazardous materials/hazardous waste work.
[ ] Has medical limitations that restrict full participation in hazardous materials/hazardous waste work. See work function limitations listed in “Restrictions”.

Hearing:

[ ] Hearing loss <u>not</u> noted.
  [ ] Comparison with prior audiogram shows no significant change.
  [ ] There is no prior audiogram for comparison.
[ ] Hearing loss noted. There is a significant change from prior audiogram.
  [ ] This represents an STS in speech frequencies.
  [ ] This represents an STS in the 4K to 6K high frequency range.

Restrictions: ____

The above employee has been provided a copy of this evaluation: [ ] Yes [ ] No

Name and Title of evaluator: ____

Signature: ____

Respirator Program Administrator: ____________________________ Date: ______________

1.0 PURPOSE

The purpose of this procedure is to identify procedures and surveys necessary to assess the adequacy of control measures in the workplace

2.0 SCOPE

The procedure is designed to comply with MSHA Part 56 standards for air quality and will be applicable to all areas of the facility.

3.0 RESPONSIBILITY

3.1 Managers shall be responsible for implementing the Air Quality Surveys Non-Radiological Procedure.

3.2 Supervisors shall ensure that control equipment is maintained and kept functional at all times.

3.3 The Safety Department shall develop and maintain the Air Quality Surveys Non-Radiological Procedure and perform the necessary sampling and observations to ensure compliance with the procedure

4.0 PROCEDURE

4.1 Initial surveys to determine potential exposure to dusts, mists and fumes will be conducted throughout the milling facility. Contaminants to be sampled for include, but are not limited to:

4.1.1 Silica Dust

4.1.2 Nuisance Particulates

4.1.3 Sulfur Dioxide

4.1.4 Carbon Dioxide

4.1.5 Ammonia Fumes

4.1.6 Welding Fumes

4.1.7 Vanadium Compounds

4.2 All methods of sampling will be consistent with established scientific principles such as NIOSH recommended methods.

4.3 If initial sampling does not indicate exposures levels that exceed the permissible limits found in the 1973 ACGIH TLV booklet, then repeat sampling will only be necessary at six (6) month intervals.

4.4 All control measures must be maintained in a condition to assure that employees are not exposed to harmful concentrations of airborne contaminants. If feasible, engineering controls do not reduce exposure to acceptable levels a respiratory protection program will be initiated.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

4.5 ***TOTAL DUST MEASUREMENTS (Includes Vanadium Compounds)***

4.5.1 Total dust measurements are taken using a personal dust sampler without the cyclone assembly in the sampling train.

4.5.2 All airborne particles or "total dust" are measured.

4.5.3 The TLV for total dust is 10 mg/m^3.

4.5.4 If dusts associated with this sampling have a free silica content of 1% or more the sampling must be done using the respirable dust sampling procedure.

4.5.5 Analysis for other contaminants of concern can be done on the dust captured on the filter and the appropriate TLV's can be assigned.

4.6 ***SAMPLING FOR SILICA DUST (Respirable Dust Sampling)***

4.6.1 The Threshold Limit Value (TLV) is 1% of total dust in the sample and the amount of total dust in sample will vary from sample to sample. The TLV will generally be in the range of 0.1 to 3.3 mg/m^3.

4.6.2 Personal respirable dust sampling must be conducted to determine the concentration of dust in the breathing zone of the worker.

4.6.3 The respirable dust collected on the filter will be analyzed for free silica content and the appropriate TLV will be determined from this analysis.

4.6.4 For respirable dust sampling a cyclone assembly is required in the sampling train.

4.7 ***WELDING FUME SAMPLING***

4.7.1 Sampling will be done during welding operations by placing the filter cassette in a position that will be inside the welding helmet when the helmet is placed down.

4.7.2 The potential contaminants include metal fumes and toxic gases and the material collected on the filter can be analyzed for the contaminants of concern and the appropriate TLV determined from that analysis.

4.8 ***OTHER AIR QUALITY MONITORING***

4.8.1 Sampling to determine adequate oxygen levels will be done using an oxygen monitor and must be performed anytime confined space entries will be made.

4.8.2 Sampling for toxic gases, flammable gases, carbon dioxide, carbon monoxide, etc. will be performed using equipment adequate to determine the hazardous levels of these gases.

4.8.3 Sampling for ammonia and sulfur dioxide will also be performed using the appropriate sampling equipment.

Attachment D

Radiological Health and Safety Procedures

1.0 PURPOSE

This procedure is for training Energy Fuels Resources personnel and contractors who work at the Piñon Ridge Mill in Radiological Health and Safety.

2.0 APPLICABILITY

This training program provides procedures for instructing Mill employees, contractors, and visitors of their potential radiation doses and the health implications of those doses.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Current Colorado Radioactive Materials License

3.1.2 Colorado Rules and Regulations Pertaining to Radiation Control (6 CCR 1007-1)

3.1.3 NRC Regulatory Guide 8.31, "Information Relevant to Ensuring That Occupational Radiation Exposures at Uranium Recovery Facilities will be As Low As is Reasonably Achievable."

3.1.4 Training Records Documentation and Tracking Procedure AD-060

3.1.5 Radiation Work Permits Procedure RH-060

3.2 *APPENDICES*

Appendix A – Radiation Safety Briefing Outline

Appendix B – Radiation Worker Training Syllabus

Appendix C – Sample Radiation Safety Test

4.0 EQUIPMENT AND MATERIALS

4.1 *MATERIALS*

Training materials will be updated periodically, as necessary, based on the current operating status of the milling facility and will address problems that have been experienced. A wide range of subjects, films, articles, new regulatory guides, personnel exposure incidents, and any other topic deemed appropriate by the Radiation Safety Officer (RSO) or designee will be addressed during radiation safety training/meetings.

4.1.1 An outline is used for the Radiation Safety Briefing.

4.1.2 A syllabus is utilized for Basic Radiation Worker Training.

4.1.3 Topical information is used for Routine Periodic Radiation Safety Retraining.

4.1.4 A written Radiation Work Permit work plan is generally used for Radiation Work Permit Training (See Radiation Work Permits Procedure RH-060)

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

4.1.5 The specific Radiological Health and Safety Procedures contained in this plan are used for Training.

4.1.6 Competency checklists, which mimic the Operating Procedures will be developed and will be used for the Competency Training for specific jobs and tasks.

5.0 RESPONSIBILITY

The RSO or Alternate RSO is responsible for:

5.1 Determining the need for Radiation Safety Training or specialized training.

5.2 Training of all personnel, contractors, and visitors to the Mill.

5.3 Tracking the training provided to employees and contractors.

5.4 Grading the Radiation Safety Training Test. New employees are required to re-train and re-take test if they do not pass (70%).

6.0 PREREQUISITE INFORMATION

6.1 *DEFINITIONS*

Designated Training Personnel – An individual or group designated as being qualified to provide appropriate training to key individuals or to assess qualifications of key individuals.

6.2 *FREQUENCY*

6.2.1 At minimum, contractors, vendors, or visitors entering low radioactivity areas will receive a Radiation Safety Briefing. Additional training will be provided as specified by the RSO or designee commensurate with their expected exposure potential and duration of time onsite, as described in Section 7.1, below.

6.2.2 New Energy Fuels employees and contractor employees designated by the RSO or designee must attend Basic Radiation Safety Training prior to starting their work assignments. Quarterly radiation safety/training meetings will be held for the purpose of accumulating an estimated 4 hours of yearly retraining of all mill employees.

6.2.3 Training associated with work to be performed under Radiation Work Permits will be completed prior to employees performing the work.

6.2.4 Training in execution of these radiological health and safety procedures will be completed prior to employees performing the work independently.

6.2.5 Competency checklists for Operating Procedure Training are designed to be completed within 90 days of an employee's assignment or reassignment and prior to performing the work independently.

7.0 PROCEDURES

The following sections describe the training categories, training documentation, and training testing required for Energy Fuels employees, contractors, and visitors. All unescorted personnel, contractors, and visitors who perform work will receive a briefing concerning potential radiological hazards. Depending on the work activity, duration and exposure potential, additional training will be provided. Listed below are the training categories and levels.

7.1 Training Categories

7.1.1 Radiation Safety Briefing – visitors, vendors, short-term contractors, or contractors and employees working in low radioactivity areas.

7.1.2 Basic Radiation Worker Training – New employees, long-term contractors, or contractors working in restricted areas – test required for employees and contractors as determined by the RSO or designee.

7.1.3 Annual Radiation Safety Retraining – Energy Fuels employees receive approximately 4 hours of radiological refresher training per year. Contractors, as needed per RSO or designee.

7.1.4 Radiation Work Permit Training – As required by Radiation Work Permits.

7.1.5 Radiological Health and Safety Procedure Training – As determined by the RSO.

7.1.6 Operator, Maintenance, and Utility Crew Competency Training – the radiological health and safety implications of individual operating assignments will be covered in the course of individual task or job-specific training programs. Employees will be required to read operating procedures related to their assignment and signify their understanding of these procedures.

7.2 Training Levels

7.2.1 Level 1 – Visitors and vendors entering low radioactivity areas will receive the Radiation Safety Briefing and will be escorted by Energy Fuels personnel.

7.2.2 Level 2 – Short-term contractors and employees who are not radiation workers will receive the Radiation Safety Briefing or Basic Radiation Worker Training, as appropriate for the areas they will be accessing and activities they will be performing. Annual Radiation Safety Retraining, Radiation Work Permit Training, and task or job-specific training, will be required as necessary based on the contract duration and work performed.

7.2.3 Level 3 – Long-term contractors and mill workers will receive all training components listed under Section 7.1 above appropriate for their job duties.

7.3 Training Documentation – All Energy Fuels radiological training will be documented to show the course content, the attendees, the trainer, and the test results in accordance with the Training Records Documentation and Tracking Procedure AD-060.

7.4 New employees existing employees, and contractors are required to pass the training exams with a score of 70% or more.

Radiological Health and Safety Training Procedure RH-010

Appendix A

Radiation Safety Briefing Outline

Radiation Safety Briefing Outline

1. Administrative
   a) Hazard Recognition
   b) Waiver Release
   c) Contractor Informational Form
   d) Prior Occupational Radiation Dosage Form
   e) Contractor Dose and Monitoring Evaluation Form
   f) Part 4 and 10 of Radiation Regulations

2. Baseline Monitoring Determination
   a) TLD/pocket dosimeter
   b) Other

3. Site Rules
   a) Site entry and departure
   b) Eating, tobacco, and drinking policy
   c) Contamination control

4. Radiation Hazards and pathways (external and internal)
   a) Caution signs and posting requirements
   b) i) Radiation Symbol
      ii) Radiation Postings
         1) Entrances to property
         2) Radiation Areas
         3) Airborne Radioactivity Areas
         4) Respirator Use Areas
         5) Restricted Areas (i.e., containing licensed material)

Radiological Health and Safety Training Procedure RH-010

Appendix B

Basic Radiation Safety Training Syllabus

Basic Radiation Safety Training Syllabus

- Nature of ionizing radiation, radioactivity and basic atomic structure
- Characteristics of alpha, beta and gamma radiation
- Principles of half life and radioactive decay
- Natural and man-made sources of Ionizing Radiation
- Units of exposure
- Radiation protection regulations – CDPHE Part 4 and 10, NRC, MSHA, OSHA
- Measurement of ionizing radiation
- Health effects of ionizing radiation as specific to uranium and progeny
- Principle of ALARA – methods of exposure control
- Contamination control (hygiene) and decontamination techniques
- Waste management
- Emergency procedures
- Use of respirators when appropriate per CDPHE requirements (CDPHE 2005)
- Safety designed features of process equipment
- Ventilation systems, effluent controls and inspection requirements
- Waste management systems and inspection requirements
- Standard operating procedures
- Security and access control to designated areas
- Measurements of airborne radioactive material
- Bioassay (urinalysis and in vivo counting)
- Surveys to detect contamination of personnel and equipment and decontamination methods
- Personnel dosimetry

Radiological Health and Safety Training Procedure RH-010

Appendix C

Sample Radiation Safety Training Test

Sample Radiation Safety Training Test

1. The basic philosophy of radiation protection includes three factors:
   a. ________________________________
   b. ________________________________
   c. ________________________________
2. ALARA means ____
   ____
3. The primary responsibility for radiation protection rests with the ________________________
4. Radioactivity is the process where unstable atoms disintegrate or decay to stable atoms. The energy released in this process is called:
   a. The blast effect
   b. The shock wave
   c. A mushroom cloud
   d. Ionizing radiation
5. Cosmic radiation and radiation from terrestrial sources are examples of:
   a. Natural background radiation
   b. Natural man-made radiation
   c. Industrial sources of radiation
   d. Radioactive sources used in the medical field
6. An example of a man-made source of radiation is:
   a. Terrestrial sources
   b. Cosmic radiation
   c. Diagnostic radiation
   d. Potassium-40 in the human body
7. The amount of radiation absorbed into the body is:
   a. Charge
   b. Exposure rate
   c. Dose
   d. Contamination
8. The type of radiation that is a major hazard due to its relatively high penetrating power is radiation.
   a. Alpha
   b. Microwave
   c. Gamma
   d. Neutron

9. Match the type of radiation listed with its characteristics. Each type of radiation may have more than one characteristic and each characteristic may fit more than one type of radiation.

_________ alpha	a. Identical to orbital electrons
	b. No mass, no charge
_________ beta	c. Electromagnetic radiation
	d. Very penetrating
_________ gamma	e. Identical to a helium nucleus
	f. Will not penetrate the layer of dead skin cells
_________ x-rays	g. Will penetrate up to about 1 cm in tissue
	h. Will be stopped by a piece of paper

10. Three ways of reducing exposure to external radiation are:
    a. ______________________________
    b. ______________________________
    c. ______________________________

11. The rate at which an individual is exposed to radiation is:
    a. Watts per hour
    b. Roentgens
    c. Exposure rate
    d. Dose

12. Three routes of entry of radionuclides into the body are:
    a. ______________________________
    b. ______________________________
    c. ______________________________

13. For each of the three routes of entry listed above, name two ways of reducing or preventing intake:
    a. ______________________________
    b. ______________________________
    c. ______________________________

14. Radiation received by the body over a short period is:
    a. Chronic exposure
    b. Sublethal exposure
    c. Acute exposure
    d. Supralethal exposure

15. Chronic exposures are:
    a. Amounts of radiation received over a short period of time
    b. Amounts of radiation received over a very long period of time
    c. Acute exposures which affect only critical organs of the body
    d. Acute exposures which affect all parts of the body

16. Radioactive decay is defined as:
    a. The decrease in the amount of any radioactive material due to the spontaneous emission of ionizing radiation from the nucleus
    b. The decomposition of radioactive atoms due to lengthy exposure to direct sunlight
    c. The gradual decrease in the number of radioactive atoms in radioactive material due to spontaneous fission
    d. The decline in the strength of a radioactive source due to the combined effects of time, distance, and shielding
17. The unit of radioactivity is ______________________________
18. The unit of radiation dose is _____________________________
19. The most important risk of exposure to low-level radiation is ___________________________
20. The maximum allowable annual dose to a radiation worker is ___________________________
21. The most common physical symptoms of early radiation sickness are:
    a. Nausea, changes in blood cell formation, vomiting
    b. Diarrhea, nausea, vomiting, headache, fatigue
    c. Vomiting, changes in blood cell formation, burns
    d. High fever, changes in blood cell formation, nausea
22. One of the delayed effects of high-level radiation exposure is:
    a. Increased risk of cancer
    b. Nausea
    c. Vomiting
    d. Restlessness
23. When radioactive particles land on a surface, the original surface:
    a. Becomes permanently radioactive
    b. Becomes radioactive for a limited period of time
    c. Is considered contaminated, but does not become radioactive
    d. Is unaffected and is safe to walk about
24. Radiation levels naturally decrease due to radioactive:
    a. Decay
    b. Decontamination
    c. Equilibrium
    d. Absorption
25. Almost all of the world population's dose from radioactivity comes from _______________ sources?
    a. Radon
    b. Natural
    c. Nuclear medicine
    d. Artificial

26. The source of most of the dose from natural sources of radiation is from what?
    a. Radon
    b. Lead
    c. The sun
    d. Consumer products
27. The most common medical procedure leading to an individual's collective dose of radiation is what?
    a. Radiotherapy
    b. Filling a cavity
    c. Blood pressure check
    d. X-ray
28. Symptoms of ARS include:
    a. Nausea
    b. Diarrhea
    c. Fatigue
    d. All of the above
29. High-levels of ionizing radiation exposure can result in a long-term effect of:
    a. Nausea
    b. Restlessness
    c. High fever
    d. Increased risk of cancer
30. Terminal ARS symptoms may include:
    a. Over excitability and lack of coordination
    b. Breathing difficulty
    c. Occasional periods of disorientation
    d. All of the above

31. True or False

_______ Radionuclides in the thorium decay series emit all three types of radiation.

_______ Uranium and thorium are naturally occurring elements in the earth's crust.

_______ Radium is part of the decay series of uranium only.

_______ Radon (Rn-222) is a noble gas.

_______ Because uranium and thorium are naturally occurring, doses from exposure to them are not as hazardous as the same dose from man-made radionuclides would be.

_______ Colorado is an "agreement state" so it does not have to follow the same regulations as the states that are regulated by the Nuclear Regulatory Commission.

_______ The maximum allowable dose to a member of the general public from the Piñon Ridge Mill, including radon decay products, is 100 mrem per year.

_______ Greatest danger from a dirty bomb is public panic.

_______ Radiation Injury Treatment Network centers will most likely have to decontaminate patients prior to admitting them for treatment.

_______ A posting (sign) indicating "Radiation Area" means levels of radiation in that area are so severe it could be fatal if you enter it.

_______ Respirators should be donned immediately whenever you enter the mill building.

_______ When leaving the mill building, you must exit via a designated exit location and frisk yourself for contamination.

1.0 PURPOSE

This procedure describes decontamination methods used to remove radioactive materials from people or objects.

2.0 APPLICABILITY

This procedure applies to all personnel, their clothing, equipment, materials, and vehicles within the restricted area of the Mill prior to release to unrestricted areas.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Colorado Rules and Regulations Pertaining to Radiation Control (6 CCR 1007-1).

3.1.2 Release of Equipment to Unrestricted Areas Procedure RH-070

3.1.3 Personnel Release Surveys Procedure RH-200

3.1.4 Respirator Maintenance, Inspection, Cleaning, and Storing Procedure HS-131

3.2 *APPENDICES*

Appendix A – Personnel Decontamination

Appendix B – Personal Contamination Form RH-020A

4.0 EQUIPMENT AND MATERIALS

4.1 *MATERIALS (Dependent on Decontamination Method)*

4.1.1 Soap and water

4.1.2 Lava soap

4.1.3 Soft brush

4.1.4 Detergent

4.1.5 Washing machine

4.1.6 Power washer

4.1.7 Steam cleaner

4.1.8 Hand tools (shovel and wire brush)

4.1.9 Sulfuric acid

5.0 RESPONSIBILITY

5.1 The Radiation Safety Officer (RSO) or Alternate RSO is responsible for providing guidance on which decontamination method to use.

5.2 The Radiation/Security Technician (RST) is responsible for directing the decontamination method or performing the decontamination.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

6.0 PREREQUISITE INFORMATION

6.1 *FREQUENCY*

6.1.1 Whenever contamination above background is encountered on personnel, their clothing, equipment or vehicles prior to leaving the restricted area of the Mill.

6.1.2 As directed by the RSO or Alternate RSO.

7.0 PROCEDURES

7.1 *DECONTAMINATION OF PERSONNEL*

7.1.1 The RST or his designee is to assist personnel in removing contamination from their bodies using the procedures listed in Appendix A prior to leaving the restricted area of the Mill. Begin with the first procedure and then proceed stepwise, with radiation surveys between steps, to the more aggressive procedures, as necessary. Continue decontamination procedures until the contaminated area has been removed to “background” or until advised to stop by the RSO or his designee.

7.1.2 Monitor personnel intending to leave the restricted area of the Mill in accordance with the Personnel Release Surveys Procedure RH-200.

7.1.3 Complete Form RH-200A (Procedure RH-200) or the equivalent to document the initial release survey

7.1.4 If contamination is found complete Form RH-020A (Appendix B) to document the decontamination and re-surveys.

7.1.5 File and retain Forms RH-200A and RH-020A or their equivalent for 3 years.

7.2 *DECONTAMINATION OF CLOTHING*

7.2.1 Contamination on clothing can be removed prior to leaving the restricted area of the Mill using detergent and water and a brush. As an alternative, use detergent and water and a washing machine.

7.2.2 Complete and file Form RH-020A and retain for 3 years.

7.3 *DECONTAMINATION OF RESPIRATORS*

See the Respirator Maintenance, Inspection, Cleaning, and Storing Procedure HS-131.

7.4 *DECONTAMINATION OF EQUIPMENT AND MATERIALS*

7.4.1 Personal Effects, Small and/or Fragile Items

7.4.1.1 Contamination on personal effects (cell phones, wallets, etc) above background must be removed prior to leaving the restricted area.

7.4.1.2 Wipe item off thoroughly with a moist cloth. Removal of components such as battery covers may be necessary depending on the level of contamination.

7.4.1.3 Let the item dry before monitoring.

7.4.1.4 Monitor the level of contamination in accordance with the Alpha and Beta-Gamma Contamination Surveys Procedure RH-120.

7.4.1.5 If the contamination is still above background, cleaning with a dilute sulfuric acid solution may be possible if it does not damage the item. If contamination cannot be removed, the item must be disposed appropriately and may need to be managed as a radioactive waste.

7.4.1.6 Document monitoring results on Form RH-070A (Procedure RH-070).

7.4.1.7 File and retain Form RH-070A for 3 years.

7.4.2 Durable Equipment

7.4.2.1 Contamination on durable equipment above the release limits must be removed prior to leaving the restricted area or it may need to be managed as radioactive waste.

7.4.2.2 In accordance with Procedure RH-070, Table A1, the release limits for equipment for alpha or beta are:

- 15,000 dpm/100 cm^2 max;
- 5,000 dpm/100 cm^2 average; and
- 1,000 dpm/100 cm^2 removable.

7.4.2.3 Contamination of materials, equipment and surfaces that remain within the restricted area shall be maintained at less than 10^{-3} Ci/cm^2 (220,000 dpm/100 cm^2).

7.4.2.4 Begin by removing large deposits of ore, tailing, or yellowcake with a hand tools such as a shovel or wire brush. Use a respirator if dust is generated in the process.

7.4.2.5 Clean the item with a power washer or steam cleaner.

7.4.2.6 Monitor the level of contamination in accordance with Procedure RH-120.

7.4.2.7 If the contamination is still above release limits, clean with a grinder using a respirator and/or dilute sulfuric acid.

7.4.2.8 Let the equipment or materials dry before monitoring.

7.4.2.9 BEFORE PAINTING monitor the levels of contamination on equipment and materials. Do not paint over contamination that is above the release limits.

7.4.2.10 Document monitoring results on Form RH-070A (Procedure RH-070), RH-120A or the equivalent.

7.4.2.11 File and retain Form RH-070A, RH-120A or the equivalent for 3 years.

7.5 *DECONTAMINATION OF VEHICLES*

7.5.1 Contamination on vehicles (trucks and cars) above the release limits must be removed prior to leaving the restricted area.

7.5.2 In accordance with Procedure RH-070, Table A1, the release limits for equipment for alpha or beta are:

7.5.2.1 15,000 dpm/100 cm^2 max;

7.5.2.2 5,000 dpm/100 cm^2 average; and

7.5.2.3 1,000 dpm/100 cm^2 removable.

7.5.3 Vehicles are to be cleaned in the Truck Wash area by first removing large deposits of tailing, ore, or mud using high pressure sprays and/or hand tools (e.g. a shovel or wire brush). Use a respirator if dust is generated in the process.

7.5.4 Wash the vehicle in the Truck Wash.

7.5.5 Monitor in accordance with Procedure RH-070.

7.5.6 Repeat decontamination procedures as necessary to meet release limits.

7.5.7 Document monitoring results on Form RH-070A (Procedure RH-070).

7.5.8 File and retain Form RH-070A for 3 years.

Decontamination Procedure RH-020

Appendix A

Personnel Decontamination

Personnel Decontamination

Method	Surface	Action	Techniques	Advantages	Disadvantages
Soap and Water	Skin and Hands	Emulsifies and dissolves contaminant	Wash 2-3 minutes and monitor. Do not wash more than 3-4 times.	Readily available and effective for most radioactive contamination.	Continued washing will abrade the skin.
Soap and Water	Hair	Emulsifies and dissolves contaminant	Wash several times. If contamination is not lowered to acceptable levels, shave the head and apply skin decontamination methods.	Readily available and effective for most radioactive contamination.	Continued washing will abrade the scalp.
Lava soap, soft brush and water	Skin and Hands	Emulsifies and dissolves contaminant Use care	Use light pressure with heavy lather. Wash for 2 minutes, 3 times. Rinse and monitor. Do not scratch or erode skin. Apply lanolin or hand cream to prevent chapping.	Readily available and effective for most radioactive contamination.	Continued washing will abrade the skin.
Tide or other detergent	Skin and Hands	Emulsifies and dissolves contaminant Use care	Make into a paste. Use with additional water with a mild scrubbing action. Use care not to erode the skin.	Slightly more effective than washing with soap.	Will defat and abrade skin: must be used with care.

NOTE: Begin with the first listed method and then proceed step by step to the more severe methods, as necessary.

Decontamination Procedure RH-020

Appendix B

Personnel Contamination Form RH-020A

Personnel Contamination

Personnel Name: ____________________ Employee ID: ______________ Company and Phone # (if not EFR): ________________

Date: ____________

Alpha Instrument

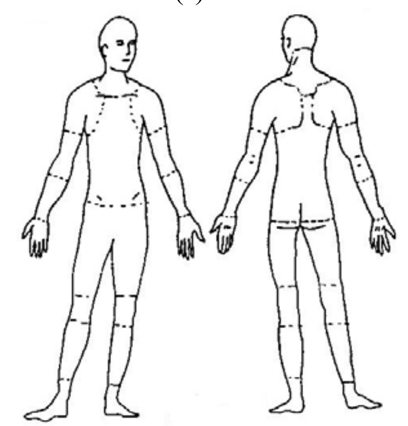
Type: ____________ Ser. No.: ____________ Source: ________ cpm Correction Factor: ________

Background: ________ cpm Instrument Action Level: __________ cpm

Beta-Gamma Instrument

Type: ____________ Ser. No.: ____________ Source: ________ cpm Correction Factor: ________

Background: ________ cpm Instrument Action Level: __________ cpm

Location of Contamination (see diagram)	Alpha Level (cpm)	Beta Level (cpm)	Was Supervisor Notified? (Y/N)	Was worker Decontaminated? (Y/N)	Resurvey Result (cpm α or β)	Mark location(s) of contamination
						

Alpha correction factor = $\frac{\text{(Source dpm)}}{\text{meter cpm}} \frac{(100\ cm^2)}{A\ cm^2} = \frac{(\_\_\_ dpm)}{\_\_\_\_ cpm} \frac{(100\ cm^2)}{\_\_\_\_ cm^2} =$

Beta correction factor = $\frac{\text{(Source dpm)}}{\text{meter cpm}} \frac{(100\ cm^2)}{A\ cm^2} = \frac{(\_\_\_ dpm)}{\_\_\_\_ cpm} \frac{(100\ cm^2)}{\_\_\_\_ cm^2} =$

Where "A cm^2" is, the open area of the probe and 100 cm^2 is the area specified in the license condition contamination limit.

Performed by ________________________________ Employee Number ________________

Signature ________________________________ Date ____________

Reviewed by ________________________________ Employee Number ________________

Signature ________________________________ Date ____________

Form RH-020A

1.0 PURPOSE

This procedure describes the posting of radiation warning signs to help maintain radiation exposure to levels that are As Low As Reasonably Achievable (ALARA) and caution signs for industrial safety.

2.0 APPLICABILITY

This procedure applies to all areas in and around the Mill.

3.0 OTHER DOCUMENTS

3.1 REFERENCES

3.1.1 Colorado Radiation Control Regulations (6 CCR 1007-1).

3.1.2 USNRC Regulatory Guide 8.30, Health Physics Surveys in Uranium Recovery Facilities.

3.1.3 Alpha and Beta-Gamma Contamination Surveys Procedure RH-120

3.1.4 Occupational General Air Particulate Survey Procedure RH-130

3.1.5 Radon-222 Decay Product Surveys Procedure RH-140

3.1.6 Occupational Breathing Zone Monitoring Procedure RH-150

4.0 EQUIPMENT AND MATERIALS

4.1 *MATERIALS*

4.1.1 “Caution Radioactive Material(s)” signs

4.1.2 “Caution Radiation Area” signs

4.1.3 “Caution Airborne Radioactivity Area” signs

4.1.4 “Any Area or Container on this Property May Contain Radioactive Materials” signs

4.1.5 “Respirator Use Required” signs

4.1.6 Industrial safety warning signs

5.0 RESPONSIBILITY

5.1 The Radiation Safety Officer (RSO) or Alternate RSO is responsible for:

5.1.1 Designating areas in and around the mill that require posting, and industrial safety posting.

5.1.2 Conducting periodic walk-arounds of the mill and reviews of survey data to ensure posting remains current and accurately describes radiological conditions and that required signage remains in good condition and has not been damaged or removed

5.2 The Radiation/Security Technician (RST) is responsible for posting the designated areas.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

6.0 PREREQUISITE INFORMATION

6.1 *DEFINITIONS*

6.1.1 Airborne Radioactivity Area – A room, enclosure, or area in which airborne radioactive materials, composed wholly or partly of licensed material, exist in concentrations:

6.1.1.1 In excess of the Derived Air Concentrations (DACs), or

6.1.1.2 To such a degree that an individual present in the area without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the Annual Limit on Intake (ALI) or 12 DAC-hours.

6.1.2 Radiation Area – An area accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 5 mrem in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

6.1.3 Radioactive Materials – An area or room in which there is used or stored an amount of licensed material exceeding 10 times the quantity of such material specified in Appendix C to 10 CFR Part 20, excerpted in the following table.

Radionuclide	Abbreviation	Quantity (µCi)
Lead-210	Pb-210	0.01
Radium-226	Ra-226	0.1
Thorium-230	Th-230	0.001
Uranium-natural		100
Cesium-137	Cs-137	10

6.2 *FREQUENCY*

6.2.1 Continuous posting of areas specified in Section 7.0

6.2.2 Radiation postings shall be reviewed during ALARA “walk-arounds” (refer to the ALARA Procedure AD-080) to ensure that appropriate areas are posted and that the postings are maintained in good condition. ALARA “walk-arounds” are scheduled at the discretion of the RSO on a weekly to monthly basis depending on the area and work being performed in that area.

7.0 PROCEDURES

7.1 *RADIATION SAFETY POSTING*

7.1.1 The RST or his designee is to conspicuously post the following signs:

7.1.1.1 Entrances to and fences around the property restricted area:

Any Area or Container on this Property May Contain Radioactive Material

7.1.1.2 Around areas in and around the mill that meet the definition of Radiation Areas:

Caution Radiation Area

7.1.1.3 Around areas in the mill that meet the definition of Airborne Radioactivity Area, including the yellowcake drying and packaging room (Reg. Guide 8.30, page 20):

Caution Airborne Radioactivity Area

7.1.1.4 Areas in the mill specified by the RSO or Alternate RSO:

Respirator Use Required

7.1.1.5 Areas in the restricted area containing licensed material (CDPHE 6 CCR 1007-1, Part 4, Section 4.28.5):

Caution Radioactive Material

7.1.2 The radiation safety posting areas shall be demarcated by:

7.1.2.1 Signs posted at the entrances to enclosed areas

7.1.2.2 Radiological boundary rope or tape around non-enclosed areas with signs posted at area entrances

7.2 *INDUSTRIAL SAFETY POSTING*

The RST or designee is to conspicuously post signs that may include:

7.2.1 Keep Out

7.2.2 Check in at the Administration Building

7.2.3 No Smoking in this Facility

7.2.4 Caution Flammable Material

7.2.5 Caution High Voltage

7.2.6 Eye Wash

7.2.7 Safety Shower

7.2.8 Hearing Protection Required

7.2.9 Tank names such as Ammonia Tank

7.2.10 Building names

1.0 PURPOSE

This procedure presents action levels and corrective actions in the radiation protection program at the Energy Fuels Piñon Ridge Mill.

2.0 APPLICABILITY

This procedure applies to all Mill personnel, contractors, and visitors who work with radioactive materials or are exposed to radiation in or around the Mill.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 NUREG-0874 Internal Dosimetry Model for Application to Bioassay at Uranium Mills, 1986.

3.1.2 NRC Regulatory Guide 8.22, Bioassay at Uranium Mills, 1988.

3.1.3 NRC Regulatory Guide 8.30, Health Physics Surveys at Uranium Recovery Facilities

3.1.4 Colorado Rules and Regulations Pertaining to Radiation Control (6 CCR 1007-1).

3.1.5 Respiratory Maintenance, Inspection, Cleaning and Storage Procedure HS-131

3.1.6 Medical Evaluation for Respirator Use Procedure HS-132

3.1.7 Posting Procedure RH-030

3.1.8 Uranium Bioassay Procedure RH-050

3.1.9 Release of Equipment to Unrestricted Areas Procedure RH-070

3.1.10 Alpha and Beta-Gamma Contamination Surveys Procedure RH-120

3.1.11 Occupational General Air Particulate Survey Procedure RH-130

3.1.12 Occupational Breathing Zone Monitoring Procedure RH-150

3.1.13 Source Leak Test, Shutter Test, and Inventory Procedure RH-160

3.1.14 Personnel Release Surveys Procedure RH-200

3.1.15 Radiation Dose Calculations Procedure RH-300

4.0 RESPONSIBILITY

4.1 The Radiation Safety Officer (RSO) or the Alternate RSO is responsible for:

4.1.1 Establishing and enforcing action levels.

4.1.2 Investigating action levels that have been met or exceeded.

4.1.3 Informing management and affected worker(s) that action levels have been exceeded and directing Radiation Safety Technicians to take corrective actions.

4.1.4 Initiating corrective actions as required.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

4.2 The Radiation/Security Technician (RST) is responsible for:

4.2.1 Identifying action levels that have been met or exceeded and reporting the situation to the RSO or Alternate RSO.

4.2.2 Implementing with the mill staff correction actions for action levels that have been met or exceeded.

5.0 PREREQUISITE INFORMATION

5.1 *FREQUENCY*

When an Action Level is met or exceeded, implement the corresponding Corrective Action as soon as practical or as specified in Section 6.0.

6.0 PROCEDURE

6.1 *GAMMA RADIATION SURVEYS (Procedure RH-110)*

Action Level	Corrective Action
100% increase over average of previous 3 readings	Investigate cause and maintain exposures to levels that Are As Low As Reasonably Achievable (ALARA).
≥5 mR/hr	Investigate source of exposure, post as a “Radiation Area” and restrict access if warranted (Procedure RH-030).

Note: It is not considered credible that external exposure rates at a uranium mill could approach those requiring posting as a “High Radiation Area” (≥ 100 mrem/hr). In the event of an unshielded, exposed SSD, the condition would not be permitted to be maintained requiring posting but would be corrected immediately.

6.2 *ALPHA AND BETA-GAMMA CONTAMINATION SURVEYS (Procedures RH-120 and RH-200)*

Action Level	Corrective Action
>Instrument background on personnel leaving the restricted area or other designated area	Contact RST and decontaminate to background before release.
≥1,000 dpm/100 cm^2 removable from surfaces and equipment in clean and unrestricted areas	Swipe to determine removable contamination level and decontaminate to below limit.
≥15,000 dpm/100 cm^2 total from surfaces and equipment in clean and unrestricted areas	Decontaminate to below limit and resurvey.
≥10^{-3} Ci/cm^2 (220,000 dpm/100 cm^2) from surfaces and equipment in restricted areas	Decontaminate to below limit and resurvey.

6.3 *GENERAL AIR SURVEY (Procedure RH-130)*

Action Level	Corrective Action
≥10% Derived Air Concentrations (DAC) ore dust or yellowcake	Investigate cause, determine if corrective measures are necessary, and sample as specified in Procedure RH-130 Table 1.Consider use of respiratory equipment. Exposures ≥ 10 % of DAC require calculation and assignment of DAC – hrs to employee(s).

6.4 *OCCUPATIONAL BREATHING ZONE MONITORING (Procedure RH-150)*

Action Level	Corrective Action
≥10% DAC ore dust or yellowcake	Investigate cause, determine if corrective measures are necessary, and sample as specified in Procedure RH-150 Table 1. Consider use of respiratory equipment. Exposures ≥ 10 % of DAC require calculation and assignment of DAC – hrs to employee(s).

6.5 *RADON DECAY PRODUCT SAMPLES (Procedure RH-140)*

Action Level	Corrective Action
≥10% DAC	Investigate cause and take weekly samples, check ventilation fans and ventilate if area is occupied. Consider use of respiratory equipment. Exposures ≥ 10 % of DAC require calculation and assignment of DAC – hrs to employee(s).
≥25% DAC	Investigate cause, limit access, take daily samples until 4 consecutive samples are less than 25% DAC, check ventilation fans and ventilate if area is occupied. Consider use of respiratory equipment. Exposures ≥ 10 % of DAC require calculation and assignment of DAC – hrs to employee(s).

6.6 *IN-VIVO LUNG SCANS (Procedure RH-050)*

Action Level	Corrective Actions
9 to 16 nCi uranium	1. Confirm results (repeat measurement within 6 months). Ensure that results are not caused by body surface activity. 2. Examine air sample data to determine source and concentrations of intake. If air sample results are anomalous, investigate air sampling procedures. Make corrections, if necessary. 3. Identify the cause of elevated activity and initiate additional uranium confinement control measures. 4. Determine whether other workers could have been exposed and perform special bioassay measurements for them. 5. Consider work assignment limitations that will permit the lung burden to be reduced through natural elimination; ensure that the lung burden does not exceed 16 nCi.
>16 nCi uranium	1. Within 90 days, take the actions listed above for 9 nCi. 2. Establish work restrictions for affected workers or increase uranium confinement control measures. (Normally, workers with a lung burden greater than 16 nCi are not allowed by their employer to resume work in airborne activity areas until the burden is reduced to less than 9 nCi. 3. Perform individual case studies (bioassays) for affected workers. 6. Continue operations only when it is virtually certain no additional workers will exceed 16 nCi.

6.7 *URINALYSIS (Procedure RH-050)*

Action Level	Corrective Actions
Exposure to ≥3E-11 µCi/ml soluble uranium for 40-hr work week	Implement uranium in urine bioassay program.
Exposure to ≥2E-12 µCi/ml ore dust or insoluble uranium for 1 calendar quarter	Implement uranium in urine bioassay program.
15 to 35 µg/l	1. Confirm results (repeat analysis). 2. Identify the cause of elevated urinary uranium and initiate control measures if the result is confirmed. 3. Examine air sample data to determine the source and concentration of intake. If air sample results are anomalous, investigate sampling procedures. Make corrections if necessary. 4. Determine whether other workers could have been exposed and perform bioassay measurements for them. 5. Consider work assignment limitations until the work's urinary uranium concentration falls below 15 µg/l. 6. Improve uranium confinement controls or respiratory protection programs as investigation indicates.
>35 µg/l	1. Take the actions given above. 2. Continue operations only if it is virtually certain that no other workers will exceed a urinary uranium concentration of 35 µg/l. 3. Establish work restrictions for affected employees or increase uranium confinement controls if ore dust or high-temperature dried yellowcake are involved. 4. Analyze bioassay samples weekly
Confirmed to be >35 µg/l for two consecutive specimens, confirmed to be >130 µg/l for any single specimen, or air sampling indication more than a quarterly limit of intake.	1. Take the actions give above. 2. Have urine specimen tested for albuminuria. 3. Obtain an in-vivo count if workers may have been exposed to Class Y material or ore dust. 4. Evaluate exposures. 5. Establish further uranium confinement controls or respiratory protection requirements as indicated. 6. Consider continued work restrictions on affected employees until urinary concentrations are below 15 µg/l and laboratory tests for albuminuria are negative.

6.8 *PERSONAL RADIATION MONITORING (Procedure RH-210)*

Level	Corrective Action
≥25% of the annual limit	Investigate and consider reassignment of employee.
100% of the annual limit	Report overexposure to CDPHE, investigate, and consider reassignment of employee.

6.9 *RELEASE OF EQUIPMENT AND MATERIALS TO UNRESTRICTED AREAS (Procedure RH-070)*

ACTION LEVEL FOR SURFACE CONTAMINATION				CORRECTIVE ACTIONS
NUCLIDE	AVERAGE	MAXIMUM	REMOVABLE	
Alpha contamination from U-nat, U-235, U-238, and associated decay products	5,000 dpm per 100 cm^2	15,000 dpm per 100 cm^2	1,000 dpm per 100 cm^2	Contact RST, decontaminate to below limit before release.
Gamma-Beta contamination from U-nat, U-235, U-238, and associated decay products	5,000 dpm per 100 cm^2	15,000 dpm per 100 cm^2	1,000 dpm per 100 cm^2	Contact RST, decontaminate to below limit before release.

6.10 *OTHER MONITORING*

ACTION LEVEL	CORRECTIVE ACTION
Physician's rejection of person for respirator use (Procedure HS-132).	Person not allowed to use respirator.
Spills	Clean up spill as soon as practical. Refer to Emergency Response Plan and Materials Containment Plan for further actions.
Leak test $\geq$ 0.005 μCi (Procedure RH-160)	Notify CDPHE, remove source from use, decontaminate.
Monitoring inside respirator (Procedure HS-131) > Background removable alpha ≥100 dpm/100 cm^2 fixed alpha ≥5,000 dpm/100 cm^2 beta-gamma	Before using, decontaminate to below limit. Conduct nasal/mouth swipes of affected employee. If these are ≥ background, institute ad hoc urinalysis
≥background on person leaving restricted area (Procedure RH-200)	Decontaminate to below limit prior to leaving restricted area.
Potential to receive ≥0.1 rem to female of reproductive age (Procedure RH-300) during gestation period.	Present prenatal radiation exposure instruction.
≥0.1 rem to declared pregnant female (Procedure RH-300).	Dose to embryo-fetus not to exceed 0.5 rem.

6.11 *CORRECTIVE ACTIONS*

6.11.1 When an Action Level is met or exceeded, implement the corresponding Corrective Action.

6.11.2 Document the corrective action as specified in the associated procedure.

6.12 *DOCUMENTATION*

Documentation of levels exceeding action levels shall be performed in accordance with the applicable survey or monitoring procedure.

1.0 PURPOSE:

This procedure describes how to monitor the intakes of uranium in the bodies of workers at the Mill to keep radiation doses to levels that are As Low As Reasonably Achievable (ALARA).

2.0 APPLICABILITY

This procedure applies to:

2.1 Workers (1) routinely exposed to airborne yellowcake or directly involved in maintenance tasks in which yellowcake dust may be produced or (2) routinely exposed to airborne uranium ore dust.

2.2 Workers potentially exposed to a time-weighted exposure of 40 DAC hrs of natural uranium in a 40-hour work week.

2.3 Workers potentially exposed to a time-weighted average exposure of 3E-11 μCi/mL of ore dust for one calendar quarter.

2.4 Workers who must wear a respirator to maintain uranium inhalation exposures below the limits listed above and/or whenever it is suspected that a respirator has leaked or malfunctioned.

2.5 Whenever facial contamination is detected on a worker.

2.6 Whenever required by the Radiation Safety Officer (RSO) or his designee.

3.0 OTHER DOCUMENTS:

3.1 *REFERENCES:*

3.1.1 American National Standard – Bioassay Programs for Uranium, HPS N13.22-1995

3.1.2 Nuclear Regulatory Commission Regulatory Guide 8.9, “Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program”

3.1.3 Nuclear Regulatory Commission Regulatory Guide 8.22,”Bioassay at Uranium Mills”

3.1.4 Nuclear Regulatory Commission NUREG – 0874, Internal Dosimetry Model for Applications of Bioassay at Uranium Mills

3.2 *APPENDICES:*

Appendix A – Uranium in Urine Report Form RH-050A

Appendix B – Bioassay Intake and Dose Estimates Form RH-050B

Appendix C – Table 1 Corrective Actions Based on Monthly Urinary Uranium Results

Appendix D – Table 2 Corrective Actions Based on In vivo Results

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

4.0 EQUIPMENT AND MATERIALS

4.1 *MATERIALS*

4.1.1 Urine collection bottles

5.0 RESPONSIBILITY

5.1 The RSO is responsible for both the urinalysis and in-vivo counting bioassay programs, and for the calculation of intakes and radiation doses.

5.2 A Radiation/Security Technician (RST) is responsible for the collection of urine samples and the submission of the samples to the laboratory for analysis.

5.3 The individual radiation worker participating in the bioassay program is responsible for the submission of urine samples and participation in the in-vivo counting when requested.

6.0 PREREQUISITE INFORMATION

6.1 *FREQUENCY*

6.1.1 Urinalysis will be conducted weekly/monthly/quarterly, depending on worker exposures, product specific characteristics and other considerations at the discretion if the RSO.

6.1.2 In-vivo lung (thorax) counts will be conducted based on results and exceedence of action levels in urinalysis program.

7.0 PROCEDURES

7.1 *URINALYSES*

7.1.1 Baseline uranium urinalyses are to be conducted on each worker in the urinalysis program prior to their initial work assignments and upon termination of employment.

7.1.2 Weekly uranium in urine bioassay samples are to be collected from workers where potential exposures exceed a time weighted average exposure of 5 E-10 μCi/mL of soluble uranium for 40 hours. A week is seven consecutive workdays or less. If the processing facility is operating on a 10-and-4 schedule, i.e., 10 days at work and 4 days off work, then the week is defined as 10 work days.

7.1.3 Monthly uranium in urine bioassays are to be performed on workers where exposures could exceed a time weighted average exposure of 2E-11 μCi/mL (total alpha) of insoluble uranium or uranium ore dust for one calendar quarter.

7.1.4 In addition to the above schedule, bioassays are to be performed on respirator users when the effectiveness of the respirator needs to be verified or when respirator failure or other problems that may have compromised the effectiveness of respirator are suspected.

7.1.5 All uranium in urine bioassay samples are to be collected at least 36 hours after the most recent potential exposure in the processing facility.

7.1.6 On the morning urine samples are to be submitted, each participant in the urinalysis program is to proceed to the change house to give the sample before changing into their work clothes. PARTICIPANTS MUST WASH THEIR HANDS BEFORE SUBMITTING THE SAMPLE. Provide at least a 30 mL sample in the sample bottle with a label printed with the participant's name. Write the time and date of sampling, the last time and date worked, and their initials on the label to verify that the sample was submitted as required. Immediately return the sample to the RST, who is to check that the label contains the required information.

7.1.7 The RST is to deliver the urine samples to the on-site laboratory with a chain of custody form (provided by the off-site laboratory).

7.1.8 The on-site laboratory will complete the required preservation, packing and chain of custody procedures and ship the sample to an off-site laboratory for analysis in accordance with the on-site and off-site laboratories' sample preparation procedures.

7.1.9 The RST and the Mill foremen are to coordinate to ensure the completion of the urine sampling as scheduled.

7.1.10 The measurement sensitivity for urine-analyses should be 5 μg of uranium per liter of urine or less.

7.1.11 Implement the corrective actions specified in Table 1 of the NRC Regulatory Guide 8.22 in response to the amount of uranium detected in the urine. That table is attached to this procedure in Form RH-050B.

7.1.12 Urinalysis results are to be available to the RSO or his designee within 7 days after sample collection. If an analysis exceeds 10 μg/L, the RSO is to be notified as soon as possible.

7.1.13 All laboratory analyses are to be performed in a laboratory that is essentially free of uranium contamination using contamination free equipment.

7.1.14 Each batch of specimens sent to the laboratory for analyses are to be accompanied by at least two control urine samples. Those control samples are to be taken from individuals who are not and have not been occupationally exposed to uranium; otherwise simulated controls known to contain uranium concentrations less than 1 μg/L may be used. Aliquots of each of these control urine samples should be taken; one should be a "blank," one should be spiked with uranium to obtain a concentration of 10-20 μg/L, and one should be spiked to 40-60 μg/L; the actual spike concentration being recorded confidentially and not available to the laboratory technicians. When results are received, the RSO or his designee should ensure that each reading is corrected for the reading of the corresponding blank, that the average of the percent deviation of the spiked sample net reported values from the "true" amount of spiked uranium sample is calculated. The percent deviation from the spiked samples accompanying each batch of urine samples should be within 30% of the spiked values. Likewise, the percentage deviation of the blank sample from the normal background count of the blank samples should be within 30% of the blank sample. If the spike or blank sample is not within the 30%, the most recent batch of affected samples will be rerun. Steps should be taken to correct the procedures for spiking, the procedures for laboratory analyses, procedures for contamination control, or a combination of those procedures. The laboratory is to duplicate the analyses of 10-20% of the samples received, including the blanks and spikes. The results of the laboratory blanks and standard samples are to be available to the RSO or his designee.

7.1.15 Record the results of the urinalyses for all analyses greater than 10 µg/L on Form RH-050A or the equivalent. The form is to be routed to the personnel designated on the form within 4 days. Corrective actions and responses are to be specified on the form. Complete all portions of the form.

7.2 ***IN-VIVO LUNG (THORAX)***

7.2.1 When urinalysis results are confirmed to be greater than 35 µg/L for two consecutive specimens, or are confirmed to be greater than 130 µg/L for any single specimen, or air sampling indicates more than a quarterly limit of intake to relatively insoluble uranium, perform in-vivo counting a quickly as possible to determine if corrective actions are required.

7.2.2 When in-vivo measurements are to be conducted, they should be performed as quickly as possible, but no later than 3 months after such indications.

7.2.3 The lung counting procedure is to be capable of detecting 9 nCi or less of uranium.

7.2.4 Implement the corrective actions specified in Table 2 of the NRC Regulatory Guide 8.22 (see Appendix D) in response to the amount of uranium detected in the lungs of workers.

7.3 ***DECISION ANALYSIS FOR URINALYSES***

7.3.1 When an individual urine bioassay result indicates a potential uranium concentration greater than 15 µg per liter, the RSO is to initiate an investigation. The investigation will consist of the following steps:

7.3.1.1 Immediate resample providing additional exposures have not occurred

7.3.1.2 Interview with the employee

7.3.1.3 Review the air sampling data for the period covered by the urine sample

7.3.1.4 Review of the employee's work record to determine if and when the assumed intake might have occurred.

7.3.2 Elevated urine bioassay uranium concentrations can result from several conditions:

7.3.2.1 Inhalation intake of uranium in airborne particulate matter

7.3.2.2 Ingestion intake of uranium

7.3.2.3 Contamination of sample during collection

7.3.2.4 Laboratory error

7.3.3 If the investigation indicates that the elevated urine bioassay measurement may represent a confirmed intake, the RSO is to calculate the potential intake of uranium by the worker according to the attached Form RH-050B or the equivalent.

7.3.4 If the analysis indicates that the intake is less than 10 mg of soluble uranium, a report is placed in the file.

7.3.5 If the calculated intake is greater than 10 mg of soluble uranium, CDPHE IS TO BE NOTIFIED of the noncompliance with the 10 mg/week limit for soluble uranium as specified in the Colorado Department of Public Health and Environment Radiation Control Division regulations (6 CCR 1007-1 4.6.5).

Uranium Bioassay Procedure RH-050

Appendix A

Uranium in Urine Report Form RH-050A

Uranium In Urine Report Form RH-050A

Analytical results of >10 µg/l u must be reported on this form immediately*

SAMPLE SUB. FORM NO.	EMPLOYEE NAME	EMPLOYEE NUMBER	ORIGINAL RESULT	RERUN RESULT	SAMPLE DATE
			µg/L U	µg/L U	

ACKNOWLEDGEMENT OF SAMPLE ANALYSIS (initial and date) [all <4 days**]

Mill Manager (1 day**)	RSO (1 day**)	General Foreman (1 day**)	RST	Other

SAMPLE INFORMATION

Was sample taken more than 36 hours after last work on site?	Original: [ ] yes [ ] no	Follow-up:[ ] yes [ ] no
Previous sampling: [< 2 weeks**] sample date:	analytical date:	result: µg/L
Follow-up sampling: [< 2 weeks**] sample date:	analytical date:	result: µg/L
Was employee notified? [< 5 days**] [ ] yes [ ] no	Date:	By (initials):
Where did employee work? [< 5 days**] (circle suspect areas)		
Was respiratory protection used? [ ] yes [ ] no	Type:	Duration:
Other information:		

<u>RESPONSES AND ACTIONS PLANNED OR TAKEN (***)</u> (continue on back if necessary)

		[ ] continued on back
Final determination on potential exposure: [<21 days**]	[ ] exposure confirmed	[ ] contaminated sample
Justification for final determination:		
Final recommendations:		

ACKNOWLEDGEMENT OF FINAL DETERMINATION AND RECOMMENDATIONS (initial and date) [<30 days**]

Employee	Mill Manager	RSO	Gen. Foreman	RST	Other

Completed form added to employee's permanent file? [<45 days**] [ ] yes [ ] no

*Notes: * - Analyst must fill in sample data and results, initial, date and give the form to the Lab Manager.*
*** - target time to complete item following analysis of original sample.*
**** - see back of form for corrective action requirements.*

Uranium Bioassay Procedure RH-050

Appendix B

Bioassay Intake and Dose Estimates Form RH-050B

Bioassay Intake and Dose Estimates

The following procedure will be used to estimate the potential dose to a worker based on a urine bioassay concentration greater than 10 µg/L.

Employee Number________________

Table 1: Concentration of uranium in urine

Sample No.	Uranium concentration in urine (µg/L)	Sample Date	Days since previous sample less than 15 µg/L	Solubility class
1				
2				
3				
4				
5				

Table 2: **Uranium excretion functions -** fraction of intake by inhalation excreted in 24 hours (from *Bioassay Programs for Uranium*. HPS N13.22-1995)

Days since exposure	Retention Function (Class D)	Retention Function (Class W)	Retention Function (Class Y)
1	1.87E-01	4.13E-02	2.23E-03
2	7.27E-02	1.09E-02	5.49E-04
3	3.21E-02	4.72E-03	2.30E-04
4	1.82E-02	3.22E-03	1.57E-04
5	1.31E-02	2.69E-03	1.31E-04
6	1.09E-02	2.40E-03	1.17E-04
7	9.64E-03	2.19E-03	1.07E-04
8	8.71E-03	2.02E-03	9.81E-05
9	7.94E-03	1.88E-03	9.07E-05
10	7.26E-03	1.75E-03	8.42E-05
11	6.86E-03*	1.68E-03	8.04E-05
12	6.46E-03	1.61E-03	7.67E-05
13	6.06E-03	1.54E-03	7.30E-05
14	5.66E-03	1.47E-03	6.93E-05
15	5.26E-03	1.39E-03	6.56E-05
16	4.86E-03	1.32E-03	6.19E-05
17	4.46E-03	1.25E-03	5.82E-05
18	4.06E-03	1.18E-03	5.45E-05
19	3.66E-03	1.11E-03	5.07E-05
20	3.26E-03	1.03E-03	4.69E-05

*Excretion fractions for 11 to 20 days post intake are interpolated values.

Estimated intake = [U conc. in urine in µg/L][1.4 L/d][0.68 pCi/µg]/[F (d)]

Where F(d) = fraction of the initial intake excreted in urine per day at d days after an acute intake.

Uranium Bioassay Procedure RH-050

Appendix C

Table 1 Corrective Actions Based on Monthly Urinary Uranium Results

Table 1
Corrective Actions Based on Monthly Urinary Uranium Results [a]

Urinary Uranium Concentration	Interpretation	Actions
Less than 15 µg/L	Uranium confinement sampling programs are indicated to be adequate.[b]	None - Continue to review further bioassay results.
15 to 35 µg/L	Uranium confinement and air sampling may not provide an adequate margin of safety.[b]	1. Confirm results (repeat urinalysis). 2. Identify the cause of elevated urinary uranium and initiate additional control measure if the result is confirmed. 3. Examine air sampling data to determine the source and concentration of intake. If air sampling results are anomalous, investigate sampling procedures. Make corrections if necessary. 4. Determine whether other workers could have been exposed and perform bioassay measurements for them. 5. Consider work assignment limitations until the worker's urinary uranium concentration falls below 15 µg/L. 6. Improve uranium confinement controls or respiratory protection program as investigation indicates.
Greater than 35 µg/L	Uranium confinement and perhaps air sampling programs are not acceptable.[c]	1. Take the actions given above. 2. Continue operations only if it is virtually certain that no other worker will exceed a urinary uranium concentration of 35 µg/L. 3. Establish work restrictions for affected employees or increase uranium confinement controls if ore dust or high-temperature dried yellowcake are involved. 4. Analyze bioassay samples weekly.
Confirmed to be greater than 35 µg/L for two consecutive specimens, confirmed to be Greater than 130 µg/L for any single specimen, or air sampling indication of more than a quarterly Limit on Intake.	Worker may have exceeded regulatory limit on intake.	1. Take the actions given above. 2. Have urine specimen tested for albuminuria. 3. Obtain an in vivo count if worker may have been exposed to Class Y material or ore dust. 4. Evaluate exposures. 5. Establish further uranium confinement controls or respiratory protection requirements as indicated. 6. Consider continued work restrictions on affected Employees until urinary concentrations are below 15 µg/L and laboratory test for albuminuria are negative.

[a] Use Figures 1-3 to adjust action levels for other frequencies of bioassay sampling. The model used in NUREG-0874 (Ref.1) employs fractional composition values (F1, F_2, F_3) for Class D, Class W, and Class Y components of yellowcake compounds. The assigned values in NUREG-0874 are based on data from available literature. The use of alternative values of F1, F_2, F_3 specific for a particular operation are acceptable provided (1) details regarding their determination are described and mentioned in employee exposure records (use paragraph 20.401(e) (1) of 10 CFR Part 20) and (2) the model as published in NUREG-0874 is then used in the determination of alternative urinalysis frequencies and action levels.

[b] However, if a person is exposed to uranium ore dust or other material of Class W or Y alone, refer to Section 6 of NURGEG-0474 about the possibility of the need for conducting in vivo lung counts on selected personnel or about using alternative urine sampling times and associated action levels computed using NUREG-0874.

[c] Unless the result was anticipated and caused by conditions already corrected.

Uranium Bioassay Procedure RH-050

Appendix D

Table 2 Corrective Actions Based on In-Vivo Results

Table 2
Corrective Actions Based on In-Vivo Results [a]

Amount of Uranium Detected	Interpretation	Actions
Below 9 nCi (330 Bq)	May be below detection limit. This result does not necessarily indicate that uranium confinement and air sampling programs are validated.	Rely on urinalysis results to determine corrective actions (unless air sampling indicates quarterly intake limits are exceeded for ore dust).
9 to 16 nCi (330 to 590 Bq)	Confinement and air sampling programs should be examined.[b] Uranium activity in lungs could be too high.	1. Confirm result (repeat measurement within 6 months). Ensure that results are not caused by body surface activity. 2. Examine air sampling data to determine source and concentrations of intake. If air sampling results are anomalous, investigate air sampling procedures. Make corrections, if necessary. 3. Identify the cause of elevated activity and initiate additional uranium confinement control measures. 4. Determine whether other workers could have been exposed and perform special bioassay measurements for them. 5. Consider work assignment limitations that will permit the lung burden to be reduced through natural elimination; ensure that the lung burden does not exceed 16 nCi (590 Bq).
More than 16 nCi (590 Bq)	Uranium confinement and air sampling probably are not acceptable.[b] Uranium activity in the lungs should be reduced by increased protection measures for the workers involved.	1. Within 90 days, take the actions listed above for 9 to 16 nCi (330 to 590 Bq). 2. Establish work restrictions for workers or increased uranium confinement control measures. (Normally workers with a lung burden greater than 16 nCi (590Bq) are not allowed by their employee to resume work in airborne activity areas until the burden is reduced to less than 9 nCi (330Bq). 3. Perform individual case studies (bioassays) for affected workers. 4. Continue operations only when it is virtually certain no additional workers will exceed16 nCi (590 Bq).

[a] The model used in NUREG-0874 (Ref.1) employs fractional composition values (F1, F_2, F_3) for Class D, Class W, and Class Y components of yellowcake compounds. The assigned values in NUREG-0874 are based on data from available literature. The use of alternative values of F1, F_2, F_3 specific for a particular operation are acceptable provided (1) details regarding their determination are described and mentioned in employee exposure records (use paragraph 20.401(e) (1) of 10 CFR Part 20) and (2) the model as published in NUREG-0874 is then used in the determination of alternative urinalysis frequencies and action levels.

[b] Unless the result was anticipated and caused by conditions already corrected.

1.0 PURPOSE

This procedure describes the issuance and use of Radiation Work Permits (RWPs) to maintain worker radiation doses to levels that are As Low As Reasonably Achievable (ALARA).

2.0 APPLICABILITY

An RWP is required for any work with radioactive materials, which has not been described in a written operating or maintenance procedure, for work that is performed under conditions that deviate from assumptions in existing procedures, and for work that may involve exposure above action levels. The Job Safety Analysis Procedure AD-100 should be utilized as a prerequisite to issuance of an RWP. RWPs may include:

2.1 Work on equipment (pumps, piping etc) in the near vicinity of any unshielded (shutter open) nuclear source.

2.2 Work on the all bag houses or pollution control equipment, which may contain radioactive material.

2.3 Work involving processing equipment, e.g. work in a tank containing or suspected to contain concentrated uranium (yellowcake or pregnant solution) in a dry form or in such a form that contamination by ingestion or inhalation of radioactive materials could occur.

2.4 Work where the potential for airborne radioactivity exists, such as welding, grinding, or similar activities.

2.5 Work in Radiation Areas, Airborne Radioactivity Areas, and similar higher risk areas, which present unique radiological conditions.

2.6 Any work which, at the discretion of the Radiation Safety Officer (RSO) or the Alternate RSO, is not adequately controlled by existing procedures and/or may involve elevated levels of radiological risk.

3.0 OTHER DOCUMENTS

3.1 REFERENCES

3.1.1 Colorado Radiation Control Regulation, Part 4, Standards for Protection Against Radiation (6 CCR 1007-1).

3.1.2 Job Safety Analysis Procedure (Procedure No. AD-100).

3.2 APPENDICES

Appendix A – Radiation Work Permit Form RWP-1

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

4.0 RESPONSIBILITY

4.1 The Maintenance or Mill Foreman is responsible for:

4.1.1 Initiating the RWP by completing, signing and dating the “Work Description” area of Form RWP-1 and presenting it to the RSO, Alternate RSO or Radiation/Safety Technician (RST) for approval.

4.1.2 DAY SHIFT - Review and issuance of an RWP will first be by the RSO, Alternate RSO, or RST.

4.1.3 WEEKEND, SWING or GRAVEYARD SHIFTS - Review and issuance of RWP will be by the RST on shift. If there is no RST on shift, the RSO, Alternate RSO, or RST will be contacted at home or by cell phone. The RSO, Alternate RSO or RST will return to the Mill if necessary, to review and issue the RWP or may direct the Maintenance or Mill Foreman to issue the RWP. The RSO, Alternate RSO and/or the RST should be available during these hours. Home phone numbers and cell phone numbers are posted at the Mill Safety Office. The cell phone number for the Safety Department is posted throughout the Mill area. The RSO, Alternate RSO or the RST should be contacted as far as possible in advance in order to ensure adequate review of the work task prior to commencement of work.

4.1.4 Conferring with RSO, Alternate RSO and/or the RST to determine the need for a pre-planning conference and the degree of involvement in the conference by personnel involved in or affected by performing the RWP.

4.1.5 Obtaining written approval on the RWP by the RSO, Alternate RSO or RST prior to commencement of work. NOTE: If appropriate, verbal approval can be granted by the RSO, Alternate RSO or RST during off-duty hours. However, the on-duty Mill Foreman must sign the completed RWP form. The Maintenance or Mill Foreman should acknowledge verbal approval as a note on the RWP form.

4.1.6 Retaining one copy of the current RWP. The RSO, Alternate RSO or RST will retain remaining copies.

4.1.7 Ensuring all personnel involved in the work have read and understand the RWP prior to commencement of work. Workers document their understanding of the RWP requirements by signing a training sheet for the work to be performed. The RWP will be reviewed, re-evaluated if necessary, and resigned when radiological conditions, radiological controls, or work activities change during the job.

4.1.8 Posting the current RWP at the maintenance or work location at the entrance of the RWP restricted zone.

4.1.9 Insuring that the RWP zone is clearly posted to prevent inadvertent entry to the affected RWP area.

4.1.10 Insuring that all requirements of the RWP are met by employees or contractors performing the work or in the immediate vicinity of the affected area.

4.1.11 Completing the post task information required on the “Work Description” section of his copy of the RWP after completion of the work.

4.1.12 Notifying the RSO, Alternate RSO or the RST of the completion of work under the RWP.

4.1.13 Returning the completed RWP used at the work location to the Radiation Safety Department.

4.1.14 Insuring appropriate notification of oncoming personnel at shift change of the RWP requirements for RWP operations still in progress at the time.

4.1.15 Authorizing the RWP with his signature, only during the RSO, Alternate RSO’s or RST’s absence during their off duty hours. This is done after verbal communication and approval from the RSO, Alternate RSO or RST.

4.2 The RSO, Alternate RSO, or RST is responsible for:

4.2.1 Receiving the request for the RWP and review the work description section obtaining any additional information from the Maintenance or Mill Foreman to evaluate the work task.

4.2.2 Completing the “Radiation Safety Evaluation and Requirements” section.

4.2.3 Conferring with the Maintenance or Mill Foreman and make a determination of the need for a pre-planning conference and the degree of involvement in the conference by personnel performing the work under the RWP and others affected by it.

4.2.4 Granting permission by signing the RWP to proceed with the work.

NOTE: If appropriate, verbal approval can be granted by the RSO, Alternate RSO or RST during off-duty hours. Verbal approval will be given to the Maintenance or Mill Foreman.

4.2.5 Distributing copies of the RWP as follows: one copy to the Maintenance or Mill Foreman; and one copy for the RSO, Alternate RSO or RST.

4.2.6 Determining if collection of bioassay samples or special showering and personnel monitoring is necessary for employees or contractors in tasks requiring an RWP.

4.2.7 Noting appropriate information concerning the operation in the “Task Evaluation and Results” section of the RWP after completion of work under the RWP.

4.2.8 Conducting, as necessary, a final inspection of the work area affected by the RWP to insure the integrity of the system has been maintained, this will be noted in the “Task Evaluation and Results” section as a follow-up inspection.

4.2.9 Reviewing all survey results, monitoring results, sample results, comments and/or deficiencies involving the RWP.

4.2.10 Sign and date the final evaluation section of the RWP after all necessary information and results have been received.

4.3 Employees and Contractors are responsible for:

4.3.1 Reading, asking questions, and understanding the tasks and stipulations of the RWP.

4.3.2 Initialing next to their names that they understand all aspects of work to be conducted under the RWP.

5.0 PREREQUISITE INFORMATION

5.1 *SAFETY*

Safety concerns are addressed in the individual RWPs.

5.2 *FREQUENCY*

Whenever work with radioactive materials is required that has not been addressed in written operating and maintenance procedures.

6.0 PROCEDURE

6.1 The Maintenance or Mill Foreman, initiating a work order, work plan or any other requestor requiring an RWP as described above will complete, sign and date the "Work Description" section of the RWP form and submit it to the RSO, Alternate RSO or the RST for approval.

6.2 Upon receipt of the RWP request, the RSO, Alternate RSO or the RST will review the work description section and obtain any additional information necessary to evaluate the work task. The evaluation will include the need for respiratory protection, bioassay sampling, personal protective equipment, and work restrictions to maintain radiation exposures to levels that are ALARA. After evaluation, the RSO, Alternate RSO or RST will complete the "Radiation Safety Evaluation and Requirements" section of Form RWP-1 and will review the requirements with the Maintenance or Mill Foreman. Following this review, the Maintenance or Mill Foreman will sign and date this section of the RWP form indicating his responsibility to insure compliance with the RWP requirements. The RSO, Alternate RSO or RST will make a determination of the need for a pre-planning conference and the degree of involvement in the conference by personnel performing the RWP. In all cases, written approval by the RSO, Alternate RSO or RST must be obtained prior to commencement of the work task. All involved personnel shall acknowledge that they have read and understood the requirements of the RWP by signing the training form prior to commencement of the work task.

NOTE: If appropriate, verbal approval can be granted by the RSO, Alternate RSO or RST during off-duty hours. However, the Maintenance or Mill Foreman must sign Form RWP-1 for the RSO, Alternate RSO or RST in the case of verbal approval and note that verbal approval was obtained from the RSO, Alternate RSO, or RST.

Copies of the RWP form will be distributed in the following manner:

- 1 copy for the Maintenance or Mill Foreman
- 1 copy for the RSO, Alternate RSO or RST

6.3 If it is determined that collection of bioassay samples or special showering and personnel monitoring is necessary for employees involved in an operation requiring an RWP, the employee/contractor will be notified.

6.4 If immediate review and issuance of a RWP is necessary for activities during weekend, swing or graveyard shifts, the RST on shift will be contacted. If there is no RST on shift, the RSO, Alternate RSO or the RST will be contacted at home or by the cell phone number and will return to the Mill, if necessary, to review and issue an RWP, or they may direct the Maintenance or Mill Foreman to issue the RWP. In all cases, only the RSO, Alternate RSO or the RST can approve commencement of work to be done on an RWP.

6.4.1 The RSO, Alternate RSO or the RST should be available during these hours. Their home phone numbers are posted at the Mill Safety Office. In addition, the cell phone for the Safety Department is posted through out the Mill area.

6.4.2 The RSO, Alternate RSO or the RST shall be contacted as far in advance as possible in order to insure adequate review of the work task prior to commencement of work.

6.5 The Safety Department must be notified at the completion of any RWP. Foremen will be responsible for notifying their relief on the status of the RWP prior to shift changes and for insuring appropriate notification of oncoming personnel at shift change of the RWP requirements for RWP operations still in progress at that time.

6.6 A copy of the current RWP will be posted at the entrance of the work area requiring a RWP. The Mill Foreman will be responsible for assuring that all requirements of the RWP are met by employees performing the operation or in the immediate vicinity of the affected area. The RWP area will be clearly posted to preclude inadvertent entry and will be described on the RWP form.

6.7 Contractors or individuals performing work tasks who are not employed by Energy Fuels will not be exempt from RWP requirements. It will be the responsibility of Energy Fuels personnel authorizing work performed by contractors to determine whether an RWP is necessary by contacting the RSO, Alternate RSO or RST.

6.8 The RSO, Alternate RSO or RST will be responsible for noting appropriate information concerning the operation in the "Task Evaluation and Results" section of the RWP. The Maintenance or Mill Foreman will complete the post task information required in the "Work Description" section of his copy of the RWP. All copies of the RWP will be returned to the Safety Department.

6.9 The RSO, Alternate RSO or RST will conduct, as necessary, an inspection of the work area following completion of the task to insure that the integrity of the system has been maintained. The results of this inspection will be noted in the "Task Evaluation and Results" section of Form RWP-1 as a follow-up inspection.

6.10 The RSO, Alternate RSO or RST will review all survey results, monitoring results, sample results, comments and/or deficiencies involving the RWP. When all necessary information and results have been received, the RSO, Alternate RSO or RST will sign and date the final evaluation section of the RWP form.

Radiation Work Permits Procedure RH-060

Appendix A

Radiation Work Permit Form RWP-1

Radiation Work Permit

Work Description:

Date of Request:	Rad. Safety Rep. Contacted:
Date of Operation:	Requesting Maint or Opr. Supr.:
Anticipated Time Required:	Actual Time Required:
Description of Work Task and Process Equipment Involved:	
Description of known and/or anticipated radiological conditions (e.g., airborne and contamination levels, exposure rates, postings, etc.):	

Employees Performing Work Task or in Affected Area (List)				Anticipated Tools Needed (List)	Actual Tools Used (List)
Name	Job Category	Performing Work Task	In Affected Area		
		( )	( )		
		( )	( )		
		( )	( )		
		( )	( )		
		( )	( )		
Supervisor (sign):				Date:	
Employees Performing Work (sign) ______________ ______________					
______________ ______________ ______________					
Task Training Provided:					
Comments:					

Radiation Safety Evaluation and Requirements:

Personnel Safety Requirements:

Head: Cloth Hat ( ) Hard Hat ( ) Safety Glasses ( ) Safety Goggles ( )

Body: Work Clothes ( ) Paper Suit ( ) Washable Coveralls ( )

Hands: Cloth Gloves ( ) Surgical Gloves ( ) Heavy Rubber Gloves ( )

Feet: Work Shoes ( ) Shoe Covers ( ) Cloth Boots ( ) Rubber Boots ( )

Respiratory: None ( ) Half Mask ( ) Full Mask ( ) Full Mask w/air ( )

Radiation Safety Representation: At Start ( ) Intermittent ( ) Continuous ( )
Cleanup: At Task Completion ( ) Continuous ( ) Washdown ( ) Vacuums ( ) Other:
Special Disposal Requirements (Specify):
Monitoring Requirements:

	Survey			Air			Dosimeter			Bioassay
	Alpha	Beta	Gamma	Gen	B.Z.	O.C.C.	TLD/ OSL	Pocket	Other (Specify)	
Pre										
During										
Post										

Other Requirements or Comments:	
Radiation Safety Representative Signature:	Date:
Maintenance or Operations Supervisor Signature:	Date:

Task Evaluation and Results:

Deviations from above work description or Radiation Safety Requirements (List and give reason for deviation):
Survey and Monitoring Results (List):
Follow-up Inspections, Surveys or Monitoring Results (List):
Special Disposal Method and Location (When Required):
Operation Deficiencies, Recommendations and General Comments:
Final Evaluation Date:
Radiation Safety Representative Signature:

1.0 PURPOSE

This contamination control procedure describes how to survey equipment and materials before they are released from the restricted area of the Mill for unrestricted use. The purpose of the survey is to assure that contaminated equipment and materials are not released with contamination above the regulatory guidance.

2.0 APPLICABILITY

This procedure applies to all equipment and materials that leave the restricted area of the facility.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Radioactive Materials License

3.1.2 NUREG 1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions"

3.1.3 Draft NUREG 1761, "Radiological Surveys for Controlling Release of Solid Materials," July 2002, pages 31-32, 49

3.1.4 Regulatory Guide 8.30, "Health Physics Surveys in Uranium Mills."

3.1.5 Colorado Radiation Control Regulations, Parts 3 and 4 (6 CCR 1007-1).

3.2 *APPENDICES*

Appendix A – Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use (NRC, 1987)

Appendix B – Equipment and Materials Survey Form RH-070A or its equivalent

4.0 RESPONSIBILITY:

4.1 The Radiation Safety Officer (RSO) or the Alternate RSO is responsible for:

4.1.1 Reviewing the forms for accuracy and completeness and to evaluate if any patterns of contamination may be developing over time.

4.1.2 Approving the release of material from the restricted area of the Mill.

4.2 The Radiation/Security Technician (RST) or his designee is responsible for:

4.2.1 Conducting the alpha and beta-gamma surveys of equipment and materials.

4.2.2 Converting raw contamination levels to dpm/100 cm^2 and determining the instrumentation MDAs and efficiencies.

4.2.3 Filing form RH-070A or its equivalent and retaining.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

4.3 The Quality Assurance Officer or designee is responsible for:

4.3.1 Assuring that personnel considered as key individuals relevant to this procedure are documented as properly trained and/or qualified to perform the required duties.

4.3.2 Assuring that the quality principles of this procedure are followed and maintained.

5.0 PREREQUISITE INFORMATION

5.1 *DEFINITIONS*

5.1.1 Surface Contamination – Radionuclide contamination on the surface of equipment or materials.

5.1.2 Class 1 Solid Materials **–** Equipment or materials that have known contamination or the potential for contamination above the release criteria based on process knowledge, usage location, previous surveys, and that have been in direct contact with radioactive materials.

5.1.3 Class 2 Solid Materials – Equipment or materials that have the potential for contamination and may have come in contact with radioactive materials but are not expected to be above the release criteria.

5.1.4 Class 3 Solid Materials – Equipment or materials that are not expected to be contaminated, or are contaminated at only a small fraction of the release criteria.

5.1.5 Secular Equilibrium – Equal activity of each of the decay products in a decay series such as natural uranium series.

5.2 *FREQUENCY*

Prior to the release of potentially contaminated equipment or materials from the restricted area of the Mill, conduct alpha and beta contamination surveys.

6.0 PROCEDURES

6.1 *LOCATION OF RADIOACTIVE MATERIAL*

Equipment and materials to be surveyed for potential release are to meet the following criteria:

6.1.1 Equipment and material shall have been washed with a detergent wash or the equivalent as necessary to remove contamination.

6.1.2 Radioactivity on equipment or surfaces shall not be covered by paint, plating, or other covering material unless contamination levels, as determined by a survey and documented, are below the limits specified in Appendix A, Table A1 prior to applying the covering. A reasonable effort must be made to minimize the contamination prior to use of any covering.

6.1.3 The radioactivity on the interior surfaces of pipes, drain lines, or ductwork shall be determined by making measurements at all traps, and other appropriate access points, provided that contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork.

6.1.4 Surfaces of premises, equipment, or scrap which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement shall be presumed to be contaminated in excess of the limits.

6.2 ***CLASSIFICATION OF EQUIPMENT AND MATERIALS***

6.2.1 Equipment, materials, items or a batch of items (e.g. a box of hand tools) to be released for unrestricted use are evaluated for potential contamination and classified based on contamination potential into one of three survey classes. Table 1 presents guidance on the percentage of items to be surveyed and the percentage of the surface area of each item to be surveyed (NUREG-1761 as revised). See Section 5.1 for the definition of Class 1 Solid Materials, Class 2 Solid Materials and Class 3 Solid Materials. Determine the class for the equipment and/or material to be surveyed. Survey the percentage of items and the percentage of the area shown in Table 1.

6.2.2 The classifications provide guidance to the surveyor on the percentage of items to be surveyed and the percentage of surface area of each item to be surveyed. For items or equipment classified as Class 2 Materials or Class 3 Materials, survey the surface areas which have the highest potential for contamination.

6.2.3 If it cannot be readily identified by process knowledge, usage location etc., then the equipment or material will be initially surveyed at a minimum using the requirements specified for Class 2 Materials (50%-100% of the items and 50%-100% of the surface area). For example if a less than 100% survey is performed and 50% of the survey measurements indicate contamination levels at less than the release limit but greater than twice background, increase the percentage or number of items surveyed and the percentage of surface area measured. Examples of the survey classes are listed in Table 1 below.

Table 1
Minimum Survey Release Requirement for Release of Equipment and Materials

Equipment and Material Classification	Example	Percent of items to be surveyed	Percent of surface area of each item to be surveyed [(a)]
CLASS 1 Equipment or material from the process area of the mill with known contamination or potentially contaminated above the release criteria	Electric motors from the packaging area	100	100
CLASS 2 Equipment or materials that have the potential for contamination that is not expected to be above the release criteria	Instrumentation from a control room in the mill	50-100	50-100
CLASS 3 Equipment or materials that are not expected to be contaminated or contaminated at only a small fraction of the release criteria	Office furniture from the mill office	10-50	10-50

(a) Recommended values from Draft NUREG 1761.

6.3 ***RELEASE CONTAMINATION LIMIT CRITERIA***

The activity limits specified in Appendix A, Table A1, line 1 are to be used as release criteria for materials that contain U-nat, U-235, U-238 and associated decay products.

6.4 ***SURVEYS OF EQUIPMENT AND MATERIALS***

6.4.1 Alpha Contamination Surveys

6.4.1.1 Equipment or materials for release shall be surveyed for alpha contamination in accordance with the Alpha and Beta-Gamma Contamination Surveys Procedure RH-120.

6.4.1.2 Alpha contamination instrument check and survey information shall be recorded on Form RH-070 or the equivalent (see Appendix B)

6.4.1.3 Removable alpha surveys need only be performed if the total alpha activity exceeds the removable alpha contamination limits in Table A1.

6.4.2 Beta-Gamma Contamination Surveys

6.4.2.1 Equipment or materials for release shall be surveyed for beta-gamma contamination in accordance with the Alpha and Beta-Gamma Contamination Surveys Procedure RH-120.

6.4.2.2 Beta-gamma contamination instrument check and survey information shall be recorded on Form RH-070 or the equivalent (see Appendix B)

6.4.2.3 Removable beta-gamma surveys need only be performed if the total beta-gamma activity exceeds the removable beta-gamma contamination limits in Table A1.

6.5 *AUTOMOBILE AND TRUCK SURVEYS*

Conduct the alpha survey and a beta-gamma contamination survey of cars, trucks and other vehicles leaving the restricted area of the facility. The survey should include a survey of at least the driver's door handle, the driver's seat, one tire, the floor of the inside of the vehicle, and any dirty or suspect areas. The RSO, Alternate RSO, or a designee can authorize the release of cars and trucks leaving the restricted area, providing contamination levels have not exceeded the limits in Table A1.

6.6 *RELEASE OF EQUIPMENT OR MATERIALS*

6.6.1 Compare the results recorded on Form RH-070A or the equivalent with the limits listed on Table A1. If any of the limits in Table A1 are exceeded, check NO in the release column of Form RH-070A or its equivalent and DO NOT release the material from the restricted area of the mill until it can be decontaminated below the limits. If this cannot be accomplished with standard methods in a reasonable time, contact the RSO or Alternate RSO for further instructions.

6.6.2 If the values are less than the limits, check YES in the Release column and give Form RH-070A to the RSO, the Alternate RSO, or a designee for his signature and approval to release the equipment, materials, or vehicles from the restricted area. A copy of the signed form serves as documentation of the survey and approval to release the items from the restricted area to the general public.

6.6.3 Equipment and materials that are to be sent to another licensee, that is permitted under their license to accept the items, need only comply with the Department of Transportation limits and not the limits specified on Form RH-070A (see the Shipment of Yellowcake, Ore, or Contaminated Equipment by Truck Procedure RH-080). The RSO must first verify that the transferee's license authorizes the receipt of the type, form, and quantity of radioactive material to be transferred. Energy Fuels must possess a current copy of the transferee's specific license or registration certificate or employ other allowable methods for verification (6 CCR 1007-1 3.22).

6.6.4 The RSO must approve all offsite shipments of radioactive materials, which cannot be released under the unrestricted release criteria.

6.7 ***DOCUMENTATION***

6.7.1 Form RH-070A or the equivalent shall be completed for all equipment or materials that are scanned for release from the mill.

6.7.2 The completed form shall be filed and retained for 3 years and made available to CDPHE upon request.

Release of Equipment to Unrestricted Areas Procedure RH-070

Appendix A

Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use Or Termination Of Licenses For Byproduct, Source Or Special Nuclear Material

Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct or Source Material

The instructions in this guide in conjunction with Table A1 specify the radioactivity and radiation exposure rate limits that should be used in accomplishing the decontamination and survey of surfaces of premises and equipment prior to abandonment or release for unrestricted use.

1) The Mill shall make a reasonable effort to eliminate residual contamination.
2) Paint, plating, or other covering material shall not cover radioactivity on equipment or surfaces unless contamination levels, as determined by a survey and documented, are below the limits specified in Table A1 prior to applying the covering. A reasonable effort must be made to minimize the contamination prior to use of any covering.
3) The radioactivity on the interior surfaces of pipes, drain lines, or ductwork shall be determined by making measurements at all traps, and other appropriate access points, provided that contamination at these locations is likely to be representative of contamination on the interior of the pipes, drain lines, or ductwork. Surfaces of premises, equipment, or scrap, which are likely to be contaminated but are of such size, construction, or location as to make the surface inaccessible for purposes of measurement, are presumed to be contaminated in excess of the limits.

Table A1
Acceptable Surface Contamination Levels

Nuclides [a]	**Average** [b c f] (dpm/100 cm^2)	**Maximum** [b d f] (dpm/100 cm^2)	**Removable** [b e f] (dpm/100 cm^2)
Alpha Emissions from U-nat, U-235, U-238 and associated decay products	5,000	15,000	1,000
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except others noted above	5,000	15,000	1,000

Notes:

a Where surface contamination by both alpha and beta-gamma emitting nuclides exists, the limits established for alpha and beta-gamma emitting nuclides should apply independently.

b As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

c Measurements of average containment should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

d The maximum contamination level applies to an area of not more than 100 cm^2.

e The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filters or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

f The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

Release of Equipment to Unrestricted Areas Procedure RH-070

Appendix B

Equipment and Materials Survey Form RH-070A

Equipment and Materials Survey

Location (Source of equipment)__________________Surveyed by:_______________ Date______

Alpha check source ________dpm Type _______

Beta check source _____________dpm

Gamma check source ________µCi Type _______

Equipment Description	Area Surveyed (or see map on back of form)	Total Alpha		Removable Alpha		Total Beta/Gamma		Removable Beta/Gamma		Permitted for Release	
		cpm	dpm/ 100cm^2	cpm	dpm/ 100cm^2	cpm	dpm/ 100cm^2	cpm	dpm/ 100cm^2	YES	NO
Instrument Serial No:											
Date Calibrated											
Correction Factor											
Background											
Limits – RH-070 Table A1		15000 dpm Max 100 cm^2 5000 dpm Ave 100 cm^2		1000 dpm Max 100 cm^2		15000 dpm Max 100 cm^2 5000 dpm Ave 100 cm^2		1000 dpm Max 100 cm^2			

Approval for release (RSO or Alt. RSO): __________________________________

Date: ___________________

1.0 PURPOSE

This procedure outlines the Department of Transportation requirements for the shipment of yellowcake (uranium oxide) or surface contaminated equipment from the Piñon Ridge Mill by truck. The requirements for the transportation of ore to the processing facility are also included in this procedure to help ensure that incoming shipments meet the DOT requirements. 49 CFR 100-399 presents the complete regulations for the shipment of all types of radioactive material by all methods of transportation. This procedure addresses:

1.1 What to include on shipping papers

1.2 Package specifications and markings

1.3 Radiation and contamination limitations

1.4 Placarding of trucks

2.0 APPLICABILITY

This procedure applies to the Radiation Safety Officer (RSO), the Alternate RSO, the Mill Foreman, Radiation/Security Technician (RST), and the Mill Operators.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Department of Transportations Regulations 49 CFR Parts 100-399

3.1.2 Colorado Rules and Regulations Pertaining to Radiation Control, Part 17 (6 CCR 1007-1).

3.2 *APPENDICES*

Appendix A - Form RH-100A Shipping Papers

4.0 EQUIPMENT AND MATERIALS

4.1 *EQUIPMENT*

4.1.1 Ludlum model 43 series alpha detectors (scintillation, proportional or phoswich) or equivalent

4.1.2 Ludlum model 2241 series scaler/ratemeter or equivalent

4.1.3 Ludlum model 2929 alpha/beta sample counter or equivalent

4.1.4 Ludlum 44-9 pancake GM probe or equivalent

4.1.5 Ludlum model 12s micro R meter or equivalent

4.1.6 Ludlum model 44 -10 gamma scintillation probe, 2 x 2 or equivalent

4.1.7 NIST alpha and beta check sources for determining instrument and detector efficiencies.

4.2 *MATERIALS*

4.2.1 Swipes

4.2.2 “Low Specific Activity” stencils and spray paint

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

4.2.3 "Radioactive 7" DOT placard

4.2.4 Form RH-100A or the equivalent

5.0 RESPONSIBILITY

5.1 The Mill Foreman or his designee is responsible for preparation of the shipping papers.

5.2 The RSO is responsible for shipment of yellowcake and other radioactive materials from the uranium processing facility.

5.3 The Alternate RSO or his designee is responsible for placarding of the trucks.

5.4 The RST is responsible for monitoring of individual packages of radioactive materials and transport vehicles.

5.5 The Mill Operators are responsible for proper loading and bracing of packages and/or barrels in the trucks and for the labeling of packages or barrels.

6.0 PREREQUISITE INFORMATION

6.1 *DEFINITIONS*

6.1.1 Exclusive Use – Sole use by a single consignor of a conveyance for which all initial, intermediate, and final loading and unloading are carried out in accordance with the direction of the consignor or consignee.

6.1.2 LSA - Low Specific Activity.

6.1.3 RQ - Reportable Quantity.

6.1.4 SCO - Surface Contaminated Objects.

6.1.5 Transport Index - mrem/hr at one meter from the external surface of the package, barrel, piece of equipment or transport vehicle.

6.2 *FREQUENCY*

Every time uranium oxide (yellowcake), ore, or contaminated equipment is offered for shipment from the Mill.

7.0 PROCEDURES

7.1 *PREPARATION OF SHIPMENTS*

7.1.1 Shipping Papers

The Mill Foreman or his designee is to prepare the shipping papers for yellowcake, ore, equipment, and/or materials contaminated with uranium and its progeny using Form RH-100A or its equivalent. The Department of Transportations (DOT) regulation in 40 CFR 172.201(a)(2) requires that the shipping papers be legible, and printed manually in English. The material to be shipped is specified in the middle column of the following table. The information to be included on the form is in quotes in the right-hand column. The left-hand column presents the applicable section of the DOT regulations.

DOT Regulation in 49 CFR	Material To Be Shipped	Information For Shipping Papers
§172.202(a)(1) §172.101 Hazardous Materials Table	Yellowcake, ore	Proper Shipping Name: "Radioactive Material, LSA-I"
§172.202(a)(1) §172.101 Hazardous Materials Table §173.403 *Surface Contaminated Object (SCO)*	Equipment or materials contaminated by naturally occurring uranium ores or concentrates (SCO)	Proper Shipping Name: "Radioactive Material, SCO-I" or "Radioactive Material, SCO-II" (Note 1)
§172.203(c)(2)	Yellowcake, ore, SCO equipment	Reportable Quantity: "RQ" before or after the shipping name
§172.202(a)(2)	Yellowcake, ore, SCO equipment	Hazard Class: "7"
§172.202(a)(3) §172.101 Hazardous Materials Table	Yellowcake, ore	I.D. Number: "UN2912"
§172.202(a)(3) §172.101 Hazardous Materials Table	SCO equipment	I.D. Number: "UN2913"
§172.203(d)(1)	Yellowcake, ore, SCO equipment	Radionuclide(s): "U(Natural) plus decay products"
§172.203(d)(2)	Yellowcake, SCO equipment	Physical and Chemical form: "Solid Oxide"
§172.203(d)(2)	Ore	Physical and Chemical form: "Solid Ore"
§172.202(a)(5)	Yellowcake or SCO equipment	Total Activity of Material: Enter activity, "# Ci" (Note 2)
§172.202(a)(5)	Ore	Total Activity of Material: Enter activity "# Ci" (Note 3)
§172.203(d)(3)	Yellowcake or SCO equipment	Activity of Material per Package: "# Ci/barrel (or piece)" (Note 2)
§172.203(d)(3)	Ore	Activity of Material per Package (if applicable): "# Ci/package" (Note 3)
§172.203(d)(9)(ii)	Exclusive use shipment only	Type of Shipment: "Exclusive Use Shipment"
§173.403 *Exclusive use*	Yellowcake, ore, SCO equipment	Exclusive Use Instructions: "Only transport material specified on this shipping paper."

DOT Regulation in 49 CFR	Material To Be Shipped	Information For Shipping Papers
§172.204(a)(1)	Yellowcake, ore, or SCO equipment	Shipper's certification: "This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation."
Signature §172.204(d)(1+2)	Yellowcake, ore, or SCO equipment	Print Name, Signature, and Title of principal, officer, partner, or agent

NOTES:

A packaging group Roman numeral is not required by §172.101 Hazardous Materials Table for Radioactive Materials, low specific activity, UN2912 or surface contaminated object, UN2913.

For exclusive use and domestic transportation only, a radioactive materials transportation label is not required on each container by §173.427(a)(6)(vi). Transport index per §172.203(d)(6) is not required because a transportation label is not required by §173.427(a)(6)(vi).

1) SCO-I for solid objects with average removable contamination ≤ 10E-4 $\mu Ci/cm^2$ and average fixed contamination of ≤ 1 $\mu Ci/cm^2$; SCO-II for objects that exceed SCO-I limits and have average removable contamination ≤ 10E-2 $\mu Ci/cm^2$ and average total (removable + fixed) contamination of ≤ 20 $\mu Ci/cm^2$

2) To convert pounds of uranium oxide (yellowcake) to Ci multiply the following: (lb U_3O_8)*(454 g/lb)*(7.1E-7 Ci/g)*(0.85 U_3/U_3O_8) = (lb U_3O_8)*(2.7E-4 Ci U/lb U_3O_8).

3) To convert pounds of ore to T_Bq multiply the following: (% U_3O_8 content in ore)*(lb ore)*(0.85 lb U/lb U_3O_8)*(454 g/lb)*(2.6E-8 TBq/g)* (27 Ci/TBq)*(4[to account for chain]) = (% U_3O_8 content)*(lb ore)*(1.08E-3 Ci/lb ore)

7.1.2 Barrel Specifications and Marking

Each offeror of a Specification 7A package must maintain on file, for at least one year after the latest shipment, complete documentation of tests and an engineering evaluation of comparative data showing that the construction complies with the 7A specification §173.415(a). Label the shipments as specified below:

DOT Regulation in 49 CFR	Material To Be Shipped	Marking On Each Barrel Or Requirement
§173.427(a)(6)(vi)	Yellowcake shipped in strong tight packages as exclusive use	"Radioactive-LSA, RQ" on exterior of each barrel.
§173.427(a)(6)(vi)	SCO equipment	"Radioactive-SCO-I, RQ" on equipment
§173.427(6)(ii) §173.427(b)(3)	Yellowcake	None. Barrels must be strong and tight to prevent leakage of contents under normal conditions of transport.
§173.427(a)(6)(ii)	Ore, SCO equipment	None. Leakage of radioactive material from the equipment or package is not permitted.
§173.427(a)(6)(i)	Yellowcake, ore, or SCO equipment	None. Shipments must be loaded by the consignor and unloaded by the consignee from the conveyance in which originally loaded.

7.1.3 Radiation and Contamination Limitations

Monitor the 7A barrels, ore trucks, and/or equipment and materials contaminated with uranium and its progeny as specified below: See the Beta and/or Gamma Surveys and Alpha and Beta-Gamma Contamination Radiation Surveys Procedures RH-110 and RH-120.

DOT Regulation in 49 CFR	Material To Be Shipped	Limitation
§173.441(a)	Yellowcake or SCO equipment in exclusive use shipments	200 mrem/hr at any point on the external surface of the each barrel or piece of equipment and 10 mrem/hr at one meter from the external surface of each barrel or piece of equipment
§173.443(a)	Yellowcake, Ore or SCO equipment at beginning of shipment, EACH barrel for exclusive use shipment	6,600 dpm/300 cm^2 beta/gamma removable 660 dpm/300 cm^2 alpha removable
§173.443(b)	Yellowcake, Ore or SCO equipment anytime during shipment, EACH barrel for exclusive use shipment	66,000 dpm/300 cm^2 beta/gamma removable 6,600 dpm/300 cm^2 alpha removable
§173.443(d)(1) §177.843(b)	Contamination on interior of any exclusive use transport vehicle	10 mrem/hr at the surface and 2 mrem/hr at 1 meter from the surface

NOTES:

Empty bulk shipment containers can be released for exclusive use per the requirements listed in the DOT regulations §173.443(d)(1),(2),(3) pertaining to external radiation and contamination control.

Exclusive use vehicles used to transport radioactive materials must be stenciled with the words “For Radioactive Materials Use Only.” In letters at least 7.6 cm (3 inches) high in a conspicuous place on both sides of the exterior of the vehicle (§173.443(d)(2) & §177.843(b)).

7.1.4 General Transportation Requirements

Load the 7A barrels or contaminated equipment as described below:

DOT Regulation in 49 CFR	Material To Be Shipped	Limitation
§173.448(a)	Yellowcake or SCO equipment	Each shipment must be secured to prevent shifting during normal conditions.
§173.448(b)	Yellowcake	Barrels of yellowcake or contaminated equipment may not be carried in compartments occupied by passengers, except in those compartment exclusively reserved for couriers accompanying the barrels.

7.1.5 Placarding Of Trucks

Place placards on the trucks as described below:

DOT Regulation in 49 CFR	Material To Be Shipped	Requirement
§172.504(a+e) §172.507(a) §172.556	Yellowcake or SCO equipment	Each motor vehicle used to transport barrels of yellowcake or contaminated equipment must have a "RADIOACTIVE" warning placard placed on a square background on each end and on each side of the transport vehicle. The required placarding of the front of a motor vehicle may be on the front of a truck-tractor instead of or in addition to the placarding on the front of the cargo body to which the truck-tractor is attached.
§172.506(a)	Yellowcake or SCO equipment	Shipper to supply placards unless truck is already placarded.
§173.427(6)(v) §173.443(d)(2)	Ore	No placards required on trucks. Exclusive use vehicles used to transport radioactive materials must be stenciled with the words "For Radioactive Materials Use Only" in letters at least 7.6 cm (3 inches) high in a conspicuous place on both sides of the exterior of the vehicle.

8.0 TRAINING

8.1 Employees involved in preparation of shipments as described in this procedure shall receive the following training:

8.1.1 Level 3 radiological training in accordance with the Radiological Health and Safety Training Procedure RH-010

8.1.2 Emergency Response and Security Training specific to materials and potential scenarios associated with preparation of shipments of radioactive materials

8.1.3 DOT training including review of regulations pertaining to preparation of shipments of radioactive materials

8.1.4 Annual refresher training for each of the above training areas

8.2 ***DOCUMENTATION***

8.2.1 Training shall be documented in accordance with the Training Records and Documentation Procedure AD-060

8.2.2 Training records shall be retained for minimum of 3 years

Shipment of Yellowcake, Ore or Contaminated Equipment by Truck
Procedure RH-100

Appendix A

Shipping Papers Form RH-100A

Shipping Papers

SHIPPER
Energy Fuels Resources
Piñon Ridge Mill
16910 Highway 90
Bedrock, CO 81411

EMERGENCY CONTACTS

Shipper

xxxxx (Radiation Safety Officer)	XXX-XXX-XXXX
xxxxx (Plant Manager)	XXX-XXX-XXXX
24 Hour Emergency Number	XXX-XXX-XXXX
Transporter Name/Title	Phone Number

TRANSPORTER
Name: ____________
Address: ____________

Tractor #: ______ Time In: ______
Trailer #: ______ Time Out: ______
Tailgate Check: ______

SHIPPER INFORMATION
Proper Shipping Name: Radioactive Material, LSA-I
Hazard Class: 7
I.D. Number: UN2913
Radionuclide(s): U (natural) plus decay products
Type Of Shipment: Exclusive Use
Exclusive Use Instructions: Only transport material specified on this shipping paper
Date Of Shipment: XX/XX/XX

Physical and Chemical Form: Solid Oxide
Total Activity of Shipment: X Ci
Total Quantity Of Material: X Barrels
Activity per Package: X Ci/Barrel

DESTINATION
Name: ____________
Address: ____________

SHIPPER CERTIFICATION
This is to certify that the above mentioned material are properly classified, described, packaged, and labeled, and are in proper condition for transportation according to the applicable regulations of the Department Of Transportation.

Print Name: ____________
Signature: ____________
Title: ____________

RECEIVER VERIFICATION
Receiver: ____________
Location: ____________
Date Received: ____________
Comments: ____________

1.0 PURPOSE

This procedure describes how to conduct a beta and/or a gamma survey within the Mill. The purpose of the survey is to identify areas of elevated beta or gamma exposures so that the radiation doses may be kept to levels that are As Low As Reasonably Achievable (ALARA). Gamma monitoring of personnel using dosimeters is addressed in the Personal Radiation Dosimeters Procedure RH-210.

2.0 APPLICABILITY

This procedure provides guidance to the radiation protection staff or others conducting beta and/or gamma exposure rate surveys of the facilities. All personnel and visitors present inside the uranium processing facility are to maintain their radiation doses at levels that are ALARA.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 NRC Regulatory Guide 8.30, "Health Physics Surveys in Uranium Mills."

3.1.2 Posting Procedure RH-030

3.1.3 Colorado Rules and Regulations Pertaining to Radiation Control, Part 4 (6 CCR 1007-1).

3.2 *APPENDICES*

Appendix A – Correction Factor for Beta Survey Instruments

Appendix B – Beta/Gamma Survey Form RH-110A

4.0 EQUIPMENT AND MATERIALS

4.1 *EQUIPMENT*

4.1.1 Ludlum model 2241 series scaler/ratemeter or equivalent

4.1.2 Ludlum model 2929 alpha/beta sample counter or equivalent

4.1.3 Ludlum 44-9 pancake GM probe or equivalent

4.1.4 Ludlum model 12s micro R meter or equivalent

4.1.5 Ludlum model 44 -10 gamma scintillation probe, 2 x 2 or equivalent

4.1.6 NIST beta and gamma check sources for determining instrument and detector efficiencies.

5.0 RESPONSIBILITY

5.1 The Radiation Safety Officer (RSO) or the Alternate RSO is responsible for:

5.1.1 Reviewing Form RH-110A for accuracy and completeness

5.1.2 Evaluating any trends of increasing or decreasing exposures rates over time.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

5.1.3 Instituting ALARA reviews and/or corrective actions in response to undesirable trends involving measured exposure rates

5.2 The Radiation/Security Technician (RST) is responsible for:

5.2.1 Conducting gamma surveys at representative work locations.

5.2.2 Performing beta exposure surveys of areas or equipment at the Mill.

5.3 The Quality Assurance Officer or designee is responsible for:

5.3.1 Assuring that personnel considered as key individuals relevant to this procedure are documented as properly trained and/or qualified to perform the required duties.

5.3.2 Assuring that the quality principles of this procedure are followed and maintained.

6.0 PREREQUISITE INFORMATION

6.1 *DEFINITIONS*

Radiation Area – An area accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 5 mrem in 1 hour at 30 cm from the radiation source or from any surface that the radiation penetrates.

6.2 *SAFETY*

Beta calibration of instruments using yellowcake or other processing material samples subject to dusting will be performed under a dust collection hood.

6.3 *FREQUENCY*

6.3.1 Monthly gamma radiation surveys in Radiation Areas and where specified by the RSO.

6.3.2 Quarterly gamma and beta-gamma radiation surveys in other plant areas as determined by the RSO.

6.3.3 Pre and post-job surveys shall be completed as needed to verify changing radiological work conditions, as indicated in radiation work permits, and at the discretion of the RSO or Alternate RSO.

7.0 PROCEDURES

7.1 *GAMMA SURVEYS*

7.1.1 The RST is to turn on the gamma survey meter. Use the battery scale on the meter to check the condition of the batteries. Change the batteries if low battery voltage is indicated.

7.1.2 Read the calibration sticker on the instrument to verify that the instrument has been calibrated within the last year or as specified by the manufacturer. If not, use an instrument that is in calibration. Record the instrument and probe serial numbers on Form RH-110A or the equivalent.

7.1.3 Inspect the survey meter, probe and probe cable for damage etc. If damaged, replace cable etc. or select another instrument for the survey.

7.1.4 Note the instrument reading without the check source present and record on calibration check form. This is the background count rate.

7.1.5 Place the gamma check source on contact with the instrument detector and observe the reading, subtract the background measurement and record the net reading on Form RH-110A. Use the same check source that was used to determine the reference reading when the instrument was calibrated. If the reading with the check source varies more than 20% (Reg. Guide 8.30, page 21) from the historic reference readings, select another instrument for the survey and submit the defective instrument for repair.

7.1.6 The RST is to survey at least 20 locations quarterly to characterize exposures rates to workers in the facility. Included shall be areas where workers might stand or work or approximately 12 inches from the equipment. Record the results on Form RH-110A.

7.1.7 If the dose rate in areas accessible to workers exceeds 5 mrem/hr at 12 inches from the radiation source, post the area as a "Radiation Area" in accordance with the Posting Procedure RH-030 and resurvey quarterly.

7.2 ***BETA-GAMMA EXPOSURE RATE SURVEY OF EQUIPMENT AND MATERIALS***

7.2.1 Turn on the instrument equipped with a GM pancake probe or GM probe with a sliding shield. Use battery scale on the meter to check the condition of the batteries. Change the batteries if low battery voltage is indicated.

7.2.2 Read the calibration sticker on the instrument to verify that the instrument has been calibrated within the last year or at a frequency specified by the manufacturer. If not, use an instrument that has a current calibration. Record the instrument serial number on Form RH-110A or the equivalent.

7.2.3 Inspect the meter and probe for damage. If damaged, use another instrument.

7.2.4 Observe the instrument background count rate and record on the calibration form.

7.2.5 Measure the beta check source activity. Proceed if the measured activity is within 20% of the historic reference readings. Record the check source activity on Form RH-110A or the equivalent.

7.2.6 Quarterly beta radiation surveys are to be performed at representative locations where workers are exposed, when equipment or operating procedures are modified in a way that may have changed the beta dose that would be received by the worker, and specifically at locations that involve direct handling of large quantities of aged yellowcake. Additional surveys will be performed at locations where other materials for processing are stored and processed to evaluate the exposure levels.

7.2.7 Perform a measurement with the pancake probe without a probe shield and subtract the background reading. This net reading is the beta + gamma exposure rate.

7.2.8 Perform a measurement using the pancake probe with the plastic shield in place. Subtract the background reading recorded in 7.2.4 above. This net reading is the gamma only exposure rate from the item surface.

7.2.9 Determine the difference between the two measurements and multiply the reading by the beta correction factor. See Appendix A for the determination of the beta correction factor. The correction factor is noted on a label attached to the instrument.

7.2.10 Determine the beta-gamma exposure rate by summing the gamma only measurement as determined in 7.2.8 and the corrected beta reading calculated in 7.2.9. Record the average and maximum beta-gamma exposure rates on Form RH-110A.

7.2.11 Update area postings and Radiological Work Permit (RWP) information, as necessary.

7.2.12 Post a copy of the radiological survey in Radiation Areas to allow personnel to review conditions.

7.2.13 Notify the RSO or Alternate RSO of any significant changes in radiological conditions.

7.3 *DOCUMENTATION*

7.3.1 The RSO or Alternate RSO shall review and sign the Form RH-110A or equivalent.

7.3.2 The Alternate RSO or designee shall file Form RH-110A or equivalent in the Safety Department Records.

7.3.3 Retain Form RH-110A or equivalent for 3 years.

Beta and/or Gamma Exposure Rate Surveys Procedure RH-110

Appendix A

Correction Factors

Correction Factor for Beta Survey Instruments

As noted in the USNRC Regulatory Guide 8.30, "Health Physics Surveys of Uranium Mills," Appendix C, a correction factor needs to be generated for the beta survey instrument. The beta survey correction factor is calculated as follows:

$$CF = \frac{YC}{R_u - R_s}$$

Where:

CF = Correction factor

YC = Actual beta dose rate from an old yellowcake source
= 75 mrem/hr at 2 cm from the surface or 150 mrem/hr at the surface (Reg. Guide 8.30, Appendix C)

R_u = Unshielded exposure rate

R_s = Shielded exposure rate

Correction Factor for Probes with a Sliding Shield

For survey instruments with a GM probe and a sliding shield the beta survey correction factor was calculated as shown in the following example:

Instruments:

Eberline Model E 140 Survey Meter with an HP 270 GM probe with a sliding shield, Serial # 1760, calibrated 2-02-02. Eberline Model E 140 Survey Meter with an HP 270 GM probe with a sliding shield, Serial # 2263, calibrated 2-02-02.

Source: "Black yellowcake, 9-25-85, Lot 8406-60, Uncovered lab sample from drum. Data courtesy of Cotter Corporation.

Measurements at 2 cm from source on 7/17/02:	Meter # 1760	Meter # 2263
• Background	0.04 mR/hr	0.04 mR/hr
• Probe shield closed	10. mR/hr	12. mR/hr
• Probe shield open	40. mR/hr	36. mR/hr

CF at 2 cm for instrument # 1760 $= \frac{YC}{R_u - R_s} = \frac{75}{40\text{-}10} = 2.5$

CF at 2 cm for instrument # 1760 $= \frac{YC}{R_u - R_s} = \frac{75}{36\text{-}12} = 3.1$

Different correction factors may be determined when processing high thorium content ores.

Correction Factor for a Pancake Probe

For survey instruments with a pancake probe, a beta survey correction factor can be calculated as follows:

Instruments: Eberline E-140 with a HP-210 probe or the equivalent.

Material Source:

Processing material sample e.g. Black aged yellowcake, Uncovered lab sample from drum.

Measurements:

Take two measurements with the meter:

- At 2 cm above the surface of the yellowcake or other processing material without the plastic detector shield,
- At 2 cm above the surface of the yellowcake or other processing material with the plastic detector shield in place.

A 1.0 cm thick Plexiglas or Lucite plate may be used for the plastic detector shield.

Calculate the correction factor as shown above.

Application of the Correction Factor

The actual beta dose rate = $(S_u - S_s)(CF)$

Where:

S_u = Unshielded exposure rate from a source such as a contaminated tool.

S_s = Shielded exposure rate from a source such as a contaminated tool. The shield can be a sliding shield on a GM detector or a piece of 1.0 cm thick Plexiglas used with a pancake probe.

Beta-gamma dose rate = Actual beta dose rate + Gamma (shielded) dose rate

Beta and/or Gamma Exposure Rate Surveys Procedure RH-110

Appendix B

Beta/Gamma Survey Form RH-110A

Beta/Gamma Survey Form

Instrument ______________________________ SN ____________________

Detector/Probe ________________ SN __________ Calibration Date _________

Net Check Source Reading ___________ Historical check source reading ___________

Date	Survey Location[1]	Type of Measurement	Gamma plus Beta Reading	Gamma Only Reading

1) Complete a diagram of the radiological area boundaries on the following sheet.

Survey Completed by (Print Name) ______________________________

Employee Number ______________________________

Signature ______________________________ Date __________

Survey Reviewed by (Print Name) ______________________________

Employee Number ______________________________

Signature ______________________________ Date __________

Diagram of the Radiological Area Boundaries

1.0 PURPOSE

This procedure describes methods for measuring alpha and beta-gamma surface contamination.

2.0 APPLICABILITY

This procedure applies to all equipment, materials and personnel potentially contaminated in and around the Piñon Ridge Mill.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 NRC Regulatory Guide 8.30, Health Physics Surveys in Uranium Recovery Facilities.

3.1.2 NUREG 1507 "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminates and Field Conditions."

3.1.3 Colorado Radiation Control Regulations, Part 4 (6 CCR 1007-1).

3.1.4 Decontamination Procedure RH-020.

3.1.5 Radiation Exposure Action Levels Procedure RH-040

3.1.6 Radiation Work Permits Procedure RH-060

3.1.7 Release of Equipment to Unrestricted Areas Procedure RH-070

3.1.8 Personnel Release Surveys Procedure RH-200

3.1.9 Piñon Ridge Mill Facility Operating Plan

3.2 *APPENDICES*

Appendix A – Alpha/Beta-Gamma Contamination Survey Report Form RH-120A.

4.0 EQUIPMENT AND MATERIALS

4.1 *EQUIPMENT*

4.1.1 Ludlum model 43 series alpha detectors (scintillation, proportional or phoswich) or equivalent

4.1.2 Ludlum model 2241 series scaler/ratemeter or equivalent

4.1.3 Ludlum model 2929 alpha/beta-gamma sample counter or equivalent

4.1.4 Ludlum 44-9 pancake GM probe or equivalent

4.1.5 Ludlum model 12s micro R meter or equivalent

4.1.6 Ludlum model 44 -10 gamma scintillation probe, 2 x 2 or equivalent

4.1.7 Protective gloves

4.1.8 Swipes

4.1.9 Form RH-120A or the equivalent.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

4.1.10 Th-230 National Institute of Standards and Technology (NIST)-traceable alpha check source or equivalent

4.1.11 NIST beta-gamma check sources for determining instrument and detector efficiencies

5.0 RESPONSIBILITY

5.1 The Radiation Safety Officer (RSO) or Alternate RSO is responsible for:

5.1.1 Assuring that all personnel performing the surveys are properly trained.

5.1.2 Determining the locations throughout the facility where surveys should be performed.

5.1.3 Determining the frequency of sampling at a given location based on previous scans or by administrative controls.

5.1.4 Determining any corrective actions that should be put into affect to alleviate areas of higher radioactivity in the Mill.

5.1.5 Reviewing Contamination Survey Reports.

5.1.6 Reporting any undesirable trends to management as soon as practical and documenting program trends in the annual report.

5.2 The Radiation/Security Technician (RST) is responsible for:

5.2.1 Assuring that data are collected according to this procedure.

5.2.2 Filing and retaining the Alpha/Beta-Gamma Contamination Survey Report Form RH-120A or the equivalent.

5.3 The Quality Assurance Officer or designee is responsible for:

5.3.1 Assuring that personnel considered as key individuals relevant to this procedure are documented as properly trained and/or qualified to perform the required duties.

5.3.2 Assuring that the quality principles of this procedure are followed and maintained.

6.0 PREREQUISITE INFORMATION

6.1 *FREQUENCY*

6.1.1 Alpha and beta-gamma contamination area surveys for total and removable contamination will be conducted weekly throughout restricted, unrestricted and clean areas of the Mill facility as specified by license conditions and/or the RSO or Alternate RSO.

6.1.2 Alpha and beta-gamma contamination equipment and materials surveys will be conducted when equipment or materials need to be removed from the restricted area for unrestricted use or repair in accordance with the Release of Equipment to Unrestricted Areas Procedure RH-070.

6.1.3 Alpha and beta-gamma contamination personnel surveys will be conducted when personnel are leaving the restricted area, leaving an area of higher contamination potential or entering a clean area in accordance with the Personnel Release Surveys Procedure RH-200.

6.1.4 Pre and post job surveys will be conducted as needed in support of work activities and Radiological Work Permits (RWPs) to verify changing radiological conditions, or at the direction of the RSO or Alternate RSO.

7.0 PROCEDURES

7.1 *INSTRUMENT INSPECTION*

7.1.1 When performing contamination surveys, the surveyor is to wear protective gloves.

7.1.2 The surveyor will check the operation of the instrument(s) selected for monitoring. Refer to the instrument's operational manual for specific information.

7.1.2.1 Turn on the survey meter.

7.1.2.2 Use the battery scale on the meter to check the condition of the batteries. Change the batteries if low battery voltage is indicated.

7.1.2.3 For line-powered instruments, verify that the power cord is plugged in and that there is power to the outlet.

7.1.2.4 Read the calibration sticker on the instrument to verify that the instrument has been calibrated within the last year or at a frequency specified by the manufacturer. If not, use an instrument that has a current calibration. Record the instrument serial number on Form RH-120A or equivalent.

7.1.3 Inspect the survey meter for damage.

7.1.3.1 If an alpha scintillation probe is to be used in the survey, hold the probe towards a light source. If the count rate suddenly increases, look for tiny pinholes in the Mylar surface of the probe face. Repairs can be made with "whiteout." If two or more whiteout spots are present, use another instrument and report the damage to the RSO or Alternate RSO.

7.1.3.2 RSO or Alternate RSO will replace damaged instrument with properly working instrument.

7.1.3.3 RSO or Alternate RSO will tag instrument with RST name, date, and problem.

7.1.3.4 RSO or Alternate RSO will take damaged instrument to the Safety Department for evaluation, repair and/or replacement.

7.2 *ALPHA SURVEY INSTRUMENT CHECKS*

7.2.1 Perform the Instrument Inspection sup-procedure outlined in Section 7.1, above.

7.2.2 Observe the background count rate of the instrument and record the background rate observed on the instrument(s) on Form RH-120A.

7.2.2.1 Preferably, perform surveys in a low background area.

7.2.2.2 If more than five counts per minute alpha, use a different survey meter and report the potential contamination and/or malfunction to the RSO or Alternate RSO.

7.2.2.3 For a laboratory-type counting instrument, the background rate should be less than 5 cpm alpha. If not, decontaminate the counting chamber using an alcohol wipe, or the equivalent, and recount the background.

7.2.3 Position the probe face of the survey meter within 1.0 cm of the Th-230 or the equivalent alpha check source. Use the end of one's finger or jig under the edge of the alpha probe as a guide for the 1.0 cm spacing. Use a source-to-detector distance for the calibration that is similar to the expected surface-to-detector spacing used in the field. Record the reading on Form RH-120A or equivalent. If the reading is within 20% (Reg. Guide 8.30, page 21) of the historic reference readings, conclude that the instrument is functioning properly. If not, report the malfunction to the RSO or Alternate RSO and use an instrument that is functioning properly.

7.2.4 Calculate the portable survey instrument correction factor by:

$$\text{Alpha Correction factor} = \frac{(\text{Source dpm})\ (100\ \text{cm}^2)\ (E_s)}{(\text{Meter cpm})\ (X\ \text{cm}^2)}$$

Where X is the detection surface area of the probe with no corrections made for the protective screen and 100 cm^2 is the area specified in the release limits. The "source dpm/meter cpm" measurement corrects for the screen covering part of the detection area of the probe. E_s = Efficiency of the instrument.

7.2.5 Determine the instrument minimum detectable activity (MDA) and record on the calibration form.

7.2.5.1 For an integrated measurement over a preset time, the MDA can be approximated by:

$$MDA = \frac{2.71 + 4.65 \sqrt{[(B_R)\ (t)]}}{(t)\ (E)\ (A/100)}$$

7.2.5.2 For a ratemeter instrument the MDA can be approximated by taking twice the time constant of the meter as the counting time:

$$MDA = \frac{4.65 \sqrt{[(B_R)/(2t_c)]}}{(E)\ (A/100)}$$

Where:

MDA = minimal detectable activity in dpm/100 cm^2

B_R = background cpm

t = counting time in minutes

t_c = meter time constant in minutes

E = instrument detector efficiency

A = probe area in cm^2

7.2.5.3 For a laboratory-type instrument the MDA can be approximated by:

$$MDA = \frac{2.71 + 3.45 \sqrt{[(B_R)\ (t)]}}{(t)\ (E)}$$

7.3 *BETA-GAMMA SURVEY INSTRUMENT CHECKS*

7.3.1 Perform the Instrument Inspection sup-procedure outlined in Section 7.1, above.

7.3.2 Observe the background count rate of the instrument and record the background rate observed on the instrument(s) on Form RH-120A or equivalent.

7.3.2.1 Preferably, perform surveys in a low background area.

7.3.2.2 For a laboratory-type counting instrument, the background rate should be less than 100 cpm. If not, decontaminate the counting chamber using an alcohol wipe, or the equivalent, and recount the background.

7.3.3 Using a Cl-36 calibration standard for beta and a Cs-137 calibration standard for gamma or the equivalent and a source-to-detector distance for the calibration that is similar to the expected surface-to-detector spacing used in the field (e.g. 1 cm) measure the source activity and background with a pancake probe. Proceed if the measured activity is within 20% of the historic calibration measurements. If not, report to the RSO or Alternate RSO and use an instrument that is functioning properly.

7.3.4 Calculate the pancake probe beta-gamma correction factor by:

$$\text{Pancake Beta-Gamma Correction factor} = \frac{(\text{Source dpm})\,(100\ \text{cm}^2)(E_s)}{(\text{Meter cpm})\,(X\ \text{cm}^2)}$$

Where X is the pancake probe detection surface area and 100 cm^2 is the surface area specified in the release limits. The "source dpm/meter cpm" measurement corrects for the screen covering part of the detection area of the probe.

7.3.5 Calculate the efficiency of the pancake probe as:

$$E = \frac{\text{meter cpm} - \text{background cpm}}{\text{Source dpm}}$$

7.3.6 Determine the pancake instrument minimum detectable activity (MDA) using E calculated above.

7.3.6.1 For an integrated measurement over a preset time, the MDA can be approximated by:

$$MDA = \frac{2.71 + 4.65\sqrt{[(B_R)\,(t)]}}{(t)\,(E)\,(A/100)}$$

7.3.6.2 For a ratemeter instrument, the MDA can be approximated by taking twice the time constant of the meter as the counting time:

$$MDA = \frac{4.65\sqrt{[(B_R)/(2t_c)]}}{(E)\,(A/100)}$$

Where:

MDA = minimal detectable activity in dpm/100 cm^2

B_R = background cpm

t = counting time in minutes

t_c = meter time constant in minutes
E = instrument detector efficiency
A = probe area in cm^2

7.3.6.3 For a laboratory-type instrument, the MDA can be approximated by:

$$MDA = \frac{2.71 + 3.45\sqrt{[(B_R)(t)]}}{(t)(E)}$$

7.4 *TOTAL ALPHA CONTAMINATION SURVEY*

7.4.1 Perform Alpha Survey Instrument Check sub-procedure outlined in section 7.2, above.

7.4.2 If the item to be monitored is wet, dry the item prior to conducting the alpha survey.

7.4.3 Survey the surface.

7.4.3.1 Position the probe face of the survey meter within 1.0 cm of the equipment or material being monitored.

7.4.3.2 Minimize touching the probe face with the surface being surveyed to avoid the possibility of contaminating the probe face.

7.4.3.3 Use the end of one’s finger or jig under the edge of the alpha probe as a guide to the 1.0 cm spacing.

7.4.3.4 Slowly (~1 cm/sec) move the probe over the area to be surveyed stopping at areas of suspect contamination to obtain an accurate determination of the level of contamination. Average surface contamination measurements are for 100 cm^2 areas averaged over 1 m^2. Note increases in the count rates as indicated by the instrument’s audible output.

7.4.3.5 Maximum contamination measurements are averaged over 100 cm^2. Survey several different areas to obtain an average count rate and a maximum count rate.

7.4.4 Subtract the background cpm reading observed during the survey. Multiply the highest and average survey result by the correction factor and record on Form RH-120A or equivalent under the Total Alpha dpm/100 cm^2 column.

7.5 *REMOVABLE ALPHA CONTAMINATION SURVEY*

7.5.1 Measure for removable alpha activity only if the Total Alpha Activity exceeds the appropriate removable activity release limit.

7.5.2 Number the swipes for identification.

7.5.3 Using a swipe, rub lightly an area of 100 cm^2 of potential contamination.

7.5.4 If the surface monitored was wet, let the swipe dry or dry the swipe in a microwave oven before counting.

7.5.5 Place the swipe on a clean flat surface and count the alpha emission rate using the portable alpha meter as outlined in the Total Alpha

Contamination Survey sub-procedure in section 7.4, above. Alternately, count the swipe in a Ludlum model 2000 scaler/43 series alpha swipe counter or similar instrument.

7.5.6 Subtract the background cpm reading observed during the survey. Multiply the result by the correction factor and record on Form RH-120A under the Removable Alpha dpm/100 cm^2 column.

7.6 ***TOTAL BETA-GAMMA CONTAMINATION SURVEY***

7.6.1 Perform Beta-Gamma Survey Instrument Check sub-procedure outlined in section 7.3, above.

7.6.2 If the item to be monitored is wet, dry the item prior to conducting the beta-gamma survey.

7.6.3 Survey the surface.

7.6.3.1 Position the pancake probe of the survey meter using a contaminated equipment-to-detector distance similar to the calibration source-to-detector distance used above. (If alpha contamination is expected, a piece of paper can be placed between the probe and the surface being monitored to shield out the alpha particles).

7.6.3.2 Minimize touching the probe face with the surface being surveyed to avoid the possibility of contaminating the probe face.

7.6.3.3 Slowly (~1 cm/sec) move the probe over the area to be surveyed stopping at areas of suspect contamination to obtain an accurate determination of the level of contamination. Note increases in the count rates as indicated by the instrument's audible output.

7.6.3.4 Survey several different areas, to obtain an average count rate and a maximum count rate.

7.6.4 Subtract the background reading from the reading observed during the survey and multiply by the pancake correction factor. Record the readings obtained in the Total Beta-Gamma column of Form RH-120A or equivalent.

7.7 ***REMOVABLE BETA-GAMMA CONTAMINATION SURVEY***

7.7.1 Measure for removable activity only if the Total Beta-Gamma Activity exceeds the appropriate removable activity release limit.

7.7.2 Number the swipes for identification.

7.7.3 Using a swipe, rub lightly an area of 100 cm^2 of potential contamination.

7.7.4 If the surface monitored was wet, let the swipe dry or dry the swipe in a microwave oven before counting.

7.7.5 Place the swipe in the pancake probe holder or on a clean flat surface and count the beta-gamma emission rate as outlined in the Total Beta-Gamma Contamination Survey sub-procedure in section 7.6, above). Alternately, count the swipe in an Eberline model BC-4 beta-gamma swipe counter or similar instrument.

7.7.6 Multiply the observed reading less the background reading by the pancake probe efficiency. Record the measurements in the removable beta/gamma column of Form RH-120A or equivalent.

7.8 AREA SURVEYS

Routine area contamination surveys shall be performed at several designated areas at the Mill facility as directed by the RSO.

7.8.1 Areas to be routinely surveyed will include clean areas within the restricted area (such as the lunch room), controlled areas (such as contamination or airborne radioactivity areas), process areas within the restricted area, and unrestricted areas in the Mill facility (such as the change room).

7.8.2 Unrestricted areas and clean areas shall be decontaminated immediately if found to exceed the unrestricted use release limits as specified in Procedure RH-070, Table A1. The release limits for equipment for alpha or beta in unrestricted areas are:

7.8.2.1 15,000 dpm/100 cm^2 max;

7.8.2.2 5,000 dpm/100 cm^2 average; and

7.8.2.3 1,000 dpm/100 cm^2 removable.

7.8.3 Contamination of materials, equipment and surfaces that remain within the restricted area shall be maintained at less than 10^{-3} Ci/cm^2 (220,000 dpm/100 cm^2).

7.8.3.1 Surfaces exceeding this limit generally occur only in yellowcake drying and packaging areas and contamination is visible to the naked eye.

7.8.3.2 Visible contamination in the Mill facility is decontaminated immediately in accordance with the General Housekeeping Maintenance Procedure MP-010 (see the Facility operating Plan).

7.9 RESULTS AND DOCUMENTATION

7.9.1 If the survey measurements exceed the appropriate release limits specified by the appropriate procedure, perform decontamination in accordance with the Decontamination Procedure RH-020.

7.9.2 Following decontamination efforts, resurvey and document results on Form RH-120A or equivalent.

7.9.3 In the event that decontamination is not successful, notify the RSO or Alternate RSO for assistance.

7.9.4 Enter the following data on Form RH-120A or its equivalent:

7.9.4.1 Equipment description;

7.9.4.2 Area surveyed or name of person surveyed;

7.9.4.3 Technician conducting the survey (if not self-survey);

7.9.4.4 Date and time of survey;

7.9.4.5 Location where survey is conducted;

7.9.4.6 Survey equipment serial number for both the alpha and beta-gamma surveys;

7.9.4.7 Date the equipment was calibrated; and

7.9.4.8 Results of survey.

7.9.5 The RSO or Alternate RSO shall review and sign the Form RH-120 or equivalent.

7.9.6 The Alternate RSO or designee shall file Form RH-120A or equivalent in the Safety Department Records.

7.9.7 Retain Form RH-120A or equivalent for 3 years.

Alpha and Beta-Gamma Contamination Surveys Procedure RH-120

Appendix A

Alpha/Beta-Gamma Contamination Survey Report Form RH-120A

Alpha/Beta-Gamma Contamination Survey Report Form

Date of Survey: ____________________ Reviewed by: ____________________ Location: Piñon Ridge Mill

Name of Surveyor: ____________________ Date: ____________________

Employee Number: ____________________ Employee Number: ____________________

Signature: ____________________ Signature: ____________________

Alpha Instrument Type__________ Background Activity__________

SN__________ Alpha MDA__________

Calibration Date__________ Alpha Correction Factor__________

Beta-Gamma Instrument Type__________ Background Activity__________

SN__________ Beta-Gamma MDA__________

Calibration Date__________ Beta-Gamma Correction Factor__________

Potential Location[1]	Total Alpha Activity (dpm/100cm^2)	Removable Alpha Activity (dpm/100cm^2)	Total Beta-Gamma Activity (dpm/100cm^2)	Removable Beta-Gamma Activity (dpm/100cm^2)	Was Supervisor Notified?	Was Area Cleaned?	Final Reading (dpm/100cm^2)

Potential Location[1]	Total Alpha Activity (dpm/100cm^2)	Removable Alpha Activity (dpm/100cm^2)	Total Beta-Gamma Activity (dpm/100cm^2)	Removable Beta-Gamma Activity (dpm/100cm^2)	Was Supervisor Notified?	Was Area Cleaned?	Final Reading (dpm/100cm^2)

1) See the attached diagram of the radiological area boundaries on the following sheet.

Diagram of the Radiological Area Boundaries

1.0 PURPOSE

This procedure is for the measurement of radioactive airborne particulate concentrations at the Piñon Ridge Mill to establish:

1.1 Working locations where airborne concentrations are As Low As Reasonably Achievable (ALARA),

1.2 The need for respiratory protection, and

1.3 Trends in workers' radiation doses from long-lived airborne radionuclides.

2.0 APPLICABILITY

General area air particulate grab sampling will be used in areas of the Mill where potential exists that employees could be exposed to air concentrations at or above 10% of the applicable Derived Air Concentration (DAC) for both long-lived radionuclides. Radon progeny monitoring is addressed in Procedure RH-140. Breathing zone air sampling is addressed in Procedure RH-150.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 NRC Regulatory Guide 8.25, Air Sampling in the Workplace.

3.1.2 NRC Regulatory Guide 8.30, Health Physics Surveys in Uranium Recovery Facilities.

3.1.3 Posting Procedure RH-030.

3.1.4 Radiation Exposure Action Limits Procedure RH-040.

3.1.5 Radionuclide Concentrations in Air Samples Procedure RH-302.

3.1.6 Colorado Rules and Regulations Pertaining to Radiation Control Part 4 (6 CCR 1007-1).

3.2 *APPENDICES*

Appendix A – General Air Sample Data Form RH-130A

4.0 EQUIPMENT AND MATERIALS

4.1 *EQUIPMENT*

4.1.1 Eberline RAS-1 air sampler**,** or the equivalent sampler capable of sampling at approximately 30 liters per minute (lpm).

4.1.2 Breathing zone air sampler may be used in areas where electrical power is not available or as specified by the Radiation Safety Officer (RSO) or Alternate RSO (See the Occupational Breathing Zone Monitoring Procedure RH -150)

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

4.2 ***MATERIALS***

4.2.1 47 mm, glass fiber filter sized to fit the Eberline RAS-1 air sampler, or the equivalent.

4.2.2 37 mm membrane filter for the breathing zone type sampler, if used.

5.0 RESPONSIBILITY

5.1 The RSO or the Alternate RSO is responsible for:

5.1.1 Identifying and assigning the locations for sampler placement and frequency of sampling to the Radiation/Security Technicians (RSTs).

5.1.2 Training the RSTs on occupational air sampling.

5.1.3 Reviewing data from the general air samples, determining the needs for respiratory protection, and if necessary, taking any corrective actions.

5.2 The Radiation/Security Technician (RST) is responsible for:

5.2.1 Collecting the general air samples according to the schedule and frequency provided by the RSO.

5.2.2 Insuring that the equipment used for this sampling is properly calibrated and maintained.

5.2.3 Following the procedures contained herein to accomplish the sampling.

5.2.4 Informing the RSO or Alternate RSO of any deviations or problems that were encountered during sampling activities.

5.2.5 Retaining forms for a minimum of 3 years (6 CCR 1007-1 4.42.1).

6.0 PREREQUISITE INFORMATION

6.1 ***DEFINITIONS***

6.1.1 General Air Samples - Air samples from the area of the Mill where personnel are working with radioactive materials. The general air samples are collected in the airflow pathway downstream of the sources of airborne radioactive material and between the source and the worker. “These samples do not have to be placed near the worker’s breathing zone (within about 1 foot of the worker’s head) and thus concentrations (measured by general air samples) might be considerably different from the concentrations in the breathing zone.” (Reg. Guide 8.25, pages 4-5).

6.1.2 Mobile Air Particulate Sampler –Air sampler which can be moved to various locations to measure airborne concentrations.

6.1.3 Breathing Zone Air Particulate Sampler – A portable, battery operated air pump and filter cassette worn by the worker to measure concentrations of particulates in the vicinity of the “breathing zone” since the filter cassette is typically attached to a shirt lapel.

6.2 ***SAFETY***

6.2.1 Care should be taken to avoid electrical shock. Samplers should be placed where water cannot come in contact with the pump or power cords.

6.2.2 Intrinsically safe equipment shall be used in locations where potential explosion hazards.

6.2.3 Place power cords in positions where they are not tripping hazards.

6.3 *FREQUENCY*

6.3.1 Weekly, monthly, or quarterly air particulate samples based on percent of applicable Derived Air Concentration (DAC).

6.3.1.1 Concentration >25% DAC = Daily

6.3.1.2 Concentration >10% and <25% DAC = Weekly

6.3.1.3 Concentration <10% DAC = Monthly

6.3.2 The RSO or Alternate RSO is to determine the locations, sampling frequencies and parameters to be analyzed. He/she is to convey that information to the RST. Criteria for the types and frequency of general air particulate sampling are provided in Table 1.

6.3.3 Criteria for the RSO to establish the sampling locations are:

6.3.3.1 General air samples should be collected in airflow pathways downstream from sources of airborne radioactive material and between the source and the worker. Periodic airflow pattern studies (smoke or similar studies) shall be performed as needed to determine downwind locations for proper placement of air samplers where airflow is uncertain or difficult to determine through observation alone.

6.3.3.2 Sampling locations should be as close to the frequently occupied work locations as practical without interfering with work.

6.3.3.3 Air samples intended to measure workplace concentrations should not be located in or near exhaust ducts because of the usual diluting effect of the exhausts.

6.3.4 For materials not listed in Table 1, a work plan and/or RWP may specify material-specific DACs, sampling locations and frequencies.

Table 1
Summary of Air Particulate Survey Frequencies and Type

Type of Survey	Type of Area	DAC[a]	Frequency and Type of Survey[b]	LLD[c]
Uranium ore dust	Airborne Radioactivity Area	>DAC	Daily 30-minute grab samples at ~30 lpm in worker occupied areas	3E -12 µCi/ml (uranium)
Uranium ore dust	Ore handling area indoors or Ore pad	>10% and <25%	Weekly 30-minute grab sample at ~ 30 lpm in worker occupied areas	3E -12 µCi/ml (uranium)
Uranium ore dust	Ore handling area indoors or Ore pad	<10%	Monthly 30-minute grab sample at ~30 lpm in worker occupied areas	3E -12 µCi/ml (uranium)

Type of Survey	Type of Area	DAC[(a)]	Frequency and Type of Survey[(b)]	LLD[(c)]
Uranium ore dust	Ore pad	>10%	Breathing zone grab sample if front-end loader generates visible ore dust	3E -12 µCi/ml (uranium)
Yellowcake	Special maintenance involving high airborne concentrations of yellowcake	≥DAC	Continuous breathing zone air monitoring (See Procedure RH-150) (Analyze samples before end of next shift).	3E -11 µCi/ml
Yellowcake	Special maintenance involving high airborne concentrations of yellowcake	>12 DAC-hrs per week	Breathing zone grab samples (See Procedure RH-150)	3E -11 µCi/ml
Yellowcake	Airborne Radioactivity Area or soluble uranium area	>10%	Daily 30-minute grab samples at ~30 lpm in worker occupied areas	3E -11 µCi/ml
Yellowcake	Other indoor process areas	>10% and <25%	Weekly 30-minute grab sample at ~ 30 lpm in worker occupied areas	3E -11 µCi/ml
Yellowcake	Other indoor process areas	<10%	Monthly 30-minute grab sample at ~30 lpm in worker occupied areas	3E -11 µCi/ml

(a) Derived air concentration (DAC). See Reg. Guide 8.25. See Procedure RH-300 for material specific DACs.

(b) Type and frequencies of sampling recommended in Reg. Guide 8.25 and 8.30. Alternatively, a grab sample may consist of a 5-minute high-volume sample at ~850 liters per minute (lpm), which is equivalent to 30 cubic feet per minute (cfm). Breathing zone air sampling is included in Table 1 to demonstrate when general air samples are not sufficient.

(c) LLD = Established at ≤ 10% of the applicable DAC per NRC Regulatory Guide 8.30; DAC values from Colorado Rules and Regulations Pertaining to Radiation Control (6 CCR 1007-1), Part 4, Table 4B including footnote 3 for natural uranium in ore dust

7.0 PROCEDURE

7.1 The RST is to collect the area samples at locations and at the frequencies specified by the RSO or Alternate RSO. Sample the work area for a minimum of 30 minutes at approximately 30 liters per minute or equivalent volume using a breathing zone type air sampler.

7.2 The RST is to check the sampling equipment for visible damage and operational status before each use.

7.3 Calibration of the air samplers flow rate is required at least once per quarter. Verify that the calibration is current. A tag attached to the sampler notes when the latest calibration was performed.

7.3.1 If the calibration is out of date, remove the sampler from service and tag as out of use until recalibrated.

7.3.2 If calibration is current the instrument should be visually inspected for loose fittings and electrical connections. If this inspection reveals any obvious problems the sampler should be removed from service and repaired.

7.4 At the assigned sampling location install a 47 mm glass fiber filter or equivalent in the sampler filter holder. Assure that the filter is installed correctly to provide a good seal on the filter media.

7.5 Turn on the sampler and check for airflow being drawn in through the sample holder. Adjust the air sampler flow rate to the desired set point as indicated on the sampler rotometer. The set point value is noted on the calibration tag attached to the air sampler.

7.6 At the completion of sampling, recheck the sampler flow rate as indicated on the rotometer and record any difference from the initial setting. Turn off the sampler, remove the sampler filter, and place the filter in a petri dish or envelope.

7.7 The RST is to mark the top of the sample collection petri dish or envelope with:

7.7.1 Sample ID number

7.7.2 Date and time of collection

7.7.3 Location ID Number – As indicated in sample location diagram included with Form RH-130A

7.8 The RST is to fill in the following information on the General Air Sample Data Form:

7.8.1 Sample ID number

7.8.2 Location ID number

7.8.3 Date and start and end times of collection

7.8.4 Sample collection minutes

7.8.5 Start and end sampler flow rates

7.8.6 Total volume sampled

7.8.7 Sampling instrument number

7.8.8 Area operational status

7.8.9 Ventilation conditions at time of collection

7.8.10 Status of emission control equipment

7.9 After completing the day's sampling, the RST is to turn in samples to the Mill or contract laboratory for analysis of gross alpha and/or total U, Th-230, Ra-226, and Th-232 based on the requirements in Procedure RH-300.

7.10 Sample analysis procedures are specified in the Laboratory Procedures Manual.

7.11 The RSO or Alternate RSO is to review the measured concentrations, compare them to the DAC for specific areas and type of ore being processed (See Procedure RH-302), and assess the need for additional engineering controls to maintain radiation exposures to As Low As Reasonably Achievable (ALARA). This assessment will determine:

7.11.1 The need for respiratory protection;

7.11.2 The type of respirator for the area;

7.11.3 The need for breathing zone samplers;

7.11.4 The need to change area postings as a result of the air sampling data; and

7.11.5 Compliance with Radiation Work Permits.

7.12 The RST is to file and retain the results for a minimum of three years.

Occupational General Air Particulate Survey Procedure RH-130

Appendix A

General Air Sample Data Form RH-130A

General Air Sample Data Form

RWP-____________________ Sampler Name ____ Employee Number ____________________

Sampler Signature ____ Date _________________

Location ID Number[2]	Sample ID Number	Sample Date	Time			Flow Rate			Sampling Instrument Number	Total Volume (liters)	P (Y/N)	V (Y/N)	E (Y/N)
			Start	Finish	Total (minutes)	Start (lpm)	Stop (lpm)	Average[1] (lpm)					
COMMENTS:													

1) Average Air Flow calculated using arithmetic method
2) See Attached Sample Location Diagram
P = Production area, V = Visible dust, E = Emission control equipment in operation

Reviewed by ____Employee Number ____

Signature ____ Date _____________________________

Form RH-130A

SAMPLE LOCATION DIAGRAM

1.0 PURPOSE

This procedure is for the determination of airborne concentrations of Radon-222 Decay Products (RDP) in work areas at the Piñon Ridge Mill to establish:

1.1 Concentrations of radon progeny in air to which workers are potentially exposed,

1.2 The need for respiratory protection and/or corrective action, and

1.3 Trends in workers doses from RDP.

2.0 APPLICABILITY

This procedure applies to employees and contractors to Energy Fuels Resources at the Piñon Ridge Mill and is applicable to the measurement of radon-222 progeny in air. Since the ore to be processed by the Piñon Ridge mill is not expected to contain elevated levels of naturally occurring Th-232, it will not be necessary to also assess the contribution from airborne concentrations of radon-220 (thoron) progeny from the natural Th–232 decay chain.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 NRC Regulatory Guide 8.30, Health Physics Surveys in Uranium Recovery Facilities.

3.1.2 Colorado Rules and Regulations Pertaining to Radiation Control Part 4 (6 CCR 1007-1)

3.1.3 Kunsetz, HL. Radon daughters in mine atmospheres: a field method for determining concentrations. Amer. Ind Hyg Assoc 17:85. 1956.

3.1.4 Thomas JW Measurement of radon daughters in air. Health Physics 23,783. 1972.

3.2 *APPENDICES*

Appendix A – Sampling Locations, Monthly & Quarterly

Appendix B – Radon-222 Decay Product Survey Form RH-140A

Appendix C – Time Factors for Radon Progeny Determination

4.0 EQUIPMENT AND MATERIALS

4.1 *EQUIPMENT*

4.1.1 Eberline RAS -1 air sampler or equivalent.

4.1.2 SKC Model PCXR4 or Gillian GilAir 5 air pumps or equivalent

4.1.3 Ludlum model 2929 alpha/beta sample counter or equivalent.

4.2 *MATERIALS*

4.2.1 Radon-222 Decay Product Survey Form RH-140A (Appendix B).

4.2.2 Gelman Type A/E 25mm fiberglass filter for portable sampler or the

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

equivalent.

5.0 RESPONSIBILITY

5.1 The Radiation Safety Officer (RSO) or the Alternate RSO is responsible for:

5.1.1 Determining the locations throughout the facility where samples should be collected.

5.1.2 Determining the frequency of sampling at a given location based on previous results or by administrative controls.

5.1.3 Reviewing data from the RDP surveys, determining the needs for respiratory protection, and if necessary, taking any corrective actions.

5.2 The Radiation/Security Technician (RST) is responsible for:

5.2.1 Collecting the RDP air samples according to the schedule and frequency provided by the RSO or Alternate RSO.

5.2.2 Ensuring that the equipment used for this sampling is properly calibrated and maintained.

5.2.3 Following the procedures contained herein to accomplish the sampling.

5.2.4 Recording information from sampling to include:

5.2.4.1 The operational status of the area being sampled.

5.2.4.2 Location of sampling

5.2.4.3 Sampling rate

5.2.4.4 Sampling time

5.2.4.5 Sample volume

5.2.4.6 Sampling activity

5.2.5 Analyzing the samples for RDP concentrations and calculating the Working Level (WL).

5.2.6 Informing the RSO or Alternate RSO of any deviations or problems that were encountered during sampling activities.

6.0 PREREQUISITE INFORMATION

6.1 ***DEFINITIONS***

6.1.1 WL - Working Level

6.1.2 DAC - Derived Air Concentration = 3.0 E-8 Ci/ml (0.33 WL) for Rn-222

6.2 ***FREQUENCY***

6.2.1 Weekly, monthly, or quarterly RDP surveys based on percent of the applicable derived air concentration (DAC).

6.2.1.1 Concentration >25% DAC = Daily

6.2.1.2 Concentration >10% and <25% DAC = Weekly

6.2.1.3 Concentration <10% DAC = Monthly

6.2.2 Routine samples are collected at least monthly from locations where RDP concentrations have been most likely to occur (See Appendix A).

7.0 PROCEDURES

7.1 *RADON DECAY PRODUCT (RDP) SURVEYS*

7.1.1 Airborne concentrations are determined using the modified Kusnetz Method for determination of Rn-222 as described in the literature (see references in Sections 3.1.3 and 3.1.4).

7.1.2 The following applies to either method utilized.

7.1.2.1 The RSO or Alternate RSO is to determine the sampling locations, sampling frequencies and convey that information to the RST.

7.1.2.2 The RST is to check the sampling equipment for visible damage and operational status prior to use.

7.1.2.3 Verify that air sampling equipment and alpha counting instruments are properly calibrated and ready for use.

7.2 *MODIFIED KUSNETZ METHOD*

7.2.1 At the sampling area or location attach a sampling cassette with a 25 mm glass fiber filter onto the hose attached to the portable air sampling pump. Assure that the filter is installed correctly to provide a good seal on the filter media.

7.2.2 Remove the sampling cassette cover, and turn on the sampling pump.

7.2.3 Collect the air sample for a period of five minutes at a sample rate of 2 liters per minute (lpm).

7.2.4 Turn off the sampling pump and replace the cassette cover.

7.2.5 Record the following information on Form RH-140A or equivalent:

7.2.5.1 Sampling location or area

7.2.5.2 Operational status at sampling location

7.2.5.3 Start/Stop time

7.2.5.4 Air sampling equipment used and sampling flow rate

7.2.6 When ready to count the sample filter, remove the sample filter from the sampling cassette and place the filter into the counting chamber of the alpha instrument detector.

7.2.7 The filters must be counted between 40 and 90 minutes after sample collection.

7.2.8 Count the sample filter for one minute and determine the alpha activity.

7.2.9 Calculate the disintegrations per minute per liter (dpm).

7.2.10 Select the appropriate time factor (see Appendix C) based on the elapsed time from the end of sample collection and calculate the WL concentration.

7.2.11 Record the following on Form RH-140A or equivalent:

7.2.11.1 Name of surveyor

7.2.11.2 Sampling location or area

7.2.11.3 Operational status at sampling location

7.2.11.4 Start/Stop time

7.2.11.5 Sampling minutes

7.2.11.6 Sampler flow rate in lpm

7.2.11.7 Air sampling equipment used

7.2.11.8 Alpha counting instrument used

7.2.11.9 Elapsed time from the end of sample collection to the count time

7.2.11.10 Alpha activity determined from sample in dpm

7.2.12 Calculated working level (WL) by:

$$\text{Working Levels} = \frac{(\text{CPM})(\text{efficiency factor})}{(\text{Volume sampled in liters})(\text{Time factor})}$$

$$\text{Efficiency factor} = \frac{\text{Calibration source DPM}}{\text{Calibration source CPM}}$$

CPM – counts per minute

Time factors are listed in Appendix C.

7.2.13 Calculate the sample's percentage of the DAC by dividing the sample concentration by the appropriate DAC and multiplying by 100.

7.3 ***TWO-COUNT METHOD***

Collect the sample the same as specified above, except with the following changes:

7.3.1 Set the air sampler to a flow rate of 3 lpm

7.3.2 Collect the sample for a period of 10 minutes.

7.3.3 Alpha count the sample from 2 to 7 minutes (5 minutes total) after sample collection and apply a time factor of 235.

7.4 ***DOCUMENTATION***

7.4.1 The RSO or Alternate RSO shall review and sign the Form RH-140A or equivalent.

7.4.2 The Alternate RSO or designee shall file Form RH-140A or equivalent in the Safety Department Records.

7.4.3 Retain Form RH-140A or equivalent for 3 years.

Radon-222 Decay Product Surveys Procedure RH-140

Appendix A

Sampling Locations, Monthly and Quarterly

Insert Sampling Location Map here when available

Radon-222 Decay Product Surveys Procedure RH-140

Appendix B

Radon-222 Decay Product Survey Form RH-140A

Radon-222 Decay Product Survey

Date: ______________ Location: __________________________________

Sample Collection

Pump No.: ___________

Sample ID	Location	Time			Flow Rate		Volume Sampled (liter)
		Start	Stop	Total (min)	Start (lpm)	Stop (lpm)	

Sample Analysis

Alpha Instrument Type: ________________ Ser. No: _______________

Source: __________ cpm Efficiency: __________Background: __________ cpm

Sample ID (from above)	Time Counted	Elapsed Time (min)	Method[1] (MK/TC)	Count Time (min)	Time Factor	Counts per Minute less Background (cpm)	Working Levels[2] (WL)

1) **MK – Modified Kusnetz Method:** flow rate = 2 lpm, total sample time = 5 min, elapsed time = 40 to 90 min, count time = 1 min, time factor = see App C

2) Working Levels = $\dfrac{\text{(cpm)(Efficiency Factor)}}{\text{(Volume Sampled)(Time Factor)}}$

Performed by _______________________________________ Employee Number _______________

Signature ____ Date _________________

Reviewed by ____ Employee Number _______________

Signature ____ Date _________________

Radon-222 Decay Product Surveys Procedure RH-140

Appendix C

Time Factors for Radon Progeny Determinations

Time Factors For Radon Progeny Determinations

(5 Min. Sample and 1 Min. Count)

Elapsed Time (Minutes)	Time Factor	Elapsed Time (Minutes)	Time Factor
40	150	66	98
41	148	67	96
42	146	68	94
43	144	69	92
44	142	70	90
45	140	71	89
46	138	72	87
47	136	73	85
48	134	74	84
49	132	75	83
50	130	76	82
51	128	77	81
52	126	78	78
53	124	79	76
54	122	80	75
55	120	81	74
56	118	82	73
57	116	83	71
58	114	84	69
59	112	85	68
60	110	86	66
61	108	87	65
62	106	88	63
63	104	89	61
64	102	90	60
65	100		

1.0 PURPOSE

This procedure is for the measurement of radioactive airborne particulates concentrations in the breathing zone of employees and contractors at the Piñon Ridge Mill to establish:

1.1 Concentrations of uranium and progeny in air to which workers are potentially exposed,

1.2 The need for respiratory protection, and

1.3 Trends in workers' radiation doses from airborne radionuclides.

2.0 APPLICABILITY

Breathing zone air particulate samplers are used in worker occupied areas where an employee is potentially exposed to airborne concentrations of radionuclides in excess of 10% of applicable DACs. (e.g., for natural uranium @ 10% of 3 E-10 μCi/ml or radon progeny @ 10% of 0.3 working levels)

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 U.S. Nuclear Regulatory Commission Regulatory Guide 8.25, Air Sampling in the Workplace.

3.1.2 U.S. Nuclear Regulatory Commission Regulatory Guide 8.30, Health Physics Surveys in Uranium Recovery Facilities.

3.1.3 Colorado Radiation Control Regulations Part 4 (6 CCR 1007-1)

3.2 *APPENDICES*

Appendix A – Breathing Zone Sample Issue/Collection Report Form RH-150A

4.0 EQUIPMENT AND MATERIALS

4.1 *EQUIPMENT*

4.1.1 SKC Model PCXR4 or Gillian GilAir 5 air pumps or equivalent.

4.1.2 Cleaning containers, brushes.

4.2 *MATERIALS*

4.2.1 37 mm membrane filter paper/support pads, or the equivalent.

4.2.2 Form RH-150A, or the equivalent.

4.2.3 Breathing Zone Cassette label, or the equivalent.

4.2.4 Soap solution, acidic cleaning solution (e.g. EDTA), or the equivalent.

4.2.5 Dilute HCl solution.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

5.0 RESPONSIBILITIES

5.1 The Radiation Safety Officer (RSO) or the Alternate RSO is responsible for:

5.1.1 Identifying and assigning the locations or job categories for sampler use and frequency of sampling to the Radiation/Security Technicians (RST).

5.1.2 Training the RSTs on occupational air sampling.

5.1.3 Reviewing data from the breathing zone samples, determining the needs for respiratory protection, and if necessary, taking corrective actions.

5.1.4 Insuring that non-routine monitoring, such as during maintenance repair operations, are accomplished under a Radiation Work Permit (RWP).

5.2 The Radiation/Security Technician (RST) or designee is responsible for:

5.2.1 Collecting the breathing zone samples according to the schedule and frequency provided by the RSO or Alternate RSO.

5.2.2 Insuring that the equipment used for sampling is properly calibrated and maintained.

5.2.3 Following this procedure.

5.2.4 Informing the RSO or Alternate RSO of any deviations or problems that were encountered during sampling activities.

5.2.5 Laboratory analyses of the breathing zone samples.

5.2.6 Retaining forms for 3 years.

6.0 PREREQUISITE INFORMATION

6.1 *DEFINITIONS*

6.1.1 Breathing Zone Air Survey – Monitoring of airborne radioactive particles generally within 1 foot of the individual's head (Regulation Guide 8.25, pages 4-5) using a belt worn, battery operated air pump connected to a filter and filter head usually clipped on the workers' lapel.

6.1.2 DAC – Derived Air Concentration.

6.2 *SAFETY*

Care should be taken not to catch the tygon tube, from the belt-worn air pump to the lapel filter holder, on process equipment.

6.3 *FREQUENCY*

Continuous breathing zone air samplers will be required to be worn when exposure to uranium or radon progeny is or could be ≥ 10% of the DAC as directed by the RSO or Alternate RSO.

7.0 PROCEDURE

7.1 The RSO or Alternate RSO is to determine the locations, sampling frequencies and parameters to be analyzed. He is to convey that information to the RSTs.

7.2 The RST is to check the sampling equipment for visible damage and operational status prior to use. Before issuing a breathing zone sampler, the RST is to perform the following operational checks:

7.2.1 Calibration of the breathing zone sampler flow rate is required at least once per quarter. Verify that the calibration of the breathing zone sampler is current. A tag attached to the sampler notes when the latest calibration was performed.

7.2.2 If the calibration date of the sampler is not current, remove the sampler from service for calibration and notify the Safety Department.

7.2.3 Select a different breathing zone sampler if the sampler calibration is not current.

7.2.4 Check the battery pack of the pump unit for charge level.

7.2.5 Briefly turn on the sampler to verify operation. If the sampler fails to run correctly, select a different sampler for issue and notify the Safety Department.

7.2.6 Check the sample line from the pump to filter holder for splits or cracks, replacing if warranted.

7.2.7 Check filter gasket, replacing if worn or visible defects are observed.

7.2.8 Prior to installing the filter, check for sample line leaks by plugging the sample line at the filter end. Air flow through the pump should be nil.

7.2.9 When the above operational checks are completed and the sampler is deemed operational for use, it is ready for issue.

7.3 The RST is to install an assembled filter cassette. If monitoring for more than one day or shift, reinstall the appropriate filter cassette for that person.

7.3.1 New cassettes are received from the supplier preloaded.

7.3.2 Previously used cassettes are cleaned and decontaminated, allowed to dry and then reloaded with a new support pad, filter and then reassembled for use as follows:

7.3.2.1 Remove any remaining labels, tape, etc. from the cassettes and check for damage.

7.3.2.2 Discard cassettes that have cracks, splits etc.

7.3.2.3 Separate the inlet and outlet sections of the cassettes and place in to cleaning containers.

7.3.2.4 Add tap water, cleaning soap such as Alconox, and EDTA. Make sure all cassettes are covered with solution, and stir occasionally. Soak for approximately 8 hours.

7.3.2.5 Scrub cassettes using a stiff bristle brush to remove any remaining residue, labels, tape etc.

7.3.2.6 Place the soap-cleaned and scrubbed cassettes into a container and rinse twice with tap water and drain.

7.3.2.7 Refill containers with tap water and add 10-20 ml of HCl acid. Add HCl to water not water to HCL.

7.3.2.8 Soak cassettes in HCL solution for approximately 4 hours.

7.3.2.9 Drain HCL solution from containers and thoroughly rinse twice with tap water. Drain.

7.3.2.10 Perform final rinse of cassettes using reagent grade water and drain.

7.3.2.11 Remove cassettes from containers and place on clean tray lined with paper towels making sure to place the cassettes open end face down.

7.3.2.12 Place paper towels between layers of cassette as needed.

7.3.2.13 After the cassettes have thoroughly dried, install a new filter support pad and membrane filter on top of pad using tweezers or forceps.

7.3.2.14 Reassemble cassettes and seal the inlet and outlet opening of the cassettes with plugs or electrical tape.

7.3.2.15 Check to make sure cassette sections are seated together. A small hammer and socket can be used to seat the two sections.

7.3.2.16 Try twisting the two sections. If they are loose, seal the two section halves using electrical tape.

7.3.2.17 Place reassembled cassette into storage box for later use.

7.4 The RST is to attach the breathing zone filter cassette on to the sampling hose attached to the pump and verify that the sampler filter cassette is installed correctly. The breathing zone cassette is two or three pieces with one side marked as the inlet. The side of the cassette marked inlet is the particulate collection side. Attach the pump sampling line to the opposite side of the cassette, which looks like a wagon wheel.

7.5 The RST is to remove the cassette inlet plug.

7.6 The RST is to turn on the sampler.

7.7 The RST is to check and adjust the sampler flow rate to the value noted on the calibration sticker attached to the sampler.

7.8 The employee is to be issued the breathing zone sampler prior to reporting to their assigned work area.

7.9 The RST is to attach the sampling line with cassette installed on to the employee’s shirt collar etc. or other locations near the workers breathing zone (1 foot from worker’s head).

7.9.1 When coveralls, wet/chemical suits or coats, etc., are worn make certain the breathing zone cassette is attached to the outside of the outer clothing.

7.9.2 The cassette should be attached to the wearer so the particulate inlet to the cassette is facing downward.

7.10 The RST is to record data needed on Form RH-150A or equivalent prior to each time a sampler is issued. The items are to include.

7.10.1 Breathing Zone Sample Identification Number

7.10.2 Start date of sampler

7.10.3 Start time of sampler

7.10.4 Air Sampler used

7.10.5 Name of employee being sampled

7.10.6 Employee number

7.10.7 Routine or special sample

7.10.8 When the cassette is to be worn for more than one day, the information is to be recorded on the same sheet for that person for that sample cassette

7.11 The employee is to wear the sampler for the intended amount of time with it in operation. If the sampler shuts down or flow faults during the wearing period, the employee is to contact the RST who is to:

7.11.1 Ask the wearer the estimated time the sampler faulted.

7.11.2 Record all information on Form RH-150A or equivalent.

7.11.3 Restart the breathing zone sampler and document restart time on Form RH-150A or equivalent.

7.12 The employee, after the intended amount of time or end of shift with the breathing zone sampler in operation, is to return to the location where the sampler was initially issued to have the sampler collected by the RST.

7.13 The person collecting the samplers is to record the following information on Form RH-150A or equivalent.

7.13.1 If the indicated flow rate on the sampler is different than that noted on the calibration sticker, record the rate at which the sampler is presently operating.

7.13.2 Record stop date and time.

7.13.3 Record sampler elapsed timer reading.

7.13.4 Turn off the sampler.

7.13.5 Reinstall the cassette inlet plug and carefully remove the breathing zone cassette from the pump sample line if the sampler is not going to be reissued to the same employee for use during their next work shift.

7.13.6 Ask the wearer of the sampler the following questions and record their answer on Form RH-150A or equivalent.

7.13.6.1 Was respiratory protection worn? If so how long was the respiratory protection worn? Record what type of mask was used.

7.13.6.2 Were other workers performing the same task that did not have a breathing zone sampler?

7.13.6.3 Were there any unusual circumstances encountered when wearing the sampler?

7.14 The person who was issued and wearing the breathing zone sampler must sign Form RH-150A or equivalent verifying the information provided was accurate.

7.15 The RST receiving the breathing zone sampler is to proceed with the following:

7.15.1 Visually inspect the filter inside the breathing zone cassette. Note on Form RH-150A or equivalent the appearance of the filter (clean, discolored, etc).

7.15.2 Store the cassette so the particulate inlet side of the sample cassette is facing upwards.

7.15.3 Inspect the sample pump and hose for any visible damage. If damage is noted, document it on Form RH-150A or equivalent, determine how the damage occurred, and replace the damaged part.

7.15.4 Place the breathing zone sampling pump on to the battery charger or replace the discharged battery with a charged one.

7.16 The RST retrieving the breathing zone sample filters that need to be analyzed is to:

7.16.1 Maintain custody of the filters that are being sent to the laboratory for analysis.

7.16.2 Label a filter-transfer envelope to identify the sample. Place the samples in the filter-transfer envelop and transfer to the laboratory for analysis.

7.17 The RSO is to review the results of the laboratory analyses for accuracy and completeness. The RSO is to sign the reports to signify his review and understanding of the report and file the report.

8.0 DOCUMENTATION

8.1 The RSO or Alternate RSO shall review and sign the Form RH-150A or equivalent.

8.2 The Alternate RSO or designee shall file Form RH-150A or equivalent in the Safety Department Records.

8.3 Retain Form RH-150A or equivalent until license termination.

Occupational Breathing Zone Monitoring Procedure RH-150

Appendix A

Breathing Zone Sample Issue/Collection Report Form

Breathing Zone Sample Issue/Collection Report Form

User Name ______________________________ Employee ID ______________ Dept/Company ___________________ Special ____ Routine ____

Signature ________________________________ Date ____________

Pump #	Date	Time On	Time Off	Timer Reading (min)	Run time Per On/Off Times (min)	Run time used for calculations (min)	Filter Inspection Comments	Respirator Type and Total Time Worn	Work Area Code or Task	Unusual Circumstances	Other Workers Performing Same Task	Wearer Initials

RADIATION SAFETY DEPARTMENT USE ONLY

BZ#	Sample Submittal #	Lab #	Flow Rate (lpm)	Total time (min)	Total Volume (liters)	Remarks	Radiation Tech Initials

Respirator Type: HF: Half Face FF: Full Face AL: AirLine RH: Racal Helmet RFF: Racal Full Face

Comments ____

Surveyed Performed by ____________________________ Employee ID _______________

Signature _________________________________ Date ____________

Reviewed by ____________________________________ Employee ID _______________

Signature _________________________________ Date ____________

1.0 PURPOSE

This procedure provides guidance and instruction for the bubble calibration of personal air samplers at the Piñon Ridge Mill.

2.0 APPLICABILITY

This procedure applies to breathing zone personal air samplers.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Breathing Zone Particulate Air Sampler Manufacturer's Operations Manual.

3.1.2 Colorado Radiation Control Regulations (6 CCR 1007-1).

3.2 *APPENDICES*

Appendix A – Air Sampler Calibration Form RH-151A

4.0 EQUIPMENT AND MATERIALS

4.1 *EQUIPMENT*

4.1.1 1 liter glass burette

4.1.2 Support base and clamps for burette

4.1.3 Sealable jar with two connections through the lid for tubing

4.1.4 Beaker or other container that will fit over the larger end of the burette

4.1.5 Stopwatch

4.1.6 Calculator

4.1.7 Small screw driver

4.1.8 Sample pump – battery fully charged

4.1.9 Cassette with filter installed

4.1.10 Tubing

4.1.11 Calibration jar with lid

4.2 *MATERIALS*

4.2.1 Soap solution

5.0 RESPONSIBILITY

5.1 The Radiation Safety Officer (RSO) or Alternate RSO is responsible for assuring that all Breathing Zone Particulate Air Samplers are calibrated.

5.2 The Radiation/Security Technician (RST) is responsible for:

5.2.1 Calibrating and recording calibration data according to this procedure.

5.2.2 Retaining Form RH-151A on record.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

6.0 PREREQUISITE INFORMATION

6.1 *DEFINITIONS*

Breathing Zone Air Particulate Sampler – A portable, battery operated air pump and filter cassette worn by the worker to measure concentrations of particulates in the vicinity of the “breathing zone” since the filter cassette is typically attached to a shirt lapel.

6.2 *SAFETY*

Care should be taken to avoid breaking glass.

6.3 *FREQUENCY*

Breathing Zone Samplers that are in use will be calibrated at least semiannually and after repairs.

7.0 PROCEDURE

7.1 *BUBBLE CALIBRATION METHOD* - Assembly calibration equipment.

(NOTE: Or Commercially available calibrators will be used, e.g., Zefron, F & J Products, Gillian in accordance with manufacturer’s instructions)

7.1.1 Make a soap solution by adding a few drops of liquid soap in 200 ml of tap water in a 250 ml beaker or similar container and stir.

7.1.2 Wet the inside of the burette with the soap solution and secure to the support base with clamps, placing the larger opening of the burette towards the bottom of the support.

7.1.3 Using tubing connect:

- 7.1.3.1 The sampling pump to one of two tube fittings on the calibration jar lid.
- 7.1.3.2 The other tube fitting on the jar lid to the small opening in the burette.

7.1.4 Remove the calibration jar lid and attach a filter cassette with filter to the tube fitting that is connected to the sampling pump. Secure the lid to the jar.

7.1.5 Make sure that the burette is perpendicular to the table.

7.1.6 Turn on sampling pump and check for leakage. Correct leakage if present.

7.1.7 Raise the container containing the soap solution and briefly submerge the larger opening of the burette to generate a bubble inside the burette.

7.1.8 Repeat several times thoroughly wetting the inside walls of the burette. Continue until a bubble travels the entire length of the burette without breaking.

7.1.9 Adjust the sampling pump flow to the rotameter set point for 2 liters per minute (lpm) or other sampling rate designated by the RSO or Alternate RSO.

7.1.10 Observe the bubble moving up the burette.

7.1.11 Start the stopwatch when the bubble reaches the zero mark on the burette.

7.1.12 Stop the stopwatch when the same bubble reaches the one-liter mark on the burette.

7.1.13 Measure the elapsed time the bubble traveled one liter.

7.1.14 Calculate flow rate from the sample pump using the following equation:

$$FlowRate\,(lpm) = \frac{BuretteVolume(liters)}{Elapsedtime(\sec)}(x60)$$

7.1.15 Record the flow rate on Form RH-151A or the equivalent. Repeat steps 7.1.9 thru 7.1.14.

7.1.16 Average the two calibration runs.

7.1.17 Compare the average to 2 lpm or other set point.

7.1.18 If the average is within 2 lpm±10% (1.8 lpm – 2.2 lpm), no further calibration checks are needed. Complete the top portion of the Air Sampler Calibration Form RH-151A.

7.1.18.1 Apply a new calibration sticker to the pump specifying the calibration date, the date next calibration is due, the rotameter reading corresponding to 2 lpm, the sampler serial number and/or the sampler number, and the calibration technician's initials.

7.1.18.2 Mark on the pump with tape or grease pencil the rotameter reading corresponding to 2 lpm. Return sampling pump for use.

7.1.19 If the calibration average does not fall within 2 lpm ± 10%, adjust the sampler flow volume adjustment screw using the small screwdriver to more accurately pump 2 lpm.

7.1.20 Repeat steps 7.1.1 thru 7.1.19 until sample pump falls within the acceptable range.

7.1.20.1 Document rotameter reading on the new calibration form.

7.1.20.2 Apply a new calibration sticker to the sample pump.

7.1.20.3 Return sampler for use.

7.1.21 If the sampling pump cannot be calibrated to within 2 lpm ± 10% or other set point ± 10%, repair or remove pump from service.

7.1.22 The Radiation Safety Technician is to file and retain Form RH-151A for at least 3 years.

Calibration of Air Samplers Using the Bubble Method RH-151

Appendix A

Air Sampler Calibration Form RH-151A

Air Sampler Calibration Form

Sampler #	BZ or GA Sampler	As Found Reading Using Previous Set Point				New Set Point			
ID #	Serial #	Indicated Flow (from Rotometer)	Run 1 Flow Rate (lpm)	Run 2 Flow Rate (lpm)	Average of calibration runs (lpm)	Indicated Flow (from Rotometer)	Run 1 Flow Rate (lpm)	Run 2 Flow Rate (lpm)	Average of calibration runs (lpm)

Date	Temp. °F	BP (in. Hg)	Flow rate correction factor formula: F= √((P2/P3)*(T3)(T2)) = Actual lpm flow rate = (Std. lpm flow rate)(F) = P2= Std. BP, 29.92 in. Hg; P3= Average BP (in. Hg); T2= Std. Temp 298 ^{o} K; T3= Average Temp. = ^{o}C + 273. = [(^{o}F-32)/1.8] + 273.

Indicated readings are based on the location of the middle of the flow ball unless noted otherwise. Readings are liters per minute (lpm).
BP – Barometric Pressure

Performed by ______________________________ Employee Number ____________

Signature ______________________________ Date __________

Reviewed by ______________________________ Employee Number ____________

Signature ______________________________ Date __________

1.0 PURPOSE

This procedure describes how to leak test, shutter test and inventory sealed source devices (SSDs).

2.0 APPLICABILITY

This procedure applies to nuclear density gauges and nuclear level indicators used at the Piñon Ridge Mill. Only persons specifically trained in accordance with manufacturer's instructions are permitted to perform leak and shutter tests (See the Nuclear Density Gauges Procedure RH – 170).

3.0 OTHER DOCUMENTS

3.1 REFERENCES

3.1.1 Colorado Rules and Regulations Pertaining to Radiation Control Part 4 (6 CCR 1007-1).

3.1.2 Nuclear Density Gauges Procedure RH-170.

3.1.3 NRC NUREG-1556, Vol. 4.

3.1.4 Sealed Source and Device (SSD) Registration Certificate (provided by manufacturer for each device).

3.1.5 Radioactive Material License

3.2 APPENDICES

Appendix A – SSD Test and Inventory Form RH-160A

4.0 EQUIPMENT AND MATERIALS

4.1 EQUIPMENT

4.1.1 Ludlum 44-9 pancake GM probe or equivalent

4.1.2 Ludlum model 2241 series scaler/ratemeter or equivalent

4.1.3 Cs -137 check source or equivalent

4.2 MATERIALS

4.2.1 SSD Test and Inventory Form

4.2.2 Survey swipes

5.0 RESPONSIBILITY

5.1 The Radiation Safety Officer (RSO) or the Alternate RSO is responsible for:

5.1.1 Scheduling the leak tests and shutter tests.

5.1.2 If the source is found missing or leaking > 0.005 uCi:

5.1.2.1 Contacting the Colorado Department of Public Health and Environment (CDPHE).

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

5.1.2.2 Contacting the manufacturer, vendor, or the equivalent for repairs, removal or replacement.

5.1.3 Contacting the CDPHE immediately if a source is missing from the inventory or leakage from the source exceeds 0.005 µCi.

5.2 The Radiation/Security Technician (RST) or his designee is responsible for:

5.2.1 Conducting the leak tests and shutter tests according to this procedure.

5.2.2 Documenting the results of the test.

5.2.3 Keeping an inventory of the sealed sources.

5.2.4 Retaining the records of the tests for a minimum of five years.

5.2.5 Contacting the RSO or Alternate RSO immediately if a source is missing from the inventory or leakage from the source exceeds 0.005 µCi.

6.0 PREREQUISITE INFORMATION

6.1 *SAFETY*

6.1.1 When accessing the source on a ladder take precautions not to fall (see Procedure HS-100 Ladders and Scaffolding).

6.1.2 Only personnel specifically trained in accordance with manufacturer's instructions are permitted to perform leak tests and shutter tests. Refer to Nuclear Density Gauges Procedure RH-170.

6.1.3 Maintenance, removal, repair, etc. of fixed gauges and other non-routine activities are to be performed by an entity specifically authorized by CDPHE to perform such activities. Refer to Nuclear Density Gauges Procedure RH-170.

6.2 *FREQUENCY*

6.2.1 Leak tests shall be conducted:

6.2.1.1 Within 6 months prior to the sealed source being put into use

6.2.1.2 At intervals not to exceed 6 months or more frequently as specified by the radioactive material license or the SSD Registration Certificate while in use

6.2.1.3 Any time there is reason to suspect that the sealed source might have been damaged or might be leaking

6.2.2 A physical inventory and shutter test of each sealed source device shall be conducted at intervals not to exceed 6 months, concurrent with routine leak tests or more frequently as specified by the radioactive material license or the SSD Registration Certificate

7.0 PROCEDURES

7.1 Conduct an evaluation of the overall condition of the gauge to ensure it is not damaged and that radiation labels are present.

7.2 Perform shutter tests on gauges in accordance with the manufacturer's instructions and document the results on Form RH-160A. If the source remains in the location where it was previously used (e.g. on the same pipe or tank) and has the shutter mechanism locked in the closed position, the source is considered "not in use" and a shutter test is not required until the source is placed back in service.

7.3 Conduct a physical inventory of the fixed gauges by documenting on Form RH-160A the precise location of the device, serial number, and the condition of the source. In the event a source is found to be missing from its location, notify the RSO or Alternate RSO immediately, who will in turn, notify the CDPHE.

7.4 Conduct a leak test on each sealed source whether in use or not.

7.4.1 MAKE SURE THE SOURCE IS OFF (SHUTTER CLOSED).

7.4.2 Record the serial number of the source on Form RH-160A and number each wipe.

7.4.3 Wearing latex rubber gloves or the equivalent use a piece of filter paper or the equivalent to wipe the area of each source where activity from a leaking source may be suspected. Wipe the areas with moderate pressure.

7.4.4 Fold the filter paper wipe and place it in an envelope for transport to the counting room.

7.4.5 Place a calibrated Cs-137 source of approximately 0.005 µCi in the Harshaw shielded sample changer or the equivalent and measure the activity with a gamma scintillation detector. Measure the background with an unused wipe in the sample chamber for 1 minute. Calculate the efficiency by:

$$E = \frac{\text{Observed CPM} - \text{background CPM}}{\text{DPM of source}}$$

7.4.6 Place the sealed source wipe in the sample chamber, count the activity for 1 minute and calculate the activity on the wipe as:

$$\text{Activity on Wipe in } \mu\text{Ci} = \frac{\text{Wipe CPM-background CPM}}{(\text{E})(2.22\text{E}6 \text{ DPM}/\mu\text{Ci})}$$

7.4.7 Record the activity of the wipe in µCi on Form RH-160A or the equivalent.

7.4.8 ***IF THE ACTIVITY ON THE WIPE IS 0.005 µCi OR MORE, THE SOURCE IS LEAKING:***

7.4.8.1 **IMMEDIATELY WITHDRAW THE SOURCE FROM USE.**

7.4.8.2 Secure immediate area to limit access to prevent spread of contamination from the source.

7.4.8.3 Decontaminate the area around the source as needed to prevent employee exposures.

7.4.8.4 Contact the manufacturer, vendor or service organization authorized by the CDPHE to repair, replace, or remove the source. Energy Fuels personnel are not authorized to perform these functions.

7.4.8.5 Within 5 days file a report with the CDPHE describing the equipment involved, the test results and the corrective action taken.

7.4.9 If the activity on the wipe is less than 0.005 μCi, no action is needed.

7.4.10 The RST is to retain Form RH-160A for five years.

Source Leak Test, Shutter Test and Inventory Procedure RH-160

Appendix A

SSD Test and Inventory Form RH-160A

SSD Test and Inventory Form

Source Location: ____

Manufacturer/Model ______________________________ Ser. No. ______________________

Radionuclide _____________ Activity: _____ mCi Wipe #: ___________

Overall condition of the gauge (ensure it is not damaged): ______________________________
____

Are radiation labels are present on gauge? ______

Leak Test Survey Instrument:
Scaler Manufacturer/Model _________________________ Ser. No. ___________________
Probe Manufacturer/Model _________________________ Ser. No. ___________________

Calibration By_____________Date___________
Cs-137 Ser. No. __ Activity ____ µCi Efficiency _____%

Test Results: (______cpm Wipe) - (______cpm Bkg) (___ % eff)(____µCi) =________µCi
2.22 E6 dpm

[ ] Less than or equal to 0.005 µCi removable activity.
Source is not leaking. No Action Required.

[ ] Wipe is greater than 0.005 µCi removable activity.

(_____Net cpm)(______µCi) = _________ µCi removable activity
2.930 E5 cpm

Source is leaking. Immediately withdraw the source from use. Within five (5) days after obtaining the results of the leak test, file a report with the CDPHE to describe the equipment involved, the test results, and the corrective action taken. If personnel have been contaminated, contact CDPHE. Contact the manufacturer of the source for instructions on repairs and replacement.

Source shutter mechanism turned source on and off successfully __Yes __ No
Next test due: ____________

Performed by _____________________________________ Employee Number ______________

Signature _______________________________________ Date ________________

Reviewed by _____________________________________ Employee Number ______________

Signature _______________________________________ Date ________________

1.0 PURPOSE

This procedure specifies how to install nuclear density and nuclear level gauges.

2.0 APPLICABILITY

This procedure applies to individuals who have received specialty training in the removal and installation of nuclear level gauges and have been approved by the Colorado Department of Public Health and Environment (CDPHE) to install the nuclear devices.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 NUREG 1556 Vol. 4.

3.1.2 Sealed Source and Device (SSD) Registration Certificate (provided by manufacturer for each device).

3.1.3 Lockout/Tagout Procedure HS-110

3.1.4 Source Leak Test, Shutter Test, and Inventory Procedure RH-160

4.0 RESPONSIBILITY

4.1 The Radiation Safety Officer (RSO) or Alternate RSO is responsible for:

4.1.1 Making sure the nuclear density gauges are only installed or removed by personnel that have received training in their installation and removal and have been approved by the CDPHE.

4.1.2 Approving all removal or installation work to be performed on a SSD prior to work beginning.

4.1.3 Notifying other Mill personnel of the work as appropriate.

4.1.4 Ensuring compliance with the Source Leak Test, Shutter Test, and Inventory Procedure RH-160 including updating inventory information for the device.

4.2 The Mill Personnel are responsible for:

4.2.1 Obtaining approval from the RSO or Alternate RSO prior to installing or removing a SSD

4.2.2 Performing the installation and/or removal of an SSD in accordance with this procedure, the manufacturer's instructions and the SSD Registration Certificate.

5.0 PROCEDURES

5.1 *INSTALLATION/REMOVAL*

5.1.1 Nuclear density gauges or nuclear level gauges are to be installed on and/or removed from Mill process equipment <u>ONLY</u> by persons authorized by the CDPHE to perform those operations pursuant to the

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

current Colorado Radioactive Materials License and trained for the device as required by the manufacturer and SSD Registration Certificate.

5.1.2 Mill personnel are not authorized to perform maintenance or repair of an SSD involving opening of the device, which could cause exposure to the source material. Maintenance or repair involving opening of the device shall be conducted by the manufacturer or other authorized individual.

5.1.3 Prior to installation/removal of the device ensure that that:

5.1.3.1 The shutter is locked in the closed position in accordance with the Lockout/Tagout Procedure HS-110.

5.1.3.2 Appropriate work approvals have been issued by the RSO or Alternate RSO.

5.1.3.3 Other applicable procedures are followed. Depending on the accessibility to the device and other potential hazards these may include the Job Safety Analysis Procedure AD-100, Confined Space Entry Procedure HS-050, Electrical Safety Procedure HS-060, Fall Protection Procedure HS-080, Ladders and Scaffolding Procedure HS-100, Hand and Power Tools Procedure HS-120, and/or the Radiation Work Permits Procedure RH-060.

5.1.4 Installation and removal of the device shall be performed in accordance with the manufacturer's installation instruction for that device.

5.2 ***DEVICE MAINTENANCE***

5.2.1 Device maintenance such as cleaning or electronics maintenance may need to be performed on the device on a non-routine basis.

5.2.2 A Radiation Work Permit shall be prepared in accordance with the Radiation Work Permits Procedure for these operations.

6.0 ***DOCUMENTATION***

The inventory for the SSD shall be updated in accordance with the Source Leak Test, Shutter Test, and Inventory Procedure RH-160 and records shall be maintained in accordance with that procedure.

1.0 PURPOSE

This procedure describes how to conduct a contamination survey of personnel working in and around the Piñon Ridge Mill. The purpose of the survey is to minimize the potential for ingestion of radioactive materials while personnel eat and drink at work and to minimize contamination on individuals leaving the Mill to limits that are as low as reasonably achievable (ALARA). Guidelines on how to decontaminate personnel and clothing are listed in Procedure RH-020.

2.0 APPLICABILITY

This procedure applies to all personnel leaving the restricted area of the Mill or moving between areas within the restricted area with the potential to have significantly different radiation levels (e.g. from radiological control areas to general plant areas and from general plant areas to clean areas such as the lunch room).

3.0 OTHER DOCUMENTS

3.1 REFERENCES

3.1.1 NRC Regulatory Guide 8.30, Health Physics Surveys in Uranium Recovery Facilities.

3.1.2 NUREG 1507 Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminates and Field Conditions.

3.2 APPENDICES

Appendix A – Personnel Survey Form RH-200A

Appendix B – Quarterly Random Spot Check Form RH-200B

4.0 EQUIPMENT AND MATERIALS

4.1 EQUIPMENT

4.1.1 Ludlum model 43 series alpha detectors (scintillation, proportional or phoswich) or equivalent

4.1.2 Ludlum model 2241 series scaler/ratemeter or equivalent

4.1.3 Ludlum model 2929 alpha/beta sample counter or equivalent

4.1.4 Ludlum 44-9 pancake GM probe or equivalent

4.1.5 Ludlum model 12s micro R meter or equivalent

4.1.6 Ludlum model 44 -10 gamma scintillation probe, 2 x 2 or equivalent

4.1.7 NIST alpha and beta check sources for determining instrument and detector efficiencies.

4.2 MATERIALS

4.2.1 NIST alpha check sources for determining the instrument detector efficiency

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

4.2.2 Contamination swipes

5.0 RESPONSIBILITY

5.1 The Radiation Safety Officer (RSO) or Alternate RSO is responsible for:

5.1.1 Assuring that all personnel performing the surveys are properly trained.

5.1.2 Determining the frequency of the personnel surveys.

5.1.3 Determining the locations where surveys are to be conducted.

5.1.4 Reviewing the survey results, investigating contamination results that exceed the appropriate action limits or release criteria, and determining any corrective actions that should be put into effect.

5.2 The Radiation/Security Technician (RST) or designee is responsible for:

5.2.1 Following the requirements of this procedure.

5.2.2 Assuring that contamination survey instruments are functional, properly calibrated and available for use at the self-survey locations designated by the RSO.

5.2.3 Conducting or assisting with the contamination surveys of personnel and assisting with any decontamination that may be needed.

5.2.4 Filing and retaining the personnel contamination survey forms.

5.3 Each Individual is responsible for:

5.3.1 Surveying themselves and/or requesting assistance for a survey, comparing their results to the instrument background reading or other release action limits specified by the RSO, performing decontamination if the action levels or release limits are exceeded, and documenting the results of the survey.

5.3.2 Notifying the RSO, Alternate RSO, RST, or designee if survey assistance is needed and if any problems are encountered.

6.0 PREREQUISITE INFORMATION

6.1 ***DEFINITIONS***

6.1.1 dpm – Disintegrations per minute

6.1.2 cpm – Counts per minute observed on the survey meter

6.2 ***FREQUENCY***

6.2.1 Each time a person exits the restricted area at the Mill.

6.2.2 Additional survey frequencies as specified by RSO, which may include:

6.2.2.1 Before entry to a designated lunchroom.

6.2.2.2 Before exiting from areas with higher radiation potential (such as posted radiological control areas) to general plant areas.

6.2.2.3 As required by a Radiation Work Permit (RWP) or work plan.

6.2.3 Quarterly spot surveys for contamination by the RST or his designee on 10% of the workers leaving the facility.

7.0 PROCEDURE

7.1 *TOTAL ALPHA CONTAMINATION SURVEYS*

7.1.1 Personnel shall be surveyed for alpha contamination in accordance with the Alpha and Beta-Gamma Contamination Surveys Procedure RH-120.

7.1.2 Alpha contamination instrument check and survey information shall be recorded on Form RH-200A or RH-200B as appropriate (see Appendices A and B, respectively). Instruments determine to be out of specification shall be removed from service. The instrument inspection and checks (including background and efficiency checks) shall be conducted daily by the RST.

7.1.3 Self-Surveys

7.1.3.1 Personnel shall conduct self alpha contamination surveys prior to exiting the restricted area or at other check points as designated by the RSO.

7.1.3.2 Instructions for performing self surveys shall be posted at checkpoint locations.

7.1.3.3 Personnel not comfortable with performing the self survey shall call the Safety Department and request that an RST perform the survey.

7.1.3.4 Personnel shall:

- Perform the self survey in accordance with the total alpha contamination survey sub-procedure in Procedure RH-120,
- Document the results on Form RH-200A,
- Follow subsequent actions in accordance with the Release of Personnel section, below.

7.1.4 Quarterly random spot checks shall be performed by the RST on 10 percent of personnel leaving the restricted area and in accordance with Procedure RH-120

7.2 *BETA-GAMMA CONTAMINATION SURVEYS*

7.2.1 Beta-gamma contamination surveys of personnel are not routine because potential beta-gamma contamination received at the Mill would be accompanied by alpha contamination which would be detected in the previous procedure.

7.2.2 Beta-gamma contamination surveys of personnel may need to be performed under certain circumstances (e.g., potential contamination from tailings material) at the discretion of the RSO or Alternate RSO in accordance with the Alpha and Beta-Gamma Contamination Surveys Procedure RH-120 and the alpha contamination surveys sub-procedure above.

7.2.3 The instrument inspection and checks (including background and efficiency checks) shall be conducted before each use by the RST.

7.3 ***REMOVABLE CONTAMINATION SURVEYS***

Removable contamination surveys need not be performed on personnel since personnel may only be released if they are at background levels of total contamination. However, removable contamination may be performed as needed in accordance with Procedure RH-120 at the discretion of the RSO or Alternate RSO.

8.0 RELEASE OF PERSONNEL

8.1 If the observed readings for alpha contamination on the person's body (hands, face, etc.) exceed the survey instruments background and cannot be readily and immediately washed off, the personnel shall:

8.1.1 Notify the employee's supervisor.

8.1.2 Document the contamination on Form RH-020A.

8.1.3 Follow the decontamination procedures listed in procedure RH-020.

8.1.4 Notify the RST or designee for guidance on the decontamination procedures. Usually washing with soap and water with the use of a soft brush is sufficient to remove the contamination to background levels or below the release criteria.

8.1.5 Removal of the contamination from the person must be attempted before he/she can leave the restricted area.

8.1.6 Wash and resurvey until the contamination is at the background levels or other release level specified by the RSO. Notify the RSO or Alternate RSO for assistance if necessary.

8.1.7 Document decontamination and resurvey results on Form RH-020A.

8.2 If alpha contamination on the person's clothing, shoes or other personal items exceeds the instruments background reading or other release level specified by the RSO, then:

8.2.1 The clothing or other item must be decontaminated to background levels or other release criteria specified by the RSO

8.2.2 If the clothing or item cannot be decontaminated to background levels, it shall be disposed of properly.

8.3 Only after the surveys indicate that both the person and his/her clothing are at the survey instruments background level or other release level specified by the RSO are they allowed to leave the restricted area of the Mill.

9.0 DOCUMENTATION

The RST is to file Forms RH-200A and RH-200B or their equivalent in the Safety Department Records and retain the records for three years.

Personnel Release Surveys Procedure RH-200

Appendix A

Personnel Survey Form RH-200A

Personnel Survey Form

Survey Date: ________________

Area Location: ____

Instrument Action Level	
Alpha	Beta-Gamma
cpm	cpm

Gross Meter Readings Not to Exceed Action Level (Level includes background and correction to 100 cm^2)

NOTES:
If Background for Alpha or Beta-Gamma Contamination is exceeded, then decontamination and resurvey is required before entry.
The recorded cpm readings include background
Call RST for assistance if not comfortable with performing a self-survey

Employee ID or Contact Phone No.	Name (include company if not an Energy Fuels Resources employee)	Total Alpha (per 100 cm^2)		Total Beta-Gamma (per 100 cm^2)		Contamination Found? (Y/N)	Location of Contamination on Personnel (Use Form RH-020A if contamination is found to document decontamination and resurvey)
		cpm	dpm	cpm	dpm		

Safety Department Use Only

Alpha Efficiency x Probe Factor: ____________________ Beta/Gamma Efficiency x Probe Factor: ____________________

Alpha Background: ________ cpm Meter Efficiency: ________ Beta/Gamma Background: ________ cpm Meter Efficiency: ________

Alpha Meter SN: ____________________ Beta/Gamma Meter SN: ____________________

Personnel Release Surveys Procedure RH-200

Appendix B

Quarterly Random Spot Check Form RH-200B

Quarterly Random Spot Check

		Initial				Removable				Other					
Employee Name	Employee ID No.	Right Hand	Left Hand	Right Foot	Left Foot	Right Hand	Left Hand	Right Foot	Left Foot	Item	Reading	Instrument No.	Source Check	Initial	Remarks

Comments: ____

____

____

Performed by ______________________ Employee Number ____________

Signature ______________________ Date ____________

Reviewed by ______________________ Employee Number ____________

Signature ______________________ Date ____________

Form RH-200B

1.0 PURPOSE

This procedure provides guidance and instruction for the use of personnel dosimeters by workers to determine estimates of external exposure to ionizing radiation at the Piñon Ridge Mill.

2.0 APPLICABILITY

Personal radiation dosimeters are issued to individuals at the Mill to provide an exposure estimate from external gamma radiation. As part of the As Low As Reasonably Achievable (ALARA) program, employees and contractors at the facility are issued Thermoluminescent Dosimeters (TLD) or Optically Stimulated Luminescence Dosimeters (OSL) if there is a potential that their dose from gamma rays could exceed 10% or more of the applicable radiation dose limit, i.e. 500 mrem/year.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 NRC Regulatory Guide 8.30, Health Physics Surveys in Uranium Recovery Facilities.

3.1.2 Colorado Rules and Regulations Pertaining to Radiation Control, Parts 4 and 10 (6 CCR 1007-1).

3.1.3 Radiation Exposure Action Levels Procedure RH-040.

3.2 *APPENDICES*

Appendix A – Lost or Broken TLD/OSL Badge Report Form RH-210A

4.0 EQUIPMENT AND MATERIALS

4.1 *EQUIPMENT*

4.1.1 Thermoluminescent Dosimeter (TLD) or Optically Stimulated Luminescent Dosimeter (OSL)

5.0 RESPONSIBILITY

5.1 The Radiation Safety Officer (RSO) is responsible for:

5.1.1 Assuring that TLD/OSL badge vendor is NVLAP certified.

5.1.2 Reviewing the TLD/OSL Occupational Radiation Exposure Report and the Occupational Exposure Record for a Monitoring Period.

5.1.3 Investigating any exposure results exceeding the action level guidelines. Refer to the Radiation Exposure Action Levels Procedure RH-040 for specific action levels associated with elevated dosimeter badge readings.

5.1.4 Determining any corrective actions that should be put into affect based on the investigation.

5.1.5 Reviewing the Lost or Broken TLD/OSL Badge Report (as needed) and the Lost Badge Report (yr) Spreadsheet (quarterly).

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

5.2 The Alternate RSO is responsible for:

5.2.1 Verifying shipment of received and shipped TLD/OSL badges.

5.2.2 Issuing TLD/OSL badges to the Safety/Security Technicians at the beginning of each new quarter.

5.2.3 Tracking lost and/or broken TLD/OSL badges.

5.2.4 Distributing the Occupational Exposure Record for a Monitoring Period.

5.2.5 Notifying the dosimetry vendor of additions to and deletions from the list of personnel designated to receive TLD's/OSL's.

5.2.6 Issuing to or receiving badges from personnel and storing the TLD/OSL badges at the guard shack.

5.2.7 Exchanging the badges once per quarter or when specified by the RSO.

5.2.8 Completing the Lost or Broken TLD/OSL Badge Report when a badge is reported lost or damaged.

5.3 Each Individual issued a radiation monitor is responsible for:

5.3.1 Wearing the badge while at work at the Mill.

5.3.2 Reporting lost or damaged badges to the Safety/Security Technician.

6.0 PREREQUISITE INFORMATION

6.1 *DEFINITIONS*

6.1.1 TLD – Thermoluminescent Dosimeter

6.1.2 OSL – Optically Stimulated Luminescent Dosimeter

6.1.3 NVLAP – National Voluntary Laboratory Accreditation Program

6.1.4 DDE – Deep Dose Equivalent

6.1.5 SDE – Shallow Dose Equivalent

6.1.6 LDE – Lens Dose Equivalent

6.1.7 EDE – Extremity Dose Equivalent

6.2 *FREQUENCY*

TLD/OSL badges are exchanged on a quarterly basis or more frequently as may be required by a Radiological Work Permit (RWP) and/or at the discretion of the RSO.

7.0 PROCEDURES

7.1 *ISSUANCE OF RADIATION DOSIMETERS*

7.1.1 Prior to issuance of a dosimeter, the RSO or Alternate RSO shall verify that individuals have received applicable training.

7.1.2 Individuals are issued personal radiation monitors by and shall return the monitors to the Alternate RSO or Radiation/Security Technician.

7.1.3 When not worn, TLD/OSL badges are stored on a badge board in the guard house.

7.1.4 Each TLD/OSL badge is identified by a unique badge number assigned by the vendor along with the name of the employee.

7.1.5 TLD/OSL badges or dosimeters should be worn on the trunk of the body, at or above the waist for whole body exposure estimates.

7.1.6 A minimum of two TLD/OSL control badges are stored along with the individual TLD/OSL badges at the guard house.

7.2 READING OF TLD/OSL BADGES

7.2.1 TLD/OSL badges will be read by a NVLAP certified vendor.

7.2.2 The TLD/OSL vendor issues a quarterly Occupational Exposure Report for a Monitoring Period within thirty days from the end of the calendar quarter, and a summary Occupational Radiation Exposure Report within sixty days from the end of the calendar year, which contains the following:

7.2.2.1 Personnel Identification

7.2.2.2 Name

7.2.2.3 Badge Number

7.2.2.4 Social Security Number

7.2.2.5 Birth Date

7.2.2.6 Date of Badge Issue

7.2.2.7 Date of Badge Return

7.2.2.8 Dose measured for the reporting period, calendar quarter, calendar year, and lifetime occupational dose.

7.2.2.9 Deep Dose Equivalent (DDE)

7.2.2.10 Shallow Dose Equivalent (SDE)

7.2.2.11 Permissible accumulated dose.

7.2.3 In the event a measurement exceeds the action level (see the Action Levels Procedure RH-040):

7.2.3.1 The TLD/OSL vendor will notify the RSO, or the Alternate RSO by telephone.

7.2.3.2 A Dosimeter High Call List is also received, via fax, reviewed by the RSO, and retained in the files by the Alternate RSO.

7.2.3.3 An investigation will be undertaken which will either substantiate the occurrence of measurement or describe the conditions that caused the measurement to be non-representative of the exposure that the badge holder actually sustained. The investigation will consist of:

- Discussion with the TLD/OSL vendor to determine potential analytical causes for the high reading
- Interview and the badge holder to determine potential incidents that may have caused excess exposure to the badge and/or badge holder

- Review of employee records to determine potential work conditions that caused a high exposure to the badge and/or badge holder
- Follow-up investigative procedures as determined appropriate by the RSO or Alternate RSO to determine the validity of the measurement
- Investigative measures and documents shall be recorded in writing and filed in the Safety Department files
- In the event that the measurement is determined to be invalid, the TLD/OSL vendor shall be instructed by the RSO or Alternate RSO to issue a corrected or qualified report

7.2.4 In the event the measurement is valid and exceeds the action level, the RSO will initiate such corrective action as is necessary in his/her opinion to reduce the current exposure condition going forward for the individual involved (such as reassignment to another area or use of additional personal protective equipment).

7.2.5 An incident of exposure of an individual to radiation in excess of the maximum permissible dose stipulated by Radiation Regulations will be reported in writing to the Colorado Department of Public Health and Environment (CDPHE) within 30 days from the date of the discovery of such exposure or as required by 6 CCR 1007-1, Section 4.52. This report shall include the following:

7.2.5.1 The name, date of birth and social security number of the affected person(s)

7.2.5.2 The amount of exposure

7.2.5.3 The cause of the exposure

7.2.5.4 Corrective actions taken or planned to prevent reoccurrence.

7.3 *NOTIFICATION AND REPORTS TO INDIVIDUALS*

Radiation exposure data for an individual and the results of any measurements, analyses, and calculations of radioactive material deposited or retained in the body of an individual shall be reported to the individual in writing as specified in 6 CCR 1007-1, Section 10.4.

7.3.1 Each individual will be provided with an annual report prepared in accordance with 6 CCR 1007-1, Section 4.18) of the dose received in that monitoring year if that individual:

7.3.1.1 Received an occupational dose greater than 100 mrem TEDE or 100 mrem to any individual organ or tissue; or

7.3.1.2 Requests an annual dose report.

7.3.2 A report of the worker's exposure to sources of radiation at the request of the individual who engaged in activities at the Mill.

7.3.3 Exposure data contained in reports submitted to CDPHE will also be concurrently provided to the subject individual.

7.3.4 Upon termination of employment from the Mill, a written report including the radiation dose received by a worker during the current year shall be provided upon request of the worker.

7.4 *DOCUMENTATION*

The Alternate RSO or designee shall file exposure reports, investigation reports, and notifications in the Safety Department Records and maintain them for 3 years.

7.5 *SPECIAL CONSIDERATIONS FOR BETA EXPOSURE*

Although the primary purpose of this procedure addresses monitoring and recording of the Deep Dose Equivalent (DDE) to workers from external gamma exposure, consideration may also need to be made in uranium mills for the potential for beta exposure (Shallow Dose Equivalent - SDE). This can occur when employees are exposed to “aged yellowcake” where sufficient time has elapsed from separation of the uranium from its ores resulting in growth of beta emitting progeny (e.g. Pa-234 and Th-234). This circumstance can potentially result in exposure to the skin and/or the extremities from extended close proximity to large quantities of aged yellowcake requiring provision for finger and/or wrist dosimeter badges to assess this potential exposure (as contrasted to the “whole body dosimeters” addressed by the previous sections of this procedure).

However, the “life cycle” of uranium through the milling process once extracted from ore is short (hours or days) and it requires approximately 4 months once extracted for equilibrium with these immediate beta emitting progeny to again reach equilibrium. Additionally, since the product is loaded and stored in steel drums immediately following precipitation and drying, the betas cannot exit the container causing exposure.

Accordingly, is highly unlikely that under conditions of routine operations or as a result of spills or maintenance activities, beta exposure rates to which workers could be exposed could result in shallow dose equivalents to the skin or the skin of extremities ≥ 10% of the limits per 6 CCR 1007-1, Section 4.6.1.2 requiring individual beta monitoring per Section 4.18.1.1. However, if these circumstances were to be identified, an ALARA analysis will be performed to evaluate needs for additional surveys and controls, including provisions for personnel beta monitoring (e.g., ring and/or wrist badges). (Note: 10 % of 50 rem/yr = 5 rem/yr)

Personal Radiation Dosimeters Procedure RH-210

Appendix A

Lost or Broken TLD/OSL Badge Report Form RH-210A

Lost or Broken TLD/OSL Badge Report Form

Employee Name ______________________________ Company ___________________________

Employee Number ______________________________ Hire Date ___________________________

Termination Date___________________________

Employee Signature ______________________________ Date ___________________________

WEARER _______ was not left in controlled area for the following reason:

LOST BADGE_____________ BROKEN BADGE__________ LEFT ELSEWHERE__________________

Describe the specific area, if known, where the badge/ring was left or lost:

____

REMARKS: ____

SAFETY DEPARTMENT ONLY

If lost badge was found, complete the following:

Date Found __________________ Area Found ____________________

If blank badge was issued, complete the following:

Badge Number________________ Date Issued ____________________

Reason for issue of blank badge: ____

____

Alternate RSO or RST (Print Name) Employee Number

Signature Date

RSO (Print Name) Employee Number

Signature Date

1.0 PURPOSE

This procedure describes the radiation dose calculation for personnel at the Piñon Ridge Uranium Mill. The Radiation Dose Calculations Procedure is divided into 3 sub-procedures (RH-301, RH-302 and RH-303).

2.0 APPLICABILITY

This procedure applies to Mill personnel (including employees, contractors and visitors) that are exposed to radiation. Doses will be calculated and assigned for any personnel reaching 10% of any exposure limit including Deep Dose Equivalent, Shallow Dose Equivalent Annual Limits on Intake (ALI), Derived Air Concentrations (DAC, assigned as "DAC-hrs"), and working levels (WL) related to radionuclide concentrations in air, results of bioassay samples and measurements.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 USNRC Regulatory Guide 8.30, "Health Physics Surveys in Uranium Recovery Facilities," 2002

4.0 RESPONSIBILITY

4.1 The Radiation Safety Officer (RSO) is responsible for:

4.1.1 Calculating and assigning the radiation doses of all personnel at the Mill that receive radiation doses in excess of 10% of the applicable limits, which is the level at which personal radiation monitoring is required.

4.1.2 Providing guidance to the Radiation Security Technician (RST) on how to monitor the radiation exposures of personnel at the Mill.

4.1.3 Review all radiation doses and trends in radiation doses to maintain radiation doses to levels that are As Low As Reasonably Achievable (ALARA).

4.2 The Radiation Security Technician (RST) is responsible for monitoring radiation exposures to personnel at the Mill.

5.0 PREREQUISITE INFORMATION

5.1 *FREQUENCY*

Dose assessments and assignments will be performed monthly, or more frequently as determined by the RSO.

6.0 PROCEDURES

6.1 This procedure is divided into three separate sub-procedures as follows:

- Procedure RH-301 Worker Exposure to Long-Lived Radionuclides in Airborne Particulate Matter
- Procedure RH-302 Radionuclide Concentrations in Air Samples Based on Gross Alpha Measurements and Laboratory Analyses
- Procedure RH-303 Dose Calculation Spreadsheets

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

6.2 Procedure RH-301 provides the procedure for collecting the breathing zone and general air samples used to determine worker exposures from inhalation of long-lived radionuclides in airborne particulate matter.

6.3 Procedure RH-302 describes the method for determining gross alpha and specific radionuclide concentrations in the breathing zone and general air samples from the laboratory analysis data.

6.4 Procedure RH-303 provides the methods for calculating worker radiation doses.

1.0 INTRODUCTION

Individual worker exposures to long-lived radionuclides in airborne particulate matter are calculated based on measured radionuclide concentrations in air and worker time-logs. Airborne radionuclide concentrations are measured for a worker, or a group of workers performing the same task in the same location, using breathing zone samplers sometimes called personal lapel samplers. Concentrations at specific locations in the Mill are measured using general air samplers.

Workers record the hours spent in particular locations in weekly time logs. The time logs are also used to track whether the individual wore a breathing zone sampler and/or used respiratory protection for part or all of the day. Worker exposures are calculated by multiplying the number of hours worked by the ratio of radionuclide concentrations determined from breathing zone samples to the appropriate DAC. This results in an exposure unit of Derived Air Concentration (DAC)-hours (“DAC-hours”). Where no concentration data are available from breathing zone samplers, worker exposures are calculated by multiplying the number of hours spent in particular locations in the Mill by the ratio of the average concentrations measured using general air samples to the appropriate DAC with exposure assignments similarly in DAC-hours.

2.0 OTHER DOCUMENTS

2.1 *REFERENCES*

2.1.1 Colorado Rules and Regulations Pertaining to Radiation Control, Part 4 (6 CCR 1007-1).

2.1.2 USNRC Regulatory Guide 8.25, “Air Sampling in the Workplace,” 1992

2.1.3 U.S. NRC Regulatory Guide 8.30, “Health Physics Surveys in Uranium Recovery Facilities,” 2002

2.1.4 Occupational General Air Particulate Survey Procedure RH-130.

2.1.5 Occupational Breathing Zone Monitoring Procedure RH-150.

2.2 *APPENDICES*

Appendix A – Determination that a Sample is an Outlier, Form RH-301A

3.0 BREATHING ZONE SAMPLES

Individual workers are issued breathing zone samplers when they are expected to be in a work environment in which they could receive an exposure to airborne radionuclides equal to or greater than 12 Derived Air Concentration (DAC)-hours in any week. The worker wears the sampler for a specified number of hours, generally for the entire work day. In some cases the sampler may be worn for only part of the day or for more than one day depending on the area and work to be performed, the expected radionuclide concentrations, and the intended use of the data. The Radiation/Security Technician (RST) issues the breathing zone samplers as described in the Occupational Breathing Zone Monitoring Procedure RH-150. The worker returns the breathing zone sampler at the end of his/her shift and completes the Breathing Zone Sample Issue/Collection Report

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

Form RH-150A. The Safety Department then submits the sample to the lab for analysis as soon as possible after the end of the shift.

The RST maintains a log of all samples which includes date, sample time, individual wearing the sampler, respirator protection used (if employee meets requirements for respiratory use and if applicable – see Section 6.0 below), work being performed, and, where applicable, the location of the work. This information is provided to the individual performing the dose calculations.

4.0 GENERAL AIR SAMPLES

General air samples are taken in several specific locations in Mill buildings as determined by the Radiation Safety Officer (RSO). The general air sampling method and specific locations are designated in Procedure RH-130. These samples are used to determine whether respiratory protection is necessary (i.e., concentrations greater than 25 percent of the area-specific DAC) and as a concentration measurement for workers at that location. The data are used in estimating the individual worker's radionuclide intakes for the purpose of dose calculation. General air samples are obtained from all work areas on a daily, weekly, or monthly schedule, depending on the location, the potential for exposure of workers, and the average fraction of the DAC based on prior sampling, as per Regulatory Guide 8.25, Air Sampling in the Workplace and Regulatory Guide 8.30, Health Physics Surveys in Uranium Recovery Facilities.

The data from general air samples are used in the intake calculations for workers when breathing zone data are not available. The worker's work-hour logs are used to estimate the number of hours the worker was exposed to the air concentrations represented by the general air sample.

The employee work hours are assigned to general air sample results based on work hour logs that record time spent in each particular area of the mill. The inhalation intake calculation spreadsheet notes whether the concentration value was based on a breathing zone sample or on the average value for general air samples.

5.0 TREATMENT OF ANOMALOUS SAMPLE RESULTS

Occasionally the results of a breathing zone or general air sample show gross alpha or specific nuclide concentrations that are inconsistent with previous data, either significantly higher or lower. In such instances, the RSO or Alternate RSO investigates the potential cause for the anomalous sample. In general the sample is considered an outlier if it is more than 10 times higher or 10 times lower than the previous average values for the particular location, activity and/or job category or if the sample is greater than 50 percent of the DAC.

5.1 For breathing zone outliers, the RSO or Alternate RSO takes the following steps:

5.1.1 Verify that the sampler was handled appropriately by checking with the RST who issued it and the wearer.

5.1.2 Submit a Data Verification Request to the Laboratory.

5.1.3 Check the sample submittal form to verify that the data on the form are correct (e.g., correct sample volume).

5.1.4 Review work records and/or interview the wearer of the breathing zone sampler to determine whether anything out of the ordinary occurred and to verify that the wearer was actually in the area to which he was initially assigned.

5.1.5 Compare the anomalous concentration with previous breathing zone or general air sample results.

5.1.6 Use the data in the intake calculation for the worker unless it is clear that the sample is invalid, e.g. the sampler was dropped in a drum of yellowcake or the pump was not pulling the expected amount of air through the filter.

5.2 For anomalous general air samples, the area will be re-sampled as soon as practicable under the conditions similar to those existing when the initial sample was taken. If the RSO or Alternate RSO determines on the basis of his investigation that the sample is not valid, that decision will be documented on the Determination that a Sample is an Outlier Form RH-301A.

6.0 APPLICATION OF RESPIRATORY PROTECTION FACTORS

Workers are required to wear respiratory protection in areas where the gross alpha or uranium concentration might exceed 25 percent of the area-specific DAC based on analysis of general air samples. The area-specific DACs are as given in Procedure RH-302, Table 2.

The protection factor for the type of respirator used is applied to the measured concentration for the number of hours the respirator was worn during the period of time covered by the breathing zone or general air sample. The protection factors provided in Part 4 of 6 CCR 1007-1 will be used when the individual has passed/met the requirements for the applicable fit test (quantitative or qualitative).

7.0 SAMPLE COMPOSITES

Based on the judgement of the RSO or Alternate RSO, breathing zone samples for a particular individual may be composited to increase the volume of air represented by the sample and to improve the Lower Limit of Detection for the air concentration and/or enhance the representativeness of the exposure data. Such composites are noted on the dose calculation spread sheets.

8.0 DOSE CALCULATION

The dose calculations are described in detail in Procedure RH-303. Intakes in DAC-hours are calculated at least on a monthly basis for the purpose of determining the need for additional bioassay and/or work restrictions. The Committed Effective Dose Equivalent (CEDE) for intake of radionuclides is calculated quarterly based on the specific radionuclide concentrations and the number of hours the worker is exposed. The specific radionuclide concentrations are derived from the general air or breathing zone sample laboratory analyses for gross alpha and specific radionuclides as described in the attached radionuclide apportionment method (Procedure RH-302).

Worker Exposed to Long-Lived Radionuclides in Airborne Particulate Matter RH-301

Appendix A

Determination that Sample is an Outlier, Form RH-301A

Determination That Sample Is an Outlier

Sample ID________________________

Type of sample____________________

Location_________________________

Date of Sample Collection___________

Gross alpha concentration __________________

or

U-nat concentration________________________

Reason for determination that sample is an outlier:

____

____

____

____

____

1.0 INTRODUCTION

Airborne concentrations of radioactive materials are determined from breathing zone and general air samples that are obtained by passing a measured volume of air through a filter. The filter is then analyzed in the laboratory to determine its radionuclide content. The concentration of radioactive materials in air is determined by dividing the radioactivity on the filter by the volume of air that flowed through it.

The gross alpha activity on an air filter may need to be apportioned among natural Uranium and associated long lived decay products according to the relative concentrations in the bulk material being processed at the Mill and based on the results of specific radionuclide analysis of the filter. That is, the measured specific radionuclide concentrations, if any, will be subtracted from the final gross alpha concentration and the remainder apportioned among the other nuclides. For the purpose of determining airborne radionuclide concentrations, U-nat activity is equal to the activity of U-238 plus U-234 and the very small contribution of activity from U-235 and its decay series is ignored.

However, it is important to note that since the ore to be processed by the Piñon Ridge Mill is expected to be typical of the "Colorado Plateau". No elevated levels of natural Thorium-232 and its associated progeny or other "unusual" radionuclide characteristics are expected. Accordingly, only three relatively consistent "radionuclide mixes in air" are expected:

(1) That associated with front end processes involving ore in which it can be assumed that the airborne radionuclide mixture is natural uranium in full equilibrium with its progeny.

(2) That associated with tailings areas in which it can be assumed that the airborne radionuclide mixture is full equilibrium of progeny minus the vast majority of U-238 and U-234.

(3) Yellowcake processing areas in which it can be assumed that any airborne radionuclides are essentially exclusively natural uranium without progeny.

During initial plant operations, radionuclide characterization of air particulate filters will be performed to determine if these assumptions can be validated. If so, gross alpha counting can be then used with these assumed radionuclide mixes for each process area as applicable to determine appropriate DACs and dose conversion factors. Nonetheless, the remainder of this procedure can and will be used should more complex radionuclide mixtures in air be encountered.

Tables 1 lists the uranium series decay products along with their dose conversion factors. Assuming all of the radionuclides in each of the decay series are in secular equilibrium with the parent, the short-lived alpha emitting decay products and the beta/gamma emitters contribute no more than 2 percent of the dose from uranium and thorium and do not need to be accounted for in the analysis.

The following sections describe the method by which radionuclide concentrations are determined from the laboratory analysis data. Section 2 provides a description of the Decision Flow Charts (Figures 1 and 2). Section 3 includes the methods by which the

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RSO		
Plant Manager		

ratios of radionuclides in airborne dust are determined. Section 4 describes the methods by which the gross alpha concentrations are apportioned among the radionuclides potentially present on the filter.

2.0 DECISION FLOW CHART

The attached Figures 1 and 2 are Decision Flow Charts for the determination of radionuclide concentrations in general air or breathing zone samples. Figure 1 applies to all samples. Figure 2 applies to the product areas. Routine and special breathing zone and general air samples are taken from all areas of the plant periodically according to the requirements of the radioactive materials license and the type of work being performed. The methods by which the radionuclide concentrations are attributed to the various radionuclides potentially present in the air are described in Section 4.

2.1 Samples taken from locations on the site other than the product area are routinely counted for gross alpha activity. In rare cases air filters may have excessive dust or debris deposits so gross alpha analysis is not feasible. These samples are analyzed radiochemically for specific radionuclides. In areas where the gross alpha concentration may exceed the area-specific Derived Air Concentration (DAC) an initial gross alpha count will be requested. The area-specific DACs, given in Table 2, will depend on the relative radionuclide concentrations in the material to be processed. The activity on the filter will include Rn-222 decay products if the sample is counted within a few hours of collection. Typically, if practical, counting of filters will be delayed a minimum of 4 hours to allow for decay of the short lived radon progeny.

2.1.1 If the initial gross alpha result indicates that the radionuclide concentration may exceed the DAC listed in Table 2 for the particular area of the plant from which it was taken, the sample is analyzed for U-nat, Th-230 and Ra-226. The isotopic concentrations are apportioned as per <u>Method 6</u> (Section 4.7). The gross alpha measurement is not used in determining the airborne concentration. Specific isotopic analysis precludes a final gross alpha analysis, i.e., after Rn-222 progeny have decayed out.

2.1.2 If the initial gross alpha result indicates that the area-specific DAC listed in Table 2 will not be exceeded, a final gross alpha measurement is made after the sample has been stored for at least one day to allow the Rn-222 progeny to decay out.

2.2 If the final gross alpha measurement indicates concentrations greater than 10 percent of the U-nat DAC given in Table 2, the sample is analyzed to determine the mass of U-nat.

2.2.1 If the U-nat concentration accounts for more than 90 percent of the gross alpha, the remainder of the gross alpha is apportioned among Th-230 and Ra-226 as per <u>Method 4</u> (Section 4.4).

2.2.2 If the U-nat concentration accounts for less than 90 percent of the gross alpha, the sample is also analyzed for Th-230. The remainder of the gross alpha is attributed to Ra-226 (Method 3, Section 4.3).

2.2.3 If the final gross alpha measurement indicates concentrations less than 10 percent of the U-nat (Y) DAC given in Table 2 but greater than 10 percent of the Th-230 (Y) DAC given in Table 2, the filter is analyzed for Th-230. The remainder of the gross alpha is apportioned between U-nat and Ra-226 according to Method 2 (Section 4.2).

2.2.4 If the final gross alpha measurement indicates concentrations less than 10 percent of the Th-230 DAC, no specific radionuclide analyses are required. The gross alpha activity is apportioned according to Method 1 (Section 4.1).

2.2.5 If the sample has been taken from the product area where uranium constitutes nearly all of the airborne radioactivity and yellowcake appears to be on the filter, it is analyzed for uranium and the uranium concentration calculated directly from the laboratory data (Method 5a, Section 4.5). If no visible yellowcake residue is present, the filter is analyzed for gross alpha activity and the total gross alpha activity is attributed to U-nat (Method 5b, Section 4.6).

3.0 CALCULATION OF RADIONUCLIDE RATIOS FOR THE PURPOSE OF APPORTIONING THE GROSS ALPHA MEASUREMENT

Energy Fuels processes Colorado Plateau uranium ores. For most Colorado Plateau uranium ores the natural thorium concentrations are negligible (i.e. 0.02 percent thorium).

The theoretical fraction of the total gross alpha activity for each of the nuclides in a material that contains natural thorium as well as uranium will be calculated as follows:

3.1 Assume a total of 4 long-lived alpha emitters for the U-238 decay series (U-238, U-234, Th-230, and Ra-226).

3.2 In the bulk ore, the ratio of radionuclides can be calculated as follows:

Total Gross Alpha activity Concentration (TGAC) = [U-238 pCi/g)(4)]

Fraction from each nuclide:

$F_{U\text{-}nat} = 0.50$

$F_{Th\text{-}230} = 0.25$

$F_{Ra\text{-}226} = 0.25$

4.0 GROSS ALPHA APPORTIONMENT

As noted in the previous sections, all samples except those from the yellowcake area, are routinely analyzed for gross alpha. In some cases, specific radionuclide analyses are also performed. The spreadsheets for worker dose calculations list the results for uranium, thorium, and radium analyses whenever these laboratory analyses were performed. At least 100 percent of the gross alpha activity from air samples is accounted for in the determination of the air concentrations of radionuclides except where specific radionuclide analyses are performed for U-nat, Th-230 and Ra-226. The measured concentrations will be used in the dose calculations in such cases regardless of the gross alpha concentration. Gross alpha concentration measurements are generally less accurate than the specific radionuclide analyses. The only long-lived alpha emitter that is not accounted for by the analyses for U-nat, Th-230 and Ra-226 is Po-210. The Po-210 inhalation dose coefficient is a factor of approximately 10 lower than the U-238 dose coefficient and a factor of 30 lower than the Th-230 dose coefficient. Therefore, Po-210 would not contribute significantly to the dose.

In cases where uranium and/or thorium concentrations are specifically measured and the concentrations exceed the gross alpha concentration, i.e., the gross alpha concentration to be apportioned to the other nuclide(s) is a negative value, the remaining nuclide(s) will be assigned a concentration of zero. In the early phases of Mill operation, radioisotopic analyses of air filters will be performed. The nuclide apportionment ratios of radionuclides below may be revised based on these analyses.

Nuclide Apportionment

4.1 ***METHOD 1*: Used for samples analyzed only for gross alpha activity**

Activity of U-nat (U-238 + U-234) = [gross alpha activity][0.50]

Activity of Th-230 = [gross alpha activity][0.25]

Activity of Ra-226 = [gross alpha activity][0.25]

4.2 ***METHOD 2*: Used for samples analyzed for gross alpha and Th-230**

Activity of Th-230 = measured value

Activity of U-nat = [gross alpha activity – (Th-230 activity)][0.67]

Activity of Ra-226 = [gross alpha activity – (Th-230 activity)][0.33]

4.3 ***METHOD 3*: Used for samples analyzed for gross alpha, Th-230 and U-nat**

Activity of Th-230 = measured value

Activity of U-nat = measured mass (g) x 0.68 μCi/g

Activity of Ra-226 = gross alpha – (Th-230 + U-nat activity)

4.4 ***METHOD 4*: Used for samples analyzed for gross alpha and U-nat**

Activity of U-nat = measured U-nat mass (g) x 0.68 μCi/g

Activity of Th-230 = [gross alpha – U-nat activity][0.5]

Activity of Ra-226 = [gross alpha – U-nat activity][0.5]

4.5 ***METHOD 5a*: Used for samples from the product area analyzed for U-nat**

Activity of U-nat = measured U-nat mass (g) x 0.68 μCi/g

4.6 ***METHOD 5b*: Used for samples from the product area analyzed only for gross alpha**

Activity of U-nat = measured gross alpha activity

4.7 *METHOD 6*: Used for samples analyzed for Th-230, U-nat and Ra-226

Activity of U-nat = measured mass (g) x 0.68 μCi/g

Activity of Th-230 = measured value

Activity of Ra-226 = measured value

5.0 SOLUBILITY CLASS DETERMINATION

In all cases, Ra-226 is assumed to be International Commission of Radiological Protection (ICRP) 68 lung clearance Type M (equivalent to ICRP solubility Class W) and Th-230, ICRP 68 lung clearance Type S (equivalent ICRP 30 solubility Class Y). The lung clearance class for U-nat depends on the process and the location in the Mill. Based on information in U.S. Nuclear Regulatory Commission Regulatory Guides 8.22 and 8.30, NUREG 0874, and NUREG 3598, the current assumptions regarding solubility or lung clearance class for uranium are as follows: Class Y (equivalent to ICRP 68 lung clearance Type S) for locations where ore is handled prior to chemical separation and Class D (equivalent to ICRP 68 clearance Type F) for those locations with undried yellowcake or yellowcake dried at <400° C (which is the expected thermal environment of modern vacuum dryers). Where the solubility for a specific bulk material (e.g. yellowcake) has been analyzed, the lung clearance class will be determined based on the laboratory data.

6.0 ALTERNATE APPORTIONMENT IF LABORATORY DATA REQUIRED FOR THE PARTICULAR METHOD ARE NOT AVAILABLE

In the event laboratory data on specific radionuclide concentrations are not available for a sample either due to loss of the sample or inability to perform the required analyses according to Figure 1, the method of apportioning the gross alpha activity will default to <u>Method 1</u> (Section 4.1). If gross alpha and Th-230 activities are available but not U-nat, the gross alpha will be apportioned according to <u>Method 2</u> (Section 4.2). If U-nat concentrations but not Th-230 activity are available, <u>Method 4</u> (Section 4.4) will be used to apportion the gross alpha count.

Table 1
U-238 Decay Series Dose Coefficients (ICRP 68[1])

Nuclide	Half-life	Type of emissions	ICRP 68 Dose Coefficients[1] (Sv/Bq)	Considered in dose calculation?
U-238	4.51E9 y	Alpha	7.3E-6 (S)	Yes
Th-234	24 d	Beta	7.3E-9 (S)	No
Pa-234m	1.17 m	Beta	None given	No
U-234	2.35E5 y	Alpha	8.5E-6 (S)	Yes
Th-230	8.0E4 y	Alpha	1.3E-5 (S)	Yes
Ra-226	1.6E3 y	Alpha	1.6E-5 (M)	Yes
Rn-222	3.8 d	Alpha	NA	Yes – but taken into account separately as WL
Po-218	3.0 m	Alpha	NA	Yes (see Rn-222)
Pb-214	26.8 m	Beta/gamma	NA	Yes (see Rn-222)
Bi-214	19.7 m	Beta/gamma	NA	Yes (see Rn-222)
Po-214	164 μs	Alpha	NA	Yes (see Rn-222)
Pb-210	22 y	Beta	8.7E-7 (F)	No
Bi-210	5 d	Beta	8.4E-8 (M)	No
Po-210	138 d	Alpha	3.0E-6 (M)	Yes – not specifically, but in the gross alpha except where specific radionuclide analyses are performed.
Total Dose Coefficient			4.9 E-5	
Total Dose Coefficient for nuclides not taken into account			9.6E-7	
Fraction Dose Coefficient not taken into account			0.02	

1) ICRP 30 Dose Conversion Factors shall be used for calculations until such time CDPHE approves the use of ICRP 68 Dose Coefficients in a formal amendment to the radioactive material license.

Table 2
Area-specific Derived Air Concentrations (extracted from the *Colorado Rules and Regulations Pertaining to Radiation Control, Part 4, Table 4B1*)

Area	DAC	Justification
Ore Handling/ SAG Mill	6E-11 µCi/ml gross-α 3E-11 µCi/ml U-nat	Ore Dust DAC, footnote 3 of Table 4B1
Leach/ Solvent Extraction	2E-11 µCi/ml U-nat	Class Y U-nat DAC
Kiln/ Uranium Product	3E-10µCi/ml U-nat	Class W U-nat DAC[1]

1) Yellowcake product is in fact expected to be Class D, but Class W will be assumed until the dryer operating conditions are verified – see Section 5.0 above.

Figure 1

Decision Flow Chart
Determination of Radionuclide Concentrations in Routine Air Samples

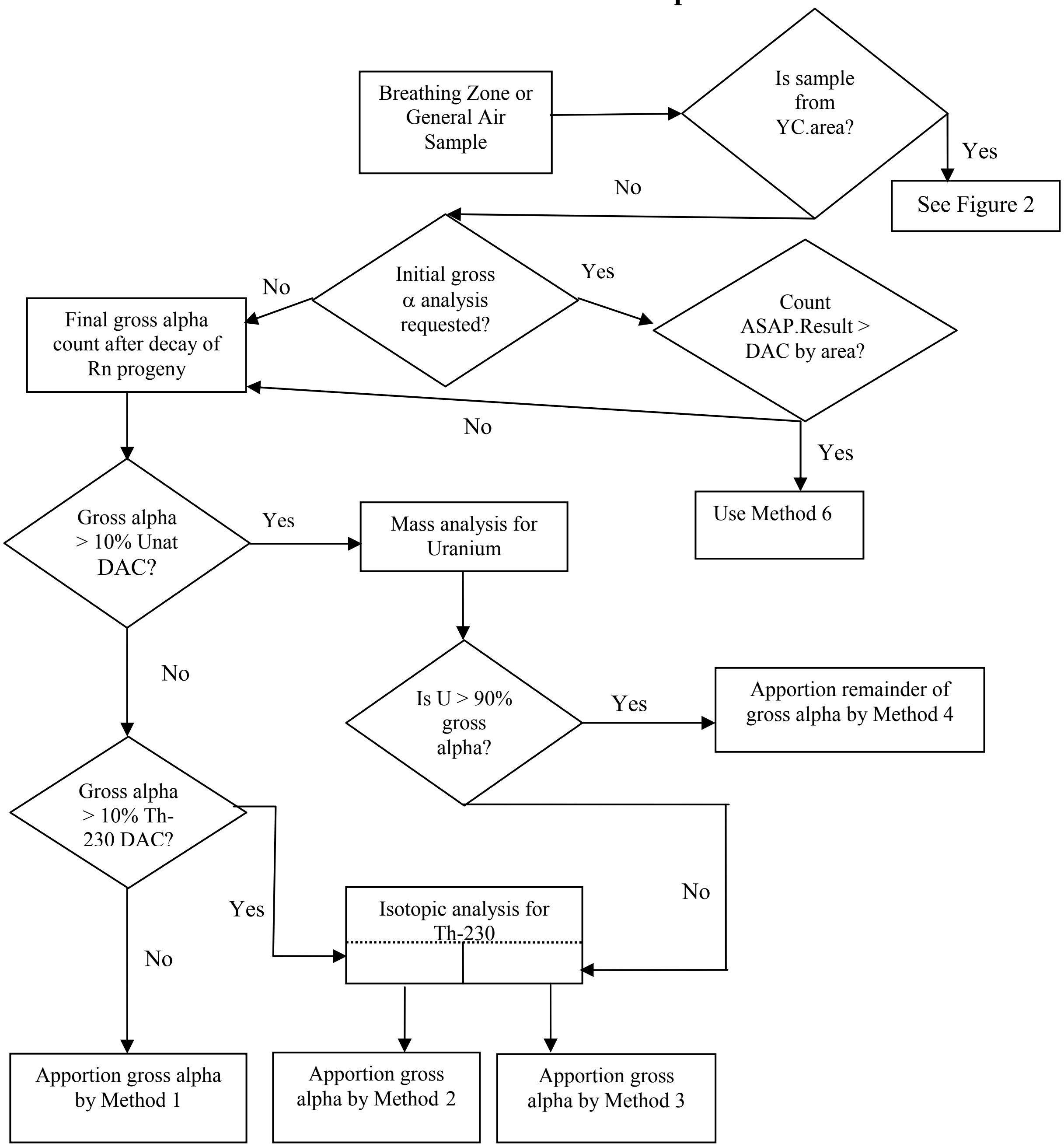
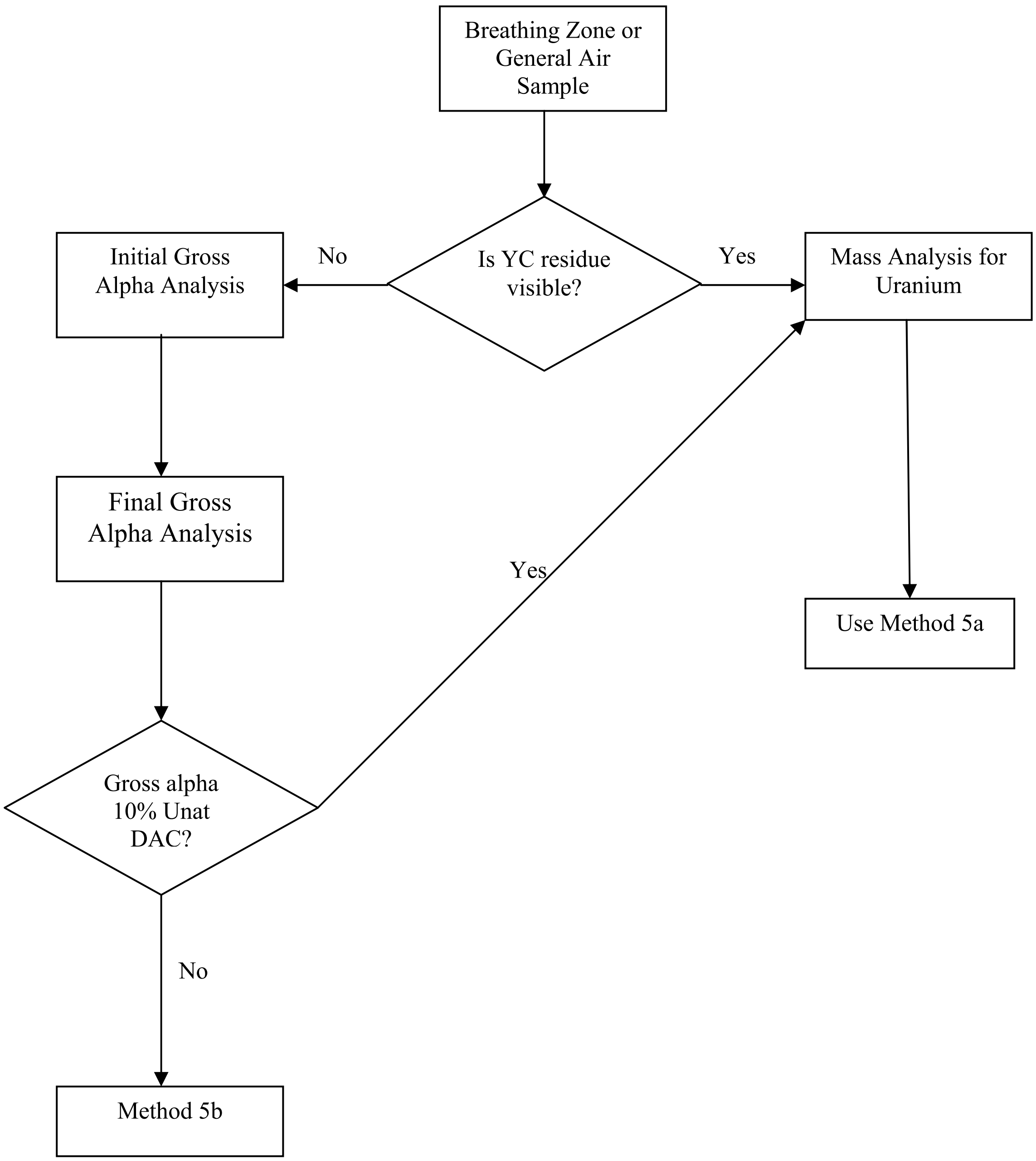


Figure 2
Decision Flow Chart
Determination of Uranium Concentrations
in Product Area Air Samples
at the Milling Facility



1.0 INTRODUCTION

Worker radiation doses are calculated based on inhalation intake of radionuclides in airborne particulate matter, inhalation intake of radon decay products, bioassay results and direct radiation dose from external sources. Spreadsheets are used to estimate the inhalation doses. Bioassay data may be used to calculate internal dose at the discretion of the RSO if it is believed it is more representative of the intake of radionuclides into the body than air sampling data. Regarding calculation of internal dose (CEDE) from air sampling and/or bioassay data, ICRP 30 dosimetry models will be used unless and until CDPHE approves use of the more recent ICRP 68 models via a formal amendment the radioactive material license. External radiation doses are taken directly from the vendor reports and entered into a dose calculation spreadsheet.

2.0 OTHER DOCUMENTS

2.1 *APPENDICES*

Appendix A – Example Total Summary Table

Appendix B – Example Organ Dose Calculation Spreadsheet

3.0 INHALATION OF LONG-LIVED RADIONUCLIDES

The individual worker's intake of long-lived radionuclides is calculated based on breathing zone and/or general air samples as described in Procedure RH-301.
Annual average concentrations of long-lived radionuclides in air for particular areas in the Mill are calculated based on the general air samples. The measured concentrations are averaged quarterly and used to calculate quarterly radionuclide intakes. Concentrations measured on breathing zone samples are used for assigning a specific radionuclide concentration to a particular employee, or group of employees performing a specific task in the same location.

The inhalation intake calculation spreadsheet tracks the radionuclide intake by worker using the air concentration data, occupancy data from the worker time logs, and use of respiratory protection. A sample inhalation intake form is attached. Table 1 provides a key to the inhalation intake calculation spreadsheet.

3.1 *RADON DECAY PRODUCT DOSE CALCULATION*

Doses due to Rn-222 decay product exposure are calculated as follows:

Exp. (WLM) = [conc. (WL)][(hours of exp.)][(12 months/y)]/[2000 h/year]

Dose = [exp. (WLM)][5 rem]/[4 WLM]

where:

WLM = exposure in Working Level Months

WL = Working Level measured concentration of Rn-222 or Rn-220 decay products

Annual Limit of Intake (ALI) for Rn-222 decay products = 4 WLM

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

3.2 *DOSE CALCULATION SPREADSHEET*

As noted in Procedure RH-300, committed effective dose equivalents (CEDEs) for workers are calculated using International Commission on Radiological Protection (ICRP) 30 effective dose conversion factors to demonstrate compliance with the stochastic occupational dose limit of 5 rem per year. The dose limit for individual organs (non-stochastic dose limit) is 50 rem per year (except skin and lens of the eye that have separate non-stochastic dose limits based on external doses). Regulatory guidance notes that organ doses only need to be calculated when the CEDE exceeds 1 rem (Reg Guide 8.34, *Monitoring Criteria and Methods to Calculate Occupational Radiation Doses*, July 1992).

The attached spreadsheets contain example data illustrating CEDE and Organ Dose Equivalent (ODE) calculations. Tables 2 and 3 describe the columns in the spreadsheets.

This procedure and the spreadsheets use the terminology specified in the regulations (i.e. terms associated with ICRP 30 dose conversion factors) even though the more recent ICRP dose calculation system (ICRP 68/ICRP 103) uses slightly different terminology. Table 4 gives a glossary of equivalent terms.

Table 1: Inhalation Intake Estimates Spreadsheet Explanation

Col. A	Employee ID #
Col. B	Employee Name/Job Assignment
Col. C	Work Area #
Col. D	Sample Collection Date
Col. E	Sample ID – multiple numbers indicate a composite sample
Col. F	Natural Uranium concentration (S, formerly Y) – Air Sample Results (μCi/ml)
Col. G	Radium-226 concentration (M, formerly W) – Air Sample Results (μCi/ml)
Col. H	Thorium-230 concentration (S, formerly Y) – Air Sample Results (μCi/ml)
Col. I	Thorium-232 Concentration (S, formerly Y) – Air Sample Results (μCi/ml)
Col. J	Uranium (F, formerly D) concentration – Air Sample Results (μCi/ml)
Col. K	Gross Alpha Concentration – Air Sample Results (μCi/ml)
Col. L	Method Code
Col. M	BZ Sample VOL – sample volume (liters)
Col. N	BZ Sample MIN – sample minutes = Col. M/2 lpm
Col. O	EXPOSURE HRS – sample hours = Col. N/60 min/hr or Assigned exposure hours
Col. P	Liters Breathed = Col. O x 1200 l/hr (breathing rate)
Col. Q	PF – protection factor assigned to respiratory protection
Col. R	Note – explanation of source of respiratory protection information (i.e. work log or radiation/security technician)
Col. S	Hours worked – Hours worked during quarter based on work records. This is used as a cross check to verify totals assigned to exposure
Col. T	Estimated inhalation intake - μCi U-nat class S (formerly Y) = Col. P x Col. F x 1000 ml/l Total = sum of Col. T
Col. U	Estimated inhalation intake - μCi Ra-226 Class M (formerly W) = Col. P x Col. G x 1000 ml/l Total = sum of Col. U
Col. V	Estimated inhalation intake - μCi Th-230 Class S (formerly Y) = Col. P x Col. H x 1000 ml/l Total = sum of Col. V
Col. W	Estimated inhalation intake - μCi Th-232 Class S (formerly Y) = Col. P x Col. I x 1000 ml/l Total = sum of Col. W
Col. X	Estimated inhalation intake - μCi U-nat Class F (formerly D) = Col. P x Col. J x 1000 ml/l Total = sum of Col. X
Col. Y	Estimated inhalation intake of soluble uranium – mg U-nat Class F (formerly D) Intake = Col. X /[(6.77E-7 μCi/μg)(1000 μg/mg)]
Col. Z	Estimated total intake of equilibrium equivalent Rn-222 – entered from the WL spreadsheet
Col. AA	Estimated intake of equilibrium equivalent Rn-222 by quarter – entered from WL spreadsheet

Table 2: Total Summary Table Explanation

Column	Content	Explanation (Reference to Intake Spreadsheet Column in Italics)
Col. A	Emp. #	
Col. B	Emp. Name	
Col. C	Job Description	
Col. D	Hours worked	
Col. E	U-238 (Y) intake	Total *Col. T*/2 Performed to apportion equal amounts of U-nat (S, formerly Y)to U-238 and U-234
Col. F	U-234 (Y) intake	Total *Col. T*/2 Performed to apportion equal amounts of U-nat (S, formerly Y) to U-238 and U-234
Col. G	U-238 (D) intake	Total *Col. X*/2 Performed to apportion equal amounts of U-nat (F, formerly D) to U-238 and U-234
Col. H	U-234 (D) intake	Total *Col. X*/2 Performed to apportion equal amounts of U-nat (F, formerly D) to U-238 and U-234
Col. I	Ra-226 (W) intake	Total *Col. U*
Col. J	Th-230 (Y) intake	Total *Col. V*
Col. K	Th-232 (Y) intake	Total *Col. W*
Col. L	Rn-222 Exposure (WLM)	*Total Col Z*
Col. M	Rn-220 Exposure (WLM)	[Rn-220 WL (from Rn-220 data sheet)][2000 hr/y/170 h/M]
Col. N	Rn-222 CEDE	[Col. L (Rn-222 intake)][5 rem/4 WLM]
Col. O	Rn-220 effective dose	[Col. M(Rn-220 intake)][5 rem/12 WLM]
Col. P	Total CEDE	Sum[Total intake for nuclide I x Effective Dose Coefficient from ICRP 68 spreadsheet for nuclide I] + Col. N + Col. O
Col. Q	DDE	From Vendor TLD report
Col. R	TEDE	Col. P + Col. Q
Col. S	U intake (mg)	[Col. E + Col. F + Col. G + Col. H]/[6.67E-4 μCi/mg]
Col. T	Class D U intake (mg)	[Col. G + Col. H]/[6.67E-4 μCi/mg]
Col. U	U intake (mg/wk)	From Intake Calculation Spreadsheet *Col. Y*

Table 3: Organ Dose Calculation Spreadsheet Explanation

Column	Content	Explanation (Reference to Intake Spreadsheet Column in Italics)
Col. A	Emp. #	
Col. B	Emp. Name	
Col. C	Job Descrip.	
Col. D	Hours worked	
Col. E	U-238 (Y) intake	Total *Col. T*/2, Performed to apportion equal amounts of U-nat (S, formerly Y)to U-238 and U-234
Col. F	U-234 (Y) intake	Total *Col. T*/2, Performed to apportion equal amounts of U-nat (S, formerly Y) to U-238 and U-234
Col. G	U-238 (D) intake	Total *Col. X*/2, Performed to apportion equal amounts of U-nat (F, formerly D) to U-238 and U-234
Col. H	U-234 (D) intake	Total *Col. X*/2, Performed to apportion equal amounts of U-nat (F, formerly D) to U-238 and U-234
Col. I	Ra-226 (W) intake	Total *Col. U*
Col. J	Th-230 (Y) intake	Total *Col. V*
Col. K	Th-232 (Y) intake	Total *Col. W*
Col. L	Rn-222 intake	Total *Col Z*
Col. M	Rn-220 intake	[Rn-220 WL (from thoron data sheet)][2000 hr/y/170 h/M]
Col. N	Rn-222 CEDE	[Col. L][5 rem/4 WLM]
Col. O	Rn-220 CEDE	[Col. M][5 rem/12 WLM]
Col. P	Rn-222 Lung Dose	[Col. N]/0.12 Note: the organ (tissue) weighting factor for the lung is 0.12
Col. Q	Rn-220 Lung Dose	[Col. O]/0.12
Col. R	Total Bone Dose	Sum[Total intake for nuclide I x Bone Dose Coefficient from ICRP 68 spreadsheet for nuclide I]
Col. S	Total Lung Dose	Sum[Total intake for nuclide I x Lung Dose Coefficient from ICRP 68 spreadsheet for nuclide I] + Col. P + Col. Q

Table 4: ICRP Terminology

Conventional Terminology	Equivalent ICRP 68 Terminology
Committed Effective Dose Equivalent (CEDE)	Effective Dose (ED)
Organ Dose Equivalent (ODE)	Committed Equivalent Organ Dose
Solubility Class Y (years)	Lung Clearance Class S (slow)
Solubility Class W (weeks)	Lung Clearance Class M (moderate)
Solubility Class D (days)	Lung Clearance Class F (fast)
Dose Conversion Factor	Dose Coefficient

Dose Calculation Spreadsheets Procedure RH-303

Appendix A

Example Total Summary Table

Example Total Summary Table

Job Description	Hours Worked	U-238 uCi (Y)	U-234 uCi (Y)	U-238 uCi (D)	U-234 uCi (D)	Ra-226 uCi (W)	Th-230 uCi (Y)	Th-232 uCi (Y)	Rn-222 WLM	Rn-220 WLM
Analyst	2941.75	0.00037	0.00037	5E-07	5E-07	0.00068	0.00072	0.00024	0.1589	0.00588
Analyst	1344.5	0.00019	0.00019	0	0	0.00019	0.0001	8.8E-06	0.0565	0.00588
Lab Manager	2762.5	0.00021	0.00021	5E-06	5E-06	0.00021	0.00014	1E-05	0.1309	0.00588
Analyst	3049	0.00037	0.00037	1E-06	1E-06	0.00065	0.00068	0.00022	0.1229	0.00588
Operator	1375	0.00029	0.00029	2E-05	2E-05	0.00077	0.00032	7.9E-05	0.0597	0.00588
Utility-LC	2117	0.00038	0.00038	6E-06	6E-06	0.00045	0.0002	1.4E-05	0.0757	0.00588
General Mill Foreman	2717	0.0003	0.0003	0.0002	0.0002	0.00033	0.00016	3.2E-05	0.1523	0.00588
Utillity-LL	2173	0.00049	0.00049	4E-05	4E-05	0.00044	0.00019	8.2E-06	0.0855	0.00588
QA/QC Coord.	2229.75	0.00012	0.00012	3E-08	3E-08	0.00011	0.00011	1E-05	0.088	0.00588
Maint. Foreman	2083.25	0.00024	0.00024	0.0001	0.0001	0.00028	0.00017	3.5E-05	0.099	0.00588
Sr RST	2179.5	0.00032	0.00032	3E-06	3E-06	0.00032	9.5E-05	1.8E-05	0.086	0.00588
Foreman	2229.25	0.00031	0.00031	0	0	0.00031	0.00023	1.3E-05	0.1059	0.00588
Accounting Clerk	2253	0.00011	0.00011	0	0	0.00011	0.00011	9.4E-06	0.1035	0.00588
RST	2029	0.00019	0.00019	6E-08	6E-08	0.00021	0.00024	2.6E-05	0.0765	0.00588
SST	1962	0.00017	0.00017	0	0	0.00017	7.1E-05	6E-06	0.0718	0.00588
SST	1786	0.00023	0.00023	0	0	0.00023	8.5E-05	5.6E-06	0.0662	0.00588
EC/RSO	2559	0.00015	0.00015	3E-06	3E-06	0.00016	0.00013	1.5E-05	0.1121	0.00588
Sr RST	2485	0.00051	0.00051	0.0002	0.0002	0.00041	0.00018	2.8E-05	0.1235	0.00588
HSS	2378	0.00015	0.00015	7E-06	7E-06	0.00016	0.00014	1.2E-05	0.1161	0.00588
Maintenance	1450.5	0.00027	0.00027	8E-05	8E-05	0.00037	0.00015	1E-05	0.0637	0.00588
SST	1929	0.00017	0.00017	0	0	0.00017	6.7E-05	5.7E-06	0.0627	0.00588
Shift Foreman	1951.25	0.0002	0.0002	0.0003	0.0003	0.00028	0.00012	2.5E-05	0.1062	0.00588
Analyst	2534	0.00033	0.00033	0	0	0.0006	0.00062	0.0002	0.1064	0.00588
SF/met tech	2146.5	0.00056	0.00056	8E-05	8E-05	0.00045	0.00022	1E-05	0.1056	0.00588
Op-ADU/SF	2215	0.00112	0.00112	0.0006	0.0006	0.00042	0.00023	1.6E-05	0.0837	0.00588
SST	1928.5	0.00018	0.00018	0	0	0.00018	6.8E-05	5.8E-06	0.0741	0.00588
Maintenance	2008.5	0.00028	0.00028	5E-05	5E-05	0.00029	0.00016	3.5E-05	0.0793	0.00588
Maint. Foreman	2205.25	0.00033	0.00033	3E-05	3E-05	0.00039	0.00019	4.1E-05	0.0847	0.00588
Warehouse Superv.	2445	0.00013	0.00013	0	0	0.00013	0.00013	1.3E-05	0.2472	0.00588
Analyst	2151.3	0.0003	0.0003	3E-05	3E-05	0.00051	0.0005	0.00016	0.0919	0.00588
Instrument	1710	0.00019	0.00019	0	0	0.00019	0.00019	1.6E-05	0.0683	0.00588
Utility/Crusher	1037	0.00013	0.00013	2E-06	2E-06	0.00013	5.5E-05	4.5E-06	0.0358	0.00588

Note: The data contained in this Table is for example only.

Example Total Summary Table (continued)

Rn-222 CEDE rem	**Rn-220 CEDE rem**	**CEDE rem**	**DDE rem**	**TEDE rem**	**U mg**	**Uranium mg (D)**	**Uranium mg/wk**		
0.199	0.0025	0.2858	0.082	0.368	0.001	0.001455	2.91E-05		
0.071	0.0025	0.0925	0.082	0.174	0	0	0	**AVG TEDE**	
0.164	0.0025	0.1883	0.087	0.275	0.014	0.013666	0.000273	0.260201949	Full-time
0.154	0.0025	0.237	0.09	0.327	0.003	0.003323	6.65E-05	**MAX TEDE**	
0.075	0.0025	0.1253	0.075	0.2	0.069	0.069231	0.001385	0.476007354	All Staff
0.095	0.0025	0.1353	0.197	0.332	0.019	0.019192	0.000384	**Median TEDE**	
0.19	0.0025	0.2255	0.1	0.325	0.554	0.55386	0.011077	0.262996899	Full-time
0.107	0.0025	0.1532	0.205	0.358	0.107	0.107383	0.002148		
0.11	0.0025	0.1267	0.086	0.213	9E-05	8.52E-05	1.7E-06		
0.124	0.0025	0.1548	0.086	0.241	0.325	0.32549	0.00651		
0.108	0.0025	0.1385	0.101	0.239	0.01	0.00986	0.000197		
0.132	0.0025	0.1687	0.148	0.317	0	0	0		
0.129	0.0025	0.1457	0.115	0.261	0	0	0		
0.096	0.0025	0.1253	0.121	0.246	2E-04	0.000177	3.54E-06		
0.09	0.0025	0.1081	0.113	0.221	0	0	0		
0.083	0.0025	0.1058	0.094	0.2	0	0	0		
0.14	0.0025	0.1604	0.077	0.237	0.01	0.010238	0.000205		
0.154	0.0025	0.2038	0	0.204	0.67	0.670352	0.013407		
0.145	0.0025	0.1661	0.097	0.263	0.022	0.021956	0.000439		
0.08	0.0025	0.1107	0.126	0.237	0.228	0.228175	0.004564		
0.078	0.0025	0.0966	0.094	0.191	0	0	0		
0.133	0.0025	0.1594	0.126	0.285	0.744	0.744151	0.014883		
0.133	0.0025	0.2092	0.099	0.308	0	0	0		
0.132	0.0025	0.1847	0.115	0.3	0	0.246234	0.004925		
0.105	0.0025	0.1925	0.161	0.353	0	1.837194	0.036744		
0.093	0.0025	0.1112	0.114	0.225	0	0	0		
0.099	0.0025	0.1318	0.108	0.24	0	0.15167	0.003033		
0.106	0.0025	0.1452	0.104	0.249	0	0.097832	0.001957		
0.309	0.0025	0.3282	0.09	0.418	0	0	0		
0.115	0.0025	0.1784	0.096	0.274	9E-04	0.078779	0.001576		
0.085	0.0025	0.1116	0.025	0.137	0.001	0	0		
0.045	0.0025	0.0591	0.073	0.132	2E-04	0.006075	0.000121		

Note: The data contained in this Table is for example only.

Dose Calculation Spreadsheets Procedure RH-303

Appendix B

Example Organ Dose Calculation Spreadsheet

Example Organ Dose Calculation Spreadsheet

Empl #	Name	Job Description	Hours Worked	U-238 uCi (Y)	U-234 uCi (Y)	U-238 uCi (D)	U-234 uCi (D)	Ra-226 uCi (W)	Th-230 uCi (Y)	Th-232 uCi (Y)	Rn-222 WLM	Rn-220 WLM
1		Analyst	2941.75	0.00037	0.00037	4.9E-07	4.9E-07	0.00068	0.00072	0.0002	0.1589	0.00588
2		Analyst	1344.5	0.00019	0.00019	0	0	0.00019	0.0001	9E-06	0.0565	0.00588
3		Lab Manager	2762.5	0.00021	0.00021	4.6E-06	4.6E-06	0.00021	0.00014	1E-05	0.1309	0.00588
4		Analyst	3049	0.00037	0.00037	1.1E-06	1.1E-06	0.00065	0.00068	0.0002	0.1229	0.00588
5		Operator	1375	0.00029	0.00029	2.3E-05	2.3E-05	0.00077	0.00032	8E-05	0.0597	0.00588
6		Utility-LC	2117	0.00038	0.00038	6.5E-06	6.5E-06	0.00045	0.0002	1E-05	0.0757	0.00588
7		General Mill Foreman	2717	0.0003	0.0003	0.00019	0.00019	0.00033	0.00016	3E-05	0.1523	0.00588
8		Utillity-LL	2173	0.00049	0.00049	3.6E-05	3.6E-05	0.00044	0.00019	8E-06	0.0855	0.00588
9		QA/QC Coord.	2229.75	0.00012	0.00012	2.9E-08	2.9E-08	0.00011	0.00011	1E-05	0.088	0.00588
10		Maint. Foreman	2083.25	0.00024	0.00024	0.00011	0.00011	0.00028	0.00017	3E-05	0.099	0.00588
11		Sr RST	2179.5	0.00032	0.00032	3.3E-06	3.3E-06	0.00032	9.5E-05	2E-05	0.086	0.00588
12		Foreman	2229.25	0.00031	0.00031	0	0	0.00031	0.00023	1E-05	0.1059	0.00588
13		Accounting Clerk	2253	0.00011	0.00011	0	0	0.00011	0.00011	9E-06	0.1035	0.00588
14		RST	2029	0.00019	0.00019	6E-08	6E-08	0.00021	0.00024	3E-05	0.0765	0.00588
15		SST	1962	0.00017	0.00017	0	0	0.00017	7.1E-05	6E-06	0.0718	0.00588
16		SST	1786	0.00023	0.00023	0	0	0.00023	8.5E-05	6E-06	0.0662	0.00588
17		EC/RSO	2559	0.00015	0.00015	3.5E-06	3.5E-06	0.00016	0.00013	2E-05	0.1121	0.00588
18		Sr RST	2485	0.00051	0.00051	0.00023	0.00023	0.00041	0.00018	3E-05	0.1235	0.00588
19		HSS	2378	0.00015	0.00015	7.4E-06	7.4E-06	0.00016	0.00014	1E-05	0.1161	0.00588
20		Maintenance	1450.5	0.00027	0.00027	7.7E-05	7.7E-05	0.00037	0.00015	1E-05	0.0637	0.00588
21		SST	1929	0.00017	0.00017	0	0	0.00017	6.7E-05	6E-06	0.0627	0.00588
22		Shift Foreman	1951.25	0.0002	0.0002	0.00025	0.00025	0.00028	0.00012	3E-05	0.1062	0.00588
23		Analyst	2534	0.00033	0.00033	0	0	0.0006	0.00062	0.0002	0.1064	0.00588
24		SF/met tech	2146.5	0.00056	0.00056	8.3E-05	8.3E-05	0.00045	0.00022	1E-05	0.1056	0.00588
25		Op-ADU/SF	2215	0.00112	0.00112	0.00062	0.00062	0.00042	0.00023	2E-05	0.0837	0.00588
26		SST	1928.5	0.00018	0.00018	0	0	0.00018	6.8E-05	6E-06	0.0741	0.00588
27		Maintenance	2008.5	0.00028	0.00028	5.1E-05	5.1E-05	0.00029	0.00016	3E-05	0.0793	0.00588
28		Maint. Foreman	2205.25	0.00033	0.00033	3.3E-05	3.3E-05	0.00039	0.00019	4E-05	0.0847	0.00588
29		Warehouse Superv.	2445	0.00013	0.00013	0	0	0.00013	0.00013	1E-05	0.2472	0.00588
30		Analyst	2151.3	0.0003	0.0003	2.7E-05	2.7E-05	0.00051	0.0005	0.0002	0.0919	0.00588
31		Instrument	1710	0.00019	0.00019	0	0	0.00019	0.00019	2E-05	0.0683	0.00588
32		Utility/Crusher	1037	0.00013	0.00013	2.1E-06	2.1E-06	0.00013	5.5E-05	5E-06	0.0358	0.00588

Note: The data contained in this spreadsheet is for example only.

Example Organ Dose Calculation Spreadsheet (continued)

Rn-222 CEDE	Rn-220 CEDE	Rn-222 Lung DE	Rn-220 Lung DE	Total Bone DE	Total Lung DE
rem	rem	rem	rem	rem	rem
0.19857	0.00245	1.65473	0.020425	0.9463232	2.2377933
0.07059	0.00245	0.58822	0.020425	0.1152485	0.7526974
0.16368	0.00245	1.36398	0.020425	0.1541625	1.5458005
0.15367	0.00245	1.28058	0.020425	0.8902153	1.8396989
0.07466	0.00245	0.62219	0.020425	0.4123341	0.9799667
0.09463	0.00245	0.78858	0.020425	0.2242548	1.0925034
0.19033	0.00245	1.58605	0.020425	0.2135364	1.8421811
0.10691	0.00245	0.89093	0.020425	0.2047313	1.2444673
0.11004	0.00245	0.91696	0.020425	0.1157994	1.0385645
0.12375	0.00245	1.03121	0.020425	0.2109103	1.2555285
0.10756	0.00245	0.89632	0.020425	0.1206037	1.1349008
0.13242	0.00245	1.10348	0.020425	0.2436997	1.3689431
0.12933	0.00245	1.07775	0.020425	0.1192049	1.1957153
0.09557	0.00245	0.79638	0.020425	0.2636143	1.0041016
0.08976	0.00245	0.74801	0.020425	0.0802286	0.8885285
0.08278	0.00245	0.68984	0.020425	0.0955675	0.8669682
0.14011	0.00245	1.16754	0.020425	0.1412058	1.3148519
0.15435	0.00245	1.28624	0.020425	0.234432	1.6576812
0.14518	0.00245	1.20981	0.020425	0.149032	1.3611882
0.07963	0.00245	0.6636	0.020425	0.1728501	0.8946159
0.07841	0.00245	0.65345	0.020425	0.0761192	0.793069
0.13281	0.00245	1.10672	0.020425	0.169032	1.2976349
0.13304	0.00245	1.10863	0.020425	0.8142698	1.6196763
0.13201	0.00245	1.10008	0.020425	0.2481707	1.4993469
0.10466	0.00245	0.87216	0.020425	0.2935905	1.5453229
0.09257	0.00245	0.7714	0.020425	0.0775499	0.9147726
0.09912	0.00245	0.826	0.020425	0.1983085	1.0669183
0.10585	0.00245	0.8821	0.020425	0.2380971	1.1722099
0.30899	0.00245	2.57489	0.020425	0.1447316	2.7132428
0.11488	0.00245	0.95733	0.020425	0.6487653	1.3871909
0.08541	0.00245	0.71179	0.020425	0.2042732	0.8993606
0.0448	0.00245	0.37332	0.020425	0.0618068	0.4828031

Note: The data contained in this spreadsheet is for example only.

1.0 PURPOSE

This procedure provides for prenatal radiation exposure training of women of reproductive age, for radiation monitoring of declared pregnant women, and for the calculation of dose to the embryo-fetus.

2.0 APPLICABILITY

This procedure applies to women of reproductive age who are Energy Fuels employees or contractors working at the Piñon Ridge Mill.

3.0 OTHER DOCUMENTS

3.1 *REFERENCES*

3.1.1 Colorado Radiation Control Regulations (6 CCR 1007-1) Part 4 Standards for Protection Against Radiation.

3.1.2 CDPHE Part 10 Notices Instructions and Reports to Workers.

3.1.3 U.S. Nuclear Regulatory Commission Regulatory Guide 8.13, Instruction Concerning Prenatal Radiation Exposure, Revision 3, June 1999.

3.2 *APPENDICES*

Appendix A - Energy Fuels Resources Policy on Declared Pregnant Women

Appendix B - Declaration of Pregnancy Form RH-310A

4.0 EQUIPMENT AND MATERIALS

4.1 *MATERIALS*

4.1.1 Regulatory Guide 8.13 or the equivalent.

5.0 RESPONSIBILITY

5.1 The Radiation Safety Officer (RSO) or Alternate RSO is responsible for:

5.1.1 Providing Prenatal Radiation Exposure Training

5.1.2 Calculating the dose to the embryo-fetus

5.1.3 Recording the radiation dose to declared pregnant women and the embryo-fetus

5.2 The Radiation/Security Technician (RST) is responsible for:

5.2.1 Radiation monitoring of declared pregnant women

5.2.2 Filing and retain Form RH-310A

5.2.3 Filing and retain the radiation doses for the embryo-fetus

6.0 PREREQUISITE INFORMATION

6.1 *DEFINITIONS*

6.1.1 CEDE - Committed Effective Dose Equivalent.

6.1.2 TEDE - Total Effective Dose Equivalent.

6.1.3 DDE - Deep Dose Equivalent.

APPROVALS	*Signature*	*Date*
RSO		
Plant Manager		

6.1.4 Declared Pregnant Woman - Woman who has voluntarily informed Energy Fuels in writing of her pregnancy and the estimated date of conception.

6.2 ***FREQUENCY***

6.2.1 One-time training of females of reproductive age.

6.2.2 Upon receipt of declaration of pregnancy provide additional radiation monitoring.

6.2.3 During and at the end of a pregnancy of a radiation worker the RSO or Alternate RSO calculates the radiation dose to the embryo-fetus.

7.0 PROCEDURES

7.1 The RSO or Alternate RSO shall provide prenatal radiation exposure instruction to all females of reproductive age who are likely in a year to receive an occupational dose in excess of 0.1 rem (6 CCR 1007-1 10.3). The instruction may include providing each trainee a copy of the U.S. Nuclear Regulatory Commission Regulatory Guide 8.13, *Instruction Concerning Prenatal Radiation Exposure,* and/or a copy of this procedure. Classroom or individual instruction, and/or videotaped presentations may be used in place of the written materials. The RSO or Alternate RSO may be contacted by the declared pregnant woman for additional information. Training will be documented on Form RH-010A which will be filed and retained.

7.2 After a woman who receives occupational radiation exposures at the mill knows she is pregnant, she is requested, but not required, to declare her pregnancy on the attached form RH-310A or the equivalent. That declaration must be in writing, contain the estimated date of conception, and be given to the RSO or Alternate RSO. If the woman chooses not to declare her pregnancy, she and her embryo-fetus will continue to be subject to the same radiation dose limits that apply to other occupational workers, i.e. 5 rem/yr.

7.3 The RSO or Alternate RSO shall monitor the radiation exposures of declared pregnant women if they are likely to receive a deep dose equivalent in excess of 0.1 rem.

7.4 The dose to an embryo-fetus during the entire pregnancy due to occupational exposure of a declared pregnant woman shall not exceed 0.5 rem. If the dose to the embryo-fetus is equal to or greater than 0.45 rem before her declaration of pregnancy, then an additional dose may not exceed 0.05 rem for the remainder of the pregnancy (6 CCR 1007-1 4.13).

7.5 The RSO or Alternate RSO are to ensure that the dose to the declared pregnant woman is substantially uniform so that all the 0.5 rem allowed dose does not occur in a short period during the pregnancy. Monthly doses greater than 0.1 rems are to be justified.

7.6 Calculate the dose to the embryo-fetus as follows:

7.6.1 The 9-month gestation internal dose equivalent is calculated by:

$CEDE_g$ = (I)(TF)(DF)

Where:

$CEDE_g$ = 9-month gestation committed effective dose equivalent
I = Radionuclide intake by the pregnant woman during her pregnancy in µCi.
TF = Transfer fraction (from mother to fetus)
DF = Dose factor in rem/µCi

The transfer fraction and dose factor applicable to an inhalation dose at the Mill were derived using USNRC Regulatory Guide 8.36. They are presented in the following table where one can specify the intakes for each radionuclide, calculate the dose for each radionuclide, and the total 9-month gestation dose equivalent.

9-Month Gestation Dose Equivalent

Radionuclide	Intake in µCi	Transfer fraction	Dose Factor[(a)]	rem/ nuclide
U-234 (S)		7.90E-02	5.84E-01	
U-238 (S)		7.90E-02	5.10E-01	
U-234 (F)		4.88E-01	5.84E-01	
U-238 (F)		4.88E-01	5.10E-01	
Ra-226 (M)		2.22E-01	1.69E+00	
Th-230 (S)		5.01E-02	1.26E+01	
Th-232 (S)		5.01E-02	2.26E+01	
			TOTAL DOSE	

Where:
(S) = Slow absorption
(M) = Moderate absorption
(F) = Fast absorption
(a) = ICRP 68 dose factors in rem/µCi.

7.6.2 The pre-existing body-burden dose equivalent from embryo-fetal burdens existing at the time of conception is calculated by:

$CEDE_c$ = (SA)(DF)

Where:

$CEDE_c$ = The committed effective dose equivalent from embryo-fetal burdens at the time of conception

SA = The nuclide burden existing at time of conception in μCi for each radionuclide

DF = The dose factors listed in the above table.

7.6.3 The Deep Dose Equivalent (DDE) for the embryo-fetus is the whole-body dose to the pregnant woman and the embryo fetus during her pregnancy, usually measured using Thermoluminescent Dosimeters (TLD) or Optically Stimulated Luminescence Dosimeters (OSL).

7.6.4 The Total Effective Dose Equivalent (TEDE) to the embryo-fetus from mill operations is the 9-month gestation dose minus the preexisting body-burden dose, plus the deep dose equivalent as shown below:

$TEDE = CEDE_g - CEDE_c + DDE$

7.7 The records of the dose to the embryo-fetus are to be kept by the Alternate RSO and retained.

Declared Pregnant Worker Procedure RH-310

Appendix A

Energy Fuels Resources Policy on Declared Pregnant Women Form RH-310A

Energy Fuels Resources Policy
On
Declared Pregnant Women

June 2009

Energy Fuels Resources will limit the occupational radiation exposures to the embryo-fetus of declared pregnant women to 0.5 rem (5 mSv) for their entire pregnancy. A declared pregnant woman is a woman who has voluntarily informed Energy Fuels in writing of her pregnancy and the estimated date of conception. Energy Fuels will avoid substantial variation above a uniform monthly dose rate during the pregnancy so that all or most of the 0.5 rem allowed dose would not occur in a short period during the pregnancy. The declared pregnant woman may be reassigned to a job involving a lower radiation exposure during her pregnancy than was received on her job before her declaration of pregnancy. The written declaration of pregnancy is to be given to Energy Fuels Radiation Safety Officer or Alternate Radiation Safety Officer.

____
Vice President of Regulatory Affairs

Declared Pregnant Worker Procedure RH-310

Appendix B

Declaration of Pregnancy Form RH-310B

Declaration Of Pregnancy Form

To: Energy Fuels Radiation Safety Officer or Alternate Radiation Safety Officer

In accordance with Colorado CDPHE Radiation Control Regulations RH 4.13, "Dose to an Embryo/Fetus," I declare that I am pregnant. I believe I became pregnant in

_______________ ________.
month year

I understand the radiation dose to my embryo-fetus during my entire pregnancy will not be allowed to exceed 0.5 rem (5 millisievert) unless that dose has already been exceeded between the time of conception and submitting this letter. I also understand that meeting the lower dose limit may require a change in job or job responsibilities during my pregnancy.

____
(Your Signature)

____
(Your Name Printed)

____
(Date)