

WHITE MESA MILL
RADIATION SAFETY TRAINING PROGRAM

1. Overview

This program outlines the radiation safety training (including respiratory protection training) that will be given to all Mill workers, as well as to contractors and visitors at the Mill.

Radiation safety training for workers at the White Mesa Mill is comprised of an initial four-hour comprehensive session for all newly hired “inexperienced” Mill workers and a one-hour session for all newly hired “experienced” Mill workers. White Mesa Inc. employees who work at the Mill are considered to be Mill workers and will receive the same radiation safety training as Denison employees.

The purpose of the initial training is to instruct all Mill workers on the inherent risks of exposure to radiation and the fundamentals of protection against exposure to uranium and its daughters before beginning their jobs.

The initial radiation safety training is supplemented by annual one-hour re-fresher training sessions which are provided to all facility workers.

In addition, contractors performing work at the Mill are required to be given appropriate training and safety instruction, and there are training requirements applicable to visitors at the Mill. Special pre-natal training is required for female Mill workers.

2. Definition of Experienced vs. Inexperienced Mill Workers

Newly hired Mill workers will be considered to be “experienced” Mill workers if:

- (a) They have received the full 24-hour training for newly hired employees, including the four-hour radiation safety training, at the Mill within the previous five years;
- (b) They were previous Mill workers who satisfied the initial training requirements at the Mill at some time in the past, and completed their last annual refresher training, including radiation refresher training, within the last five years; or
- (c) They have satisfied either (a) or (b) at another facility that the RSO has determined has a comparable radiation safety training program.

All other newly hired Mill workers are considered to be “inexperienced” Mill workers, and are required to take the full four-hour initial radiation safety training described in Section 3 below.

Newly hired experienced Mill workers are required to take the one-hour initial radiation safety training described in Section 4 below.

3. Initial Radiation Training For Newly Hired Inexperienced Mill Workers

All newly hired inexperienced Mill workers are required to be provided a four-hour radiation training session as part of their initial 24-hour training required by MSHA. This training will be provided by the Mill's RSO or Safety Coordinator or by a designee from the Radiation or Safety Departments that meets the instructor requirements established by MSHA and that has adequate knowledge and experience of radiation safety matters as determined by the RSO. The topics to be covered in this initial four-hour training session are set out in Appendix A. The Alpha Contamination Training Acknowledgement Form, Radiation Exposure Request Form and any other form or document referred to in Appendix A are attached as Appendix B.

Employees are required to document that they have received their initial training by signing the attendance list for the training session. These training lists are maintained on file with the Radiation Safety Department.

In addition, each newly hired inexperienced worker may, at the discretion of the instructor, be provided with handouts for his or her review and reference, such as one or more of the documents entitled "Radiation Protection at the White Mesa Mill," or "Radiation Information Handout (Summary of Key Concepts)" set out in Appendix C.

4. Initial Radiation Training For Newly Hired Experienced Mill Workers

All newly hired experienced Mill workers are required to be provided a one-hour radiation training session as part of their initial eight-hour training required by MSHA. This training will be provided by the Mill's RSO or Safety Coordinator or by a designee from the Radiation or Safety Departments that meets the instructor requirements established by MSHA and that has adequate knowledge and experience of radiation safety matters as determined by the RSO. The topics to be covered in this initial one-hour training session are set out in Appendix D.

Employees are required to document that they have received their initial training by signing the attendance list for the training session. These training lists are maintained on file with the Radiation Safety Department.

Each newly hired experienced worker may, at the discretion of the instructor, be provided with handouts for his or her review and reference, such as one or more of the documents entitled "Radiation Protection at the White Mesa Mill," or "Radiation Information Handout (Summary of Key Concepts)" set out in Appendix C.

5. Respirator Protection Training

The initial four hour training course for new inexperienced workers includes training for respirator users. The topics to be covered are included in Appendix A. This training will include hands-on training, and will take place prior to fit-testing.

Under the respirator protection training for newly hired inexperienced Mill workers, each worker will:

- (a) be informed of the hazard to which the respirator wearer may be exposed, the effects of contaminants on the wearer if the respirator is not worn properly, and the capabilities and limitations of each device that may be used;
- (b) be shown how spectacle adapters communications equipment, and other equipment that will be used directly in conjunction with the respirator are to be attached and operated properly;
- (c) be able to demonstrate competency in donning, using, and removing each type of respiratory protective device that may be used;
- (d) be instructed in how to inspect each type of respiratory protective device that may be used and be instructed to perform such an inspection before donning any device;
- (e) be instructed in how to perform a user seal check on face-sealing devices and be instructed to perform this user seal check each time this type of device is donned;
- (f) be informed that any 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; and
- (g) be advised that in case of respirator malfunction or wearer distress, the respirator may be removed as the respirator user exits the airborne contamination area.

The initial training course for newly hired experienced Mill workers will include training for respirator users as necessary, at the discretion of the instructor, depending on the level of knowledge and experience of the worker, and will generally include, at a minimum, the items listed in paragraphs (b), (c), (d), (e) and (f) above.

6. Annual Refresher Radiation Training

All Mill workers receive eight-hours of refresher training in accordance with the Mill's MSHA training plan each year. This training includes one hour of radiation safety training, including relevant information that may become available during the past year, a review of safety problems that arose during the year, changes in regulations and license conditions, exposure trends and other current topics. This eight-hour annual refresher training is normally divided into 10 modules, one or more of which comprises the required one-hour radiation safety training.

The annual refresher radiation training will be provided by the Mill's RSO or Safety Coordinator or by a designee from the Radiation or Safety Departments that meets the instructor requirements established by MSHA and that has adequate knowledge and experience of radiation safety matters as determined by the RSO. An example of the topics to be covered in the refresher training session(s) is set out in Appendix E.

Workers are required to document that they have received their annual refresher training by signing the attendance list for the training session. These training lists are maintained on file with the Radiation Safety Department.

In addition, further radiation safety training may, at the discretion of the RSO, be given at other monthly or periodic safety meetings.

7. Tests For Newly Hired Mill Workers

As a component of the initial training program for both newly hired inexperienced and newly hired experienced Mill workers, as well as for annual refresher training for all Mill workers, written tests on radiation safety and respiratory protection are required to be completed. The radiation safety test will have questions directly relevant to the principles of radiation safety and health protection covered in the initial training course for newly hired inexperienced Mill workers. An example of this written test is set out in Appendix F. The respiratory protection test will have questions directly relevant to respiratory protection and the proper use of respiratory protection equipment covered in the initial training course for newly hired inexperienced Mill workers. An example of the respiratory protection test is set out in Appendix G. The questions on these tests will be changed from time to time.

Employees are required to attain a passing score of 70% on each of these tests in order to proceed or continue with Mill related work assignments. After completion of the tests, the instructor will review the test results with each worker. Any wrong answers will be discussed with the worker until he/she fully understands the subject of the question and the correct answer. Workers who fail either test will receive additional training and be re-tested until a passing score is attained. All test results are maintained on file with the Radiation Safety Department.

In special circumstances, where it is not possible or practicable for the individual to take one or both of the written tests, the RSO or his designee may give the tests orally. In those circumstances, the RSO or his designee will make a written record of the questions asked and answers given. This record will be maintained on file in the Radiation Safety Department.

8. Specialized Training

In addition to the new hire training and refresher training described in items 3, 4, 5 and 6 above, all new workers (including supervisors) are given specialized training on health and radiation aspects of their specific jobs, including non-radiological hazards. New workers are first provided with their initial radiation safety training described in items 3, 4 and 5 above. When the worker gets to his or her particular job, the supervisor will give the worker individualized on-the-job training. This training typically does not cover radiation protection, to the extent it is already covered in the initial training. If specific radiation protection issues exist for any particular job, or new job (such as may result for a new alternate feed material), such issues would typically be addressed in a new Procedure or Radiation Work Permit ("RWP") or, in certain circumstances, by specific training given by the RSO or his designee. In all cases, the training should be commensurate with the risks and hazards of the task.

Specific radiation protection training is normally given on any new Procedure or RWP either at a regularly scheduled radiation and safety meeting or at a radiation and safety meeting held for the affected workers, prior to implementation of any such Procedure or RWP. New employees that

are required to be given training on Procedures or RWPs or other training specific to their jobs will be given such training prior to commencement of their jobs.

Such specialized training will be provided by the Mill's RSO or Safety Coordinator or by their designees. Workers are required to document that they have received any specialized training on a new Procedure by signing the attendance list for the training session. These training lists are maintained on file with the Radiation Safety Department. With respect to RWPs, any required training is given verbally by the member of the Radiation Safety Department who issues the RWP.

If determined necessary by the RSO, supervisors will be provided additional specialized training on their supervisory responsibilities in the area of worker radiation protection. However, given the nature of Mill operations and activities, the comprehensive training given to all workers, including supervisors, and the supervisory role on radiation safety matters provided by the Radiation Safety Department, such specialized training for supervisors is usually not required. Any such specialized training will be documented and kept on file in the Radiation Safety Department.

In addition, radiation safety matters of concern that may arise during Mill operations or activities will, at the discretion of the RSO, be discussed with all affected workers during regular meetings, such as tailgate meetings for maintenance and/or operations personnel, or at specially called radiation safety meetings.

9. Visitors At The Mill

All visitors at the Mill who have not received radiation training must be escorted by a properly trained individual who is knowledgeable about the hazards at the Mill. Such individual will instruct visitors on what they should do to avoid possible radiological and non-radiological hazards in the areas of the facility they will be visiting as an element of providing escort to the visitor.

10. Contractors At The Mill

Any contractors receiving work assignments at the Mill will be given appropriate training and safety instruction. Contractors who provide services on a full-time or long term basis or who will perform work on heavily contaminated equipment will be given the same training regime as Mill workers. However, only job-specific radiation safety instruction is necessary for contract workers who have previously received full training on prior work assignments at the Mill or have previously received full training elsewhere. Casual or short term contractors having work assignments at the Mill, where there is little or no risk of any significant exposure to radiation, are given abbreviated job-specific training and safety instructions specific to their assignments. In all cases, the training should be commensurate with the risks and hazards of the task.

A copy of the packet given to contractors is attached as Appendix H. Contractors are required to sign the packet acknowledging their acceptance thereof. Contractors that receive the same training as newly hired Mill workers will be required to sign an attendance list for the training session. These training lists will be maintained on file in the Radiation Safety Department. Where such training is not required, basic radiation training is given to contractors verbally,

unless more specific training is required, which will be addressed on a case by case basis and will be provided by the RSO or his designee.

11. Pre-Natal Training

In addition to the foregoing training requirements, pre-natal training is provided to all female workers pertaining to the content and requirements of NRC Reg. Guide 8.13 while attending the initial “new-hire” training session. A copy of NRC Reg. Guide 8.13 is attached as Appendix I. These workers are required to sign the form attached as Appendix J, attesting to the fact that they have received this pre-natal training.

12. RSO Training

The Mill’s RSO will attend refresher training on uranium recovery facility health physics every two years.

APPENDIX A

**RADIATION SAFETY TRAINING OUTLINE FOR NEWLY HIRED INEXPERIENCED
MILL WORKERS**

RADIATION AND RESPIRATORY PROTECTION SAFETY TRAINING OUTLINE FOR NEWLY HIRED INEXPERIENCED MILL WORKERS:

1. Video – “Practical Radiation Safety” or “Radiation Naturally”

2. Fundamentals of Health Protection

- a. The radiologic and toxic hazards of exposure to uranium and its daughters
 - i. U-238 is a kidney toxin
 - ii. Lungs
 - iii. Liver
 - iv. Skin
- b. How uranium and its daughters enter the body
 - i. Inhalation
 - ii. Ingestion
 - iii. Skin penetration
- c. Why exposures to uranium and its daughters should be kept ALARA
 - i. Definition/explanation of the ALARA principle
 - ii. Identification of postings in elevated areas
 - iii. Reference potential hazards with material and why it is important to maintain levels to ALARA
- d. Different types of radiation
 - i. Alpha
 1. Will not penetrate dead layer of skin
 2. Travels about 2 inches in air
 3. Can be blocked by a single sheet of paper
 4. Large particle that is the easiest to protect against, but the one that can cause the most damage when taken internally. The delicate internal workings of the living cell forming the lining of the lungs or internal organs, most certainly will be changed (mutated) or killed outright by the energetic alpha particle.
 5. Housekeeping and good personal hygiene are critical.
 - ii. Beta
 1. Can be blocked with plastic or PPE
 2. Penetration greater than Alpha
 3. Can penetrate the first two layers of skin
 4. Second largest particle.
 5. Travels about one meter in the air.
 - iii. Gamma
 1. Smallest in size
 2. Can be blocked by lead
 3. Is capable of damaging living cells as it slows down by transferring energy to the surrounding cell components
 - iv. Radon Progeny
 1. Inert gas

2. Transported by carrier (water, diesel smoke, etc...)
 3. Ventilation is principle remedy
 4. Found in soils worldwide
- e. Various types of radiation exposure potential at the Mill
- i. Conventional Ore – stockpiles and in process
 - ii. Yellowcake product – in process and final product
 - iii. Alternate feed materials – stockpile (by various supplier) and in process
 - iv. Miscellaneous – sealed sources

3. Personal Hygiene at the White Mesa Mill

- a. Wearing protective clothing
- i. Importance – how the PPE protects against Alpha and/or Beta/Gamma activity
 - ii. Types of PPE available
 1. Tyvex
 2. Coveralls
 3. Rubber suits/gloves
 4. Respiratory Protection
- b. Using respiratory protective equipment correctly – See item 4
- c. Eating, drinking and smoking only in designated areas
- i. Regulated by the State of Utah and MSHA
 - ii. Weekly alpha survey
 - iii. Reducing potential for exposure
 - iv. Wash hands regardless of job assignment
- d. Using proper methods for decontamination
- i. Showers requirements
 1. Mandatory for Yellowcake Operators
 - ii. Laundry facility

4. Respiratory Protection Training

- a. General
- i. Video on Respiratory Protection
 - ii. Program evaluation and revisions and record keeping
 - iii. Employee training and documentation
 - iv. Fit Testing
 1. Medical Clearance
 2. Fit Tester 3000
 3. Irritant smoke
 - v. Exchange/Issuance requirements – Daily Exchanges are required for all devices
 - vi. Storage and care of device
- b. Hazards to which the respirator wearer may be exposed, the effects of contaminants on the wearer if the respirator is not worn properly and the capabilities and limitations of each device that may be used
- i. Respiratory Hazards

1. Uranium airborne and effect
 2. Radon daughters and effect
 3. Chloride and effect
 4. Ammonia and effect
 5. Airborne vanadium dust and effect
 6. Acid gases and effect
 7. Other potential effects
- ii. Respirator selection
 1. Types of respirators, their function, limitations
 - a. Full-face with combo cartridges – good for all environments at the facility (pf of 50)
 - b. PAPR's – good for only dusty environments, not good for any environment that may contain chemical mists (pf 1000)
 - c. SCBA's – good for all environments, has only thirty minute bottle of air (pf 10000)
 - d. NIOSH and MSHA approved respirators only
 2. Identification of hazards
 - a. O₂ content
 - b. Routine hazards
 - c. Non-routine hazards
- c. Spectacle adapters, communications equipment and other equipment that will be used directly in conjunction with the respirator are to be attached and operated properly
 - i. At the White Mesa Mill, we only use the spectacle adapters. Spectacle adapters are used for individuals who have prescription eyewear. The adaptor is used so that there is not an issue with the arms of the glasses potentially breaking the seal of the device.
 - ii. Each employee who has to wear prescription eyewear must present a copy of their current prescription to the Safety Department and the devices will be ordered.
 - iii. After the spectacle adapter has arrived, the Safety Department will train each wearer on the proper care, maintenance and installation of the device. This training is documented with a signed training certificate by both the instructor and wearer and the document is then placed in the file in the Radiation Office files.
- d. Demonstration in donning, using and removing each type of respiratory protective device that may be used
 - i. Wearing Instructions and training
 1. Donning, wearing and removing the respirator
 2. Adjusting the respirator so that its respiratory-inlet covering is properly fitted on the wearer and so that the respirator causes a minimum amount of discomfort to the wearer
 3. Allowing the respirator wearer to wear the respirator in a safe atmosphere for an adequate period of time to ensure that the wearer is familiar with the operational characteristics of the respirator

4. Have each employee perform the donning for each device they may have to wear while on property
- e. Instruction in how to inspect each type of respiratory device that may be used and be instructed to perform such an inspection before donning any device
 - i. Field Inspection
 1. Valves
 2. Body of Mask
 3. Straps
 4. Lens
 5. Air lines
 - ii. Respirator Sealing Problems
 1. A person who has hair (stubble, mustache, sideburns, beard, low hairline, bangs) which passes between the face and the sealing surface of the face piece of the respirator shall not be permitted to wear such a respirator.
 2. A person who has hair (mustache, beard) which interferes with the function of a respirator valve(s) shall not be permitted to wear such a respirator.
 3. A spectacle which has temple bars or straps which passes between the sealing surface of a respirator full face piece and the wearer's face shall not be used.
 4. A head covering which passes between the sealing surface of a respirator face piece and the wearer's face shall not be used.
 5. The wearing of a spectacle, or goggle, a face shield, a welding helmet, or other eye and face protective device which interferes with the seal of a respirator to the wearer shall not be allowed.
 6. If scars, hollow temples, excessively protruding cheek bones, deep creases in facial skin, the absence of teeth or dentures, or unusual facial configurations prevent a seal of a respirator face piece to a wearer's face, the person shall not be permitted to wear the respirator.
 7. If missing teeth or dentures prevent a seal of a respirator mouthpiece in a person's mouth, the person shall not be allowed to wear a respirator equipped with a mouthpiece.
 8. If a person has a nose of a shape or size which prevents the closing of the nose by the nose clamp of a mouthpiece/nose clamp type of respirator, the person shall not be permitted to wear this type of respirator.
- k. Instruction in how to perform a user seal check on face sealing devices and how to perform this user seal check each time this type of device is donned
 1. Refer to "d" of this section.
 2. Demonstrate the proper techniques for performing a field positive and negative pressure test.
 3. Have each employee perform this task. (pass/fail)
 4. Emphasis to each employee the importance of performing this task each and every time the seal has been broken.

1. Information that any respirator user may leave the work area at any time for relief from respirator is 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

1. A respirator wearer shall be permitted to leave the hazardous area for any respirator-related cause. Reasons which may cause a respirator wearer to leave a hazardous area include, but are not limited to, the following:
 - a. Failure of the respirator to provide adequate protection
 - b. Malfunction of the respirator
 - c. Detection of leakage of air contaminant into the respirator
 - d. Severe discomfort in wearing the respirator
 - e. Increase resistance to breathing
 - f. Illness of the wearer, including: sensation of dizziness, nausea, weakness, fatigue, breathing difficulty, coughing, sneezing, vomiting, fever or chills.
 - g. Claustrophobia, anxiety or other psychological factors that may affect the wearer
 - h. Emergency respirator use
 - i. SCBA – Self-Contained Breathing Apparatus
 - ii. Emergency respirator issuance
 - iii. Only Certified individuals may use these devices

Be advised that in case of respirator malfunction or wearer distress, the respirator may be removed as the respirator user exits the airborne contamination area

m. Each respirator wearer must understand that during any problem with the device or distress, the device can be removed upon exiting the contamination area. A report of the incident should be given the Safety Watch and the Safety Department immediately.

5. Facility Provided Protection

- a. Ventilation systems and effluent controls
 - i. Explain the Demister and Scrubber system
 - ii. Negative pressure in Yellowcake Dryer and Packaging Enclosures
- b. Cleanliness of the work place
 - i. ALARA and the importance of the principle
 - ii. Prevention of the spread of materials
 - iii. Wash down of work areas
 - iv. Prompt notice and cleanup of materials if spilled
 - v. Wash hands regardless of job assignment
- c. Features designed for radiation safety for process equipment
 - i. Ventilation system in the process areas

- ii. Remote access for packaging operations
- d. Standard operating procedures
 - i. Each circuit's SOP addresses the specific radiation concerns
 - ii. Knowledge of the SOP's and radiation concerns of one's circuit is needed prior to commencement of any work activity
 - iii. Radiation Work Permit (RWP)
- e. Security and access control to designated areas
 - i. Restricted Area requirements
 - ii. Identification cards needed to access the Restricted Area
 - iii. Access to the Product Storage Yard
 - iv. Surveillance cameras around the facility
 - v. 24 hour coverage by a member of the Radiation Staff
- f. Electronic data gathering and storage
- g. Automated processes
 - i. Nuclear Density Gauges
- h. Postings
 - i. "Radioactive Materials Area" – This sign designates the Restricted Area and signifies that one may come in contact with radioactive materials once one has passed the signage.
 - ii. "Caution Radiation Area" – Beta/Gamma values at or above 5.0 mR/hr. This posting means reduction in time and increase distance from source or added shielding is required.
 - iii. "Caution Airborne Radioactivity Area" – Alpha activity value at or above 25% of the corresponding DAC value. Respirators required prior to entering area and increased bioassays.

6. Health Protection Measurements

- a. Measurements of airborne radioactive materials
 - i. Alpha Monitoring
 - ii. Area Airborne
 - iii. Radon Progeny
 - iv. Beta/Gamma
 - v. Breathing Zones
- b. Bioassays to detect uranium (urinalysis)
 - i. Entrance/Exit Monitoring
 - ii. Schedule
 - 1. Monthly during production periods for all employees
 - 2. Bi-monthly for employees working in ore handling and yellowcake packaging operations. Also for declared pregnancy workers.
 - iii. Action limits of uranium detection in the bioassays
 - 1. 0 to 14 $\mu\text{g/L}$
 - a. Continue to review further bioassay results
 - 2. 15 to 35 $\mu\text{g/L}$
 - a. Obtain additional sample
 - b. Identify the cause of the elevated sample
 - c. Examine air sampling data to determine the source of intake

- d. Determine if other workers could have been exposed.
- e. Consider work assignment limitations
- f. Improve uranium confinement controls or respiratory protection
- 3. Over 35 µg/L
 - a. Take actions given above
 - b. Continue operations only if it is virtually certain no other worker will exceed the concentration
 - c. Establish work restrictions for affected employees
 - d. Weekly bioassays
- iv. Investigation of potential uptake
- v. Mitigation of uptake
- c. Surveys to detect contamination of personnel and equipment
 - i. Exit Alpha Monitoring – leaving the Restricted Area
 - ii. Break Times – Entering into an designated eating area
 - iii. Spot checks
 - iv. Equipment releases and the limits for the facility
 - 1. Alpha Personnel Release Rate (1,000 dpm/100 cm²)
 - 2. Alpha values for unrestricted release
 - a. Removable 1,000 dpm/100 cm²
 - b. Average 5,000 dpm/100 cm²
 - c. Maximum 15,000 dpm/100 cm²
 - 3. Beta/Gamma limits for unrestricted release
 - a. Average 0.20 mR/hr
 - b. Maximum 1.0 mR/hr
- d. Personnel dosimetry
 - i. OSL
- e. Potential Sources of Exposure at the facility
 - i. Conventional Ore Dust
 - ii. Alternate feed materials
 - iii. Yellowcake
 - iv. Tailings
 - v. Obsolete Equipment
- f. Ways to reduce exposure
 - i. Time – limiting the amount of time one spends in a given work environment. Example is only allowing a certain amount of time to be allowed in an RWP.
 - ii. Distance – creating a separation between one self and the source of exposure. Example is remote handling of material.
 - iii. Shielding – placing a barrier between one self and the source. Example is a respirator.

7. Radiation Protection Regulations

- a. Regulatory authority of NRC, MSHA and State of Utah
- b. Employee rights in 10 CFR Part 19
- c. Radiation protection requirements in 10 CFR Part 20

- d. State of Utah R313 rules
- e. 30 CFR Parts 47 and 56
- f. Previous Radiation Exposure Information requests

8. Emergency Procedures

- a. Emergency Response Plan
- b. Facility notification cards
- c. Decontamination procedures during an emergency

9. Alpha Contamination Training

- a. Proper use of the personnel alpha monitor
- b. What to do if the alarm were to sound and who to contact
- c. Documentation of the training session and acceptance of possible disciplinary actions for failure to comply with the regulation

10. Prenatal Radiation Exposure

- a. Presentation of NRC information (see Appendices I and J)
- b. Discussion of increased monitoring
- c. Completion of Form

11. Any Handouts

12. Radiation Protection Quiz

13. Respiratory Protection Quiz

APPENDIX B

FORMS

Training on Proper use of Personnel Alpha Monitor

On _____, I received training on the proper use of the alpha monitor, and the importance and need to conduct an alpha survey of all personnel leaving the restricted area. What constitutes a proper survey with the alpha meter was discussed, along with the possible use of disciplinary actions for not complying with the survey policy. I have received the above training and understand the importance of conducting a proper personal alpha survey and the possible disciplinary actions that can be taken for non compliance with this license requirement.

Training Conducted by : _____

Training Received by : _____

Spectacle Kit Use Training

On _____, I received training on how to properly use a spectacle kit with a full face respirator. This instruction is part of the Respirator Protection Program at the White Mesa Mill of Denison Mines (USA) Corp. I understand that Denison Mines will provide me with the spec kit, but it is my responsibility to clean and care for the spec kit. If the spec kit is lost within the first year, I will be responsible for the replacement cost of the spec kit.

Training received by

Date

Training conducted by

Date

Denison Mines (USA) Corp.
P.O. Box 809
6425 South Hwy 191
Blanding, Utah 84511

Date: _____

Re: _____

SSN: _____

DOB : _____

To: _____

The above named person is employed, or is being considered for employment by Denison Mines (USA) Corp. In accordance with provisions of the United States Nuclear Regulatory Commission Regulations 10 CFR 19.13 (b), we request that you provide a report of the occupational exposure to radiation while in your employ.

Sincerely,

David Turk
Radiation Safety Officer
Denison Mines (USA) Corp.

I, _____ Hereby authorize release, to Denison Mines (USA) Corp., of my exposure history requested below.

TOTAL RADIATION EXPOSURE HISTORY

1. Period employed _____ to _____.
2. Place of employment _____.
3. Total exposure during period of employment _____.

Signed: _____

Date : _____

Position: _____

APPENDIX C

EXAMPLE HANDOUTS

RADIATION PROTECTION AT THE WHITE MESA MILL

1. Radiation

High levels of radiation are harmful to us. The amount of radiation a person is exposed to is referred to as his or her “dose”, and is typically measured in millirems (“mrems”) per year.

We are exposed to radiation from natural sources such as the sun, the soils and rocks around us as well as the air we breathe. We are also exposed to radiation from other sources such as x-rays performed in connection with medical and dental examinations. In the Blanding area, each member of the general population is exposed to about 400 mrem per year from these natural sources, not counting things such as x-rays.

2. Exposure Limits

In order to protect workers from excessive exposure to radiation, the Nuclear Regulatory Commission (“NRC”) has set maximum doses that workers can receive each year from working at facilities such as the White Mesa Mill. Under these standards, the maximum total dose from all sources at the Mill, over and above background radiation from natural sources, is 5,000 mrem per year.

In addition, the NRC requires that each facility make efforts to keep exposures to workers As Low as is Reasonably Achievable (“ALARA”) below the 5,000 mrem/yr limit. In accordance with this requirement, the Mill has set an ALARA goal at 1,250 mrem/yr for each worker, over and above natural background. This goal is 25% of the regulatory standard of 5,000 mrem/yr.

Exposures to Mill workers are typically well below this ALARA goal, being usually in the 80 mrem/yr to 400 mrem/yr range above background.

3. How do we Keep Exposures to Radiation to a Minimum

One of our prime objectives is to keep radiation exposures to Mill workers to a minimum. This not only requires the efforts of Denison. It also requires the efforts of each Mill worker to keep his or her exposures to a minimum. In order for workers to be able to do this, a proper understanding of radiation, how you can be exposed to it and what precautions you can take are extremely important. These topics are summarized below.

4. Types of radiation

There are three types of radiation: alpha, beta and gamma radiation.

4.1 Alpha Radiation

Here at the White Mesa Mill, we work with uranium, one of those elements that are naturally radioactive. Uranium is an alpha emitter. Alpha radiation doesn’t travel very far, even in air.

The range in air for alpha radiation is about 1.25 inches. A single sheet of paper can block alpha radiation. Even the skin layer on our bodies stops alpha radiation. So, outside of our body, alpha radiation is really no problem. What about inside the body? Breathing uranium dust or swallowing uranium dust is the problem. Uranium in the human body tends to seek the bones and kidneys (i.e., to collect there), where it can cause damage.

In addition, radon gas, which comes primarily from uranium ores and tailings, emits alpha radiation and is in the air we breathe at the Mill. There is no smell or taste to radon gas and you can't see it. Breathing high levels of radon in the air is also harmful to us.

4.2 *Beta Radiation*

Beta radiation does not travel very far in air, but it can penetrate the body, so merely being close to a source of beta radiation will result in exposure to radiation. It is not necessary to breathe in or swallow beta emitting particles, although that would also be another way that beta radiation could enter your body.

However, because most of the radiation associated with the uranium process is alpha radiation, beta radiation is not much of a problem at the Mill. While exposures to the body merely from being close to beta radiation are minimal at the Mill, internal exposure to beta radiation that enters the body through inhalation or ingestion of radioactive dust is a concern. For example, as uranium decays some beta radiation is emitted, especially where aged yellowcake is concerned, so personal hygiene in the yellowcake processing portion of the Mill is important.

4.3 *Gamma Radiation*

Gamma rays are constantly being emitted from the raw ore. Like beta radiation, gamma radiation can penetrate the body, so being close to a source of gamma radiation will result in exposure to radiation. However, gamma radiation is stronger, can travel further in air and can penetrate the body more readily than beta radiation. As with beta radiation, it is not necessary to breathe in or swallow gamma emitting particles, although that would also be another way that gamma radiation could enter your body.

Gamma radiation at the Mill is mainly associated with raw ores, tailings solids and some alternate feed materials. So the people working in the ore piles, bucking room, tailings or close to certain alternate feed materials should have the highest exposure to gamma radiation here at the Mill site.

4.4 Radioactive Dust is the Main Concern at the Mill Site

As can be seen from the discussion above, radiation that enters the body through the inhalation or ingestion of dust is the main concern at the Mill site. Keeping dust to a minimum and providing protections to workers to minimize their exposure to radioactive dust is therefore a primary objective. Radon is usually not a problem, unless in confined spaces. Exposures from being close to beta/gamma radiation is also not usually as big a concern at the Mill site, due to the relatively low levels of those types of radiation found at the Mill.

5. Exposure Pathways and Precautions to be Taken

Radiation can enter the body in three different ways:

5.1 Being Close to a Source of Gamma Radiation

Being close to ore, tailings or certain alternate feed materials will expose the worker to gamma and beta radiation. The stronger the source, the closer you are and the longer you spend close to the source will increase your exposure. Shielding, such as lead can be used in some circumstances to reduce exposures to gamma and beta radiation, although shielding is not commonly used at the Mill, due to the generally low beta/gamma radiation experienced at the Mill.

Each worker is required to wear an OSL badge that records his or her exposure to beta and gamma radiation. The OSL badge must be worn on the torso and must not be shielded by clothing.

Areas where beta/gamma radiation is high (i.e, over 5 mrad/hr) must be posted as “Radiation Areas”).

The precautions we take at the Mill to keep exposure to beta/gamma radiation to a minimum are:

- Keeping workers away from areas with high beta/gamma radiation. When you see an area posted as a “Radiation Area” do not go near that area unless required to do so for a specific task;
- Minimizing the time each worker is required to work in areas with elevated beta/gamma radiation. This also involves rotating workers so that the time each worker spends in the “Radiation Area” is kept to a minimum;
- Using shielding in some cases; and
- Engineered controls in our process to reduce exposures faced by workers.

5.2 Breathing in Radioactive Dust or Radon

Any dust at the Mill can be radioactive. Ore dust is radioactive. Dust from the ore pad is radioactive. Dust from around the facility buildings can be radioactive. Yellowcake dust is radioactive, and tailings dusts are radioactive. In addition, radon gas is radioactive and can be found in all areas of the Mill facility and property. Radon gas is particularly dangerous in closed areas, where it can accumulate.

The Mill monitors various areas of the Mill facilities and Mill properties for radioactive dust and radon gas. Each worker is required to keep track of the time he or she spends in each area of the Mill each day and record these times on his or her Exposure Time Sheet. This allows Mill Radiation Safety Staff to calculate how much exposure to radiation the worker has had each day by determining how much time each worker spends in each area and by calculating the exposure for the time spent in each area based on the monitoring results for that area. This is why it is important for each worker to carefully and accurately fill out his or her Exposure Time Sheet each day.

The precautions we take to keep exposures to radioactive dust and radon to a minimum are the following:

- Good housekeeping is important in order to keep dust to a minimum within facility buildings;
- Water is sprayed on the ore pad and other areas of the Mill property in order to keep dust to a minimum;
- Posting and restricting access to areas where there is a potential for higher exposures to radioactive dust;
- Respiratory protection is required in areas where there is a potential for higher exposures to radioactive dust and/or radon, such as in the yellowcake packaging area where uranium concentrate is being handled;
- Showers are available to all workers and yellowcake workers are required to shower at the end of their work shift;
- Non-routine projects that may result in radiation exposure are controlled by a Radiation Work Permit where personal protective equipment (PPE) and additional monitoring (such as breathing zone sampling) requirements can apply; and
- Work clothing remains at the Mill and all workers entering the restricted area are required to survey for alpha contamination prior to leaving the facility.

5.3 *Ingesting Radioactive Particles*

Ingestion of radioactive materials at the Mill is minimal but can occur directly by swallowing dust that has entered your mouth or indirectly from contamination of food or other items a person might put into his or her mouth. Smoking, eating, chewing gum or tobacco etc. are not allowed in working areas of the Mill. Eating is restricted to only designated eating areas. You may smoke only in a designated area outside of the Mill's restricted area. This exposure

pathway is best controlled by personal hygiene principles such as cleaning your hands before eating.

6. Monitoring and Calculation of Total Dose Received by the Worker

In order to ensure that worker exposure is maintained within the regulatory limits and the Mill's ALARA goal, various monitoring methods are used to assess the workers exposure. Air samples are collected throughout the plant to assess concentrations of radioactive dust and radon in the air, and the amount of time spent by workers in the various plant areas is recorded to determine the inhalation exposure of each worker given his/her particular job assignment. In addition, gamma and beta exposure is monitored by means of personal exposure badges (OSL) to assess individual exposure to external sources. The amount of exposure a worker receives from radioactive dust, radon and beta/gamma radiation to the body are added up to determine the total dose (referred to as the worker's Total Effective Dose Equivalent or TEDE) received by the worker for the year. The worker's TEDE is then compared to the regulatory limits and the Mill's ALARA goal.

Urine samples are also collected from workers to ensure that internal uptake of uranium is not damaging kidneys and in some instances to determine uptake due to unusual circumstances. In addition, and as mentioned above, workers are required to scan for alpha contamination as they exit the restricted area to protect against offsite contamination and exposure.

7. Leaving the Mill Each Day

As can be seen from the information provided above, contamination control is important as a means of minimizing exposure to radiation at the Mill. One of the more important places where this control is necessary is when a worker leaves the Mill. Taking a shower, leaving work clothes at the work place and scanning out to ensure that you are not taking contaminants home on your person are good practices to protect you and your family from offsite exposure. All workers must scan before leaving the Mill's restricted area. All yellowcake workers must also shower before leaving the restricted area.

8. Reporting

In order to determine that employee exposures are being maintained within the regulatory limits and company goals, annual exposure calculations for each worker are completed by the Radiation Safety Department. These reports are utilized to demonstrate compliance with the standards, assess any trends in exposure and to provide a record to the individual worker. Each worker receives an exposure report annually from the Radiation Safety Department.

9. Conclusion

Uranium is a naturally occurring radioactive element which can have harmful effects if not properly monitored and controlled. At the Mill we can be exposed to alpha, beta and gamma

radiation and our exposures to those forms of radiation are limited by regulation and company policy. Because uranium is primarily an alpha emitter, alpha radiation is the principle type of radiation exposure at the Mill. This means that minimizing the inhalation or swallowing of radioactive dust at the Mill is a primary objective.

The radiation you may be exposed to at the Mill is monitored by sampling the air you breathe and measuring the external radiation received by your personnel exposure badge. The results of this monitoring are evaluated and reported to you annually so that you are made aware of your exposure.

While the company provides engineering controls to protect you from sources of radiation, each employee must remain aware of conditions at the Mill. Avoiding high radiation areas, wearing respirators where/when required, cleaning your hands before eating, avoiding dusty situations and using contamination control procedures when you leave the property are individual protections you can use to minimize your exposure to radiation at the Mill.

RADIATION INFORMATION HANDOUT

(Summary of Key Concepts)

The following are items that are central to one's understanding of the Radiation Protection Program for Denison Mines (USA) Corp. at the White Mesa Mill.

Definitions:

- DAC – Derived Air Concentration
- ALARA – As Low As Reasonably Achievable
- NRC – Nuclear Regulatory Commission
- DRC – State of Utah Division of Radiation Control
- TEDE – Total Effective Dose Equivalent (total dose from beta/gamma, as measured by the OSL badge, air particulate and radon)
- CEDE – Cumulative Effective Dose Equivalent (dose from radon and air particulate. Does not include the dose from beta/gamma)
- PAPR – Powered Air Purifying Respirator
- SCBA – Self Contained Breathing Apparatus
- RWP – Radiation Work Permit
- OSL – Optically Stimulated Luminescence. Device used to monitor beta/gamma exposure. Device must be worn in the center of the chest not on the back of the hardhat.
- Restricted Area – Consists of all operational and disposal areas.

DACs:

Radioactive dust (air particulate) has a different impact on our bodies depending on what stage of the process or location of the facility we are in. This is because the combinations of uranium and its daughters (Radium 226, Thorium 230 and Lead 210) are different in the different stages of the process. For example uranium and its daughters have equal radioactivity levels in conventional ores on the ore pad, but yellowcake is mostly uranium and has hardly any daughters present. The DAC is the acceptable level of radioactivity in a particular area of the Mill, taking into account the mixtures of radionuclides found in the area. It sets the level of radioactivity in air particulate that you could breathe on a full time basis for an entire working year in that area of the Mill before exceeding the regulatory limit. For example, the DAC for the ore pad is more restrictive than the DAC for the yellowcake area, reflecting the fact that the mixture of radionuclides on the ore pad is more harmful to our bodies for any given level of radiation. However, even though the mixture of radionuclides found on the ore pad is more dangerous than the mixture of radionuclides found in the yellowcake packaging area for any given level of radiation, the radiation levels in the yellowcake area are much higher than on the ore pad, thus making the yellowcake packaging area an area of higher radiation concern than the ore pad.

Postings:

- “Radioactive Materials Area” – signifies that anywhere beyond that point there is the potential of coming into contact with radioactive materials. That includes disposal areas, operational areas, product and raw ore.
- “Caution Radiation Area” – signifies that that area contains material that has beta/gamma values at or above 5 mrem/hr. Areas that are posted as this are the yellowcake dryer enclosures, centrifuges, packaging enclosure and some alternate feed locations.
- “Caution Airborne Radioactivity Area” – signifies that an area contains airborne alpha activity at or above 25% of the corresponding DAC and respiratory protection is required. Areas that are posted as this are the yellowcake dryers and packaging enclosure. The SAG Mill is sometimes posted as an airborne activity area. It will all depend on the grade of ore being processed.

Bioassays:

Bioassays are collected from all employees. These samples are collected to test to see if there has been a possible ingestion or inhalation of uranium. During production periods, every employee is tested monthly. Some individuals, depending on their job assignment can be tested weekly or every two weeks. Samples are also collected after the completion of special work assignments, such as an RWP. Also, all newly hired individuals are tested to see if there is a baseline of uranium in their urine. All employees upon their termination must submit a final sample.

All bioassays are to be given prior to the beginning of one’s shift and before one enters the Restricted Area.

Exposure Limits:

The NRC states that all occupationally exposed employee shall not exceed 5 rem/yr. Our ALARA limit is 25% or 1.25 rem/yr.

Scanning:

Every person who enters into the Restricted Area must scan themselves prior to exiting or entering an eating area (within the Restricted Area). A proper scan consists of a slow brush of the detector over the hands, arms, chest, legs and shoes. The meter should be kept at ¼” away from the body in order to not puncture the mylar face of the probe. If the alarm sounds, hit reset and scan that affected area again. If the meter alarms again, contact the Radiation Department. A proper scan should take approximately 30 seconds.

Health and Hygiene:

Wash your hands regardless of your job assignment. Some positions at the facility require mandatory showers. You are paid for that shower time, so make sure you do it. Also, the facility is equipped with a laundry. Make sure you wash your work clothes periodically. Do

not take home any clothing or materials without having them scanned by a member of the Radiation Department first.

Radiation:

- Alpha –
 - Will not penetrate dead layer of skin
 - Travels about 1.25 inches in air
 - Can be blocked by a single sheet of paper
 - Large particle that is the easiest to protect against, but the one that can cause the most damage when taken internally. The delicate internal workings of the living cell forming the lining of the lungs or internal organs, most certainly will be changed (mutated) or killed outright by the energetic alpha particle.
 - Housekeeping and good hygiene are critical
- Beta –
 - Can be blocked by plastic or PPE
 - Penetration greater than Alpha
 - Can penetrate the first two layers of skin
 - Second largest particle
 - Travels about one meter in air
- Gamma –
 - Smallest in size
 - Travels furthest in air
 - Can penetrate into and through your body
 - Can be fully or partially blocked by lead or other shielding, depending on the strength of the source, the distance you are from the source and the type and thickness of the shielding
 - Is capable of damaging cells as it slows down by transferring energy to the surrounding cell components.
- Radon –
 - Inert gas
 - Transported by carrier (water, diesel smoke, etc...)
 - Ventilation is principal remedy
 - Found in soils worldwide

Three ways to reduce exposure from beta/gamma radiation:

- Time – by limiting the amount of time one spends in an area, one can reduce the amount of exposure they receive.
- Distance – by creating a space between one's self and the source you can reduce exposure.
- Shielding – by placing something between one's self and the source you can reduce exposure. This can be done by placing a barrier, such as a wall, PPE or other physical barriers between yourself and the source.

Ways to reduce exposure to alpha radiation:

- Dust minimization
 - Good housekeeping
 - Water sprays on ore pad and roadways
 - Dust collection systems at various points in the process
- Enclosed areas of high potential exposure to air particulate, such as yellowcake areas
- Use of respiratory protection in areas of high potential exposure to air particulate
- Designated eating areas
- Personal hygiene to minimize ingestion (e.g., washing hands before eating, washing work clothes)
- Mandatory showers for yellowcake workers
- Mandatory alpha scan for everyone who leaves the Mill's restricted area

Respiratory Protection:

- Types of devices on site
 - Full-face – with combo cartridges is good for both chemical and dusty environments. Has a protection factor of 50.
 - PAPR – is only good for dusty environments. Will not protect you in a chemical mist type of environment. Has a protection factor of 1,000.
 - SCBA – is good for all environments, but only has a 30 minute bottle of air. Has a protection factor of 10,000.
- Exchange policy – all respirators must be turned into the Radiation/Safety Department on a daily basis.

APPENDIX D

RADIATION SAFETY TRAINING OUTLINE FOR NEWLY HIRED EXPERIENCED MILL WORKERS

The following topics will be discussed in this training:

1. **Review of Key Radiation Safety Topics**

(a) At the discretion of the instructor, review selected key radiation safety topics, such as one or more of the topics set out in the handouts included in Appendix C or in the Radiation Safety Training outline in Appendix A, as necessary to ensure that the worker has an equivalent level of knowledge as a newly hired inexperienced worker who has completed his or her training, depending on the level of knowledge and experience of the worker.

(b) At the discretion of the instructor, distribute one or more handouts for the worker's review and reference, such as one or more of the documents entitled "Radiation Protection at the Mill," or "Radiation Information Handout" set out in Appendix C.

2. **Site Specific Training**

(a) Where the worker has received his or her previous radiation safety training at another facility, provide site specific training as necessary, in the discretion of the instructor.

3. **Relevant information that has become available since the worker's last radiation safety training or refresher training**

(a) Processing changes that may affect exposures

(b) Posting changes, if any

(c) Discussion of air, radon and beta/gamma survey results

(d) Changes to SOP's that affect Radiation Safety

4. **Review of safety problems that have arisen since the worker's last radiation safety training or refresher training**

(a) Discuss issues that have been raised through daily and weekly inspections

(b) Housekeeping issues

(c) RWP's

5. **Changes in regulations and license conditions since the worker's last radiation safety training**

(a) Discuss changes that affect the operation or other activities in the Mill

(b) Discuss NOV's or recommendations from the DRC

6. **Exposure trends**

(a) Average exposure for the previous year

(b) Highest exposure for the previous year

(c) Comparison of exposures versus background

(d) Discussion on the exposures rates received and how those results compare with the ALARA goals

7. Other current topics

(a) Discuss any problem areas that may have arisen

8. Respirator Training

(a) Provide respirator training as necessary, including at a minimum:

- i) Have the worker demonstrate how spectacle adapters communications equipment, and other equipment that will be used directly in conjunction with the respirator are to be attached and operated properly;
- ii) have the worker demonstrate competency in donning, using, and removing each type of respiratory protective device that may be used;
- iii) have the worker demonstrate how to inspect each type of respiratory protective device that may be used and instruct the worker to perform such an inspection before donning any device;
- iv) have the worker demonstrate performance of a user seal check on face-sealing devices and instruct the worker to perform this user seal check each time this type of device is donned;
- v) inform the worker that any 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; and
- i) advise the worker that in case of respirator malfunction or wearer distress, the respirator may be removed as the respirator user exits the airborne contamination area.

(b) The instructor should be satisfied that the worker understands, through this or previous training, the hazard to which the respirator wearer may be exposed, the effects of contaminants on the wearer if the respirator is not worn properly, and the capabilities and limitations of each device that may be used.

9. Pre-Natal Training

(a) Presentation of NRC information (see Appendices I and J)

(b) Discussion of increased monitoring

(c) Completion of Form

APPENDIX E

RADIATION SAFETY TRAINING OUTLINE FOR ANNUAL REFRESHER TRAINING

The following topics will be discussed in this training:

1. **Relevant information that has become available during the past year**
 - (a) Processing changes that may affect exposures
 - (b) Posting changes, if any
 - (c) Discussion of air, radon and beta/gamma survey results
 - (d) Changes to SOP's that affect Radiation Safety

2. **Review of safety problems that have arisen during the year**
 - (a) Discuss issues that have been raised through daily and weekly inspections
 - (b) Housekeeping issues
 - (c) RWP's

3. **Changes in regulations and license conditions**
 - (a) Discuss changes that affect the operation or other activities in the Mill
 - (b) Discuss NOV's or recommendations from the DRC

4. **Exposure trends**
 - (a) Average exposure for the previous year
 - (b) Highest exposure for the previous year
 - (c) Comparison of exposures versus background
 - (d) Discussion on the exposures rates received and how those results compare with the ALARA goals

5. **Other current topics**
 - (a) Discuss any problem areas that may have arisen

6. **Review of Key Radiation Safety Topics**
 - (a) At the discretion of the instructor, selected key radiation safety topics, such as one or more of the topics listed on the handouts included in Appendix C or on the Radiation Safety Training outline set out as Appendix A, may be reviewed.

APPENDIX F

SAMPLE RADIATION SAFETY QUIZ

Name _____

Date _____

Radiation Protection Quiz 2009

Select the correct answer from the possible choices.

1. Radiation Exposure time cards are:
 - a. Filled out the same every day.
 - b. A important part in estimating your radiation exposure to airborne radioactivity
 - c. Filled out by your supervisor.
 - d. Filled out in pencil.

2. OSL badges are used at the Mill to monitor:
 - a. Microwave radiation exposure.
 - b. External Beta/Gamma exposure.
 - c. Radon exposure.
 - d. Cosmic radiation exposure.

3. When issued a clean respirator you must:
 - a. Return after each shift.
 - b. Fit test with irritant smoke.
 - c. Perform a field inspection of the respirator.
 - d. All of the above.

4. To minimize the ingestion of uranium, you should:
 - a. Wash hands before eating regardless of job assignment.
 - b. Wash hands before eating only if you are working with yellowcake.
 - c. Wear gloves while eating.
 - d. Wash hands before eating when visibly dirty.

5. Leaving the restricted area requires you to:
 - a. You do not have to monitor yourself.
 - b. Monitor your self by brushing the detector over your cloths, hands, and soles of your feet.
 - c. Monitor your self when you are being watched.
 - d. Monitor your self only on the way home.

6. Housekeeping is:
 - a. Regulated by MSHA.
 - b. Regulated by the State of Utah Division of Radiation Control.
 - c. Essential to reducing the potential for exposure.
 - d. All of the above.

7. If your supervisor wants you to do a task that is not routine for your job, you should:
 - a. Find out what special hazards maybe encountered and if permits are needed.
 - b. Contact the Radiation Office afterwards.
 - c. Leave it for the next shift.
 - d. None of the above.

8. An area posted as "Caution Radiation Area" means:
 - a. Airborne uranium concentrations are above 25% of DAC.
 - b. Beta/Gamma values are at or above 5 mrem/hr.
 - c. You must wear a respirator.
 - d. An RWP is required to enter the area.

9. The ways to reduce workers dose exposures are:
 - a. Decrease time.
 - b. Increase distance.
 - c. Shielding.
 - d. All of the above.

10. Alpha radiation is the same as:
 - a. Gamma radiation.
 - b. Microwave radiation.
 - c. Radiation from the sun.
 - d. None of the above.

11. An area posted as "Caution Airborne Radioactivity Area" means:
 - a. Airborne uranium concentration is above 25% of DAC.
 - b. Beta-Gamma levels are at or above 2 mrem/hr.
 - c. You must wear a respirator when you work in the area.
 - d. Both A and C.

12. Bioassay monitoring determines:
 - a. Quantity of uranium absorbed through the skin.
 - b. Probable ingestion or inhalation of uranium.
 - c. Probable exposure to gamma radiation.
 - d. Quantity of thorium absorbed through the skin.

13. Total Effective Dose Equivalent (TEDE) is:
 - a. Internal exposure effect on the individual.
 - b. The sum of internal and external exposure.
 - c. Calculate external exposure.
 - d. The release requirements set by the state for equipment.

14. ALARA stands for:
 - a. Acceptable Level Assimilation Resonance Allowable.
 - b. As Low As Reasonably Achievable.
 - c. As Long As the RSO Allows.
 - d. Just another acronym that no one understands.

15. Yellowcake is;
 - a. Chemically toxic.
 - b. Produces only Gamma radiation.
 - c. Yellow all the time.
 - d. Should be eaten with ice cream.

16. DAC stands for:
 - a. Daily Accumulated Concentration.
 - b. Daily Accumulated Contaminate.
 - c. Dose Actually Calculated.
 - d. Derived Air Concentration.

17. ALARA limits are:
 - a. More restrictive than NRC limits.
 - b. Essentially the same as NRC limits.
 - c. Less restrictive than NRC limits.
 - d. Have nothing to do with NRC limits.

18. The Restricted Area:
 - a. May be visited, with permission, regardless of age.
 - b. Contains high level radioactive materials.
 - c. Is an excellent hunting preserve.
 - d. Consists of all operational and disposal area.

19. The Utah Radiation Control Division has regulatory authority for:
 - a. Uranium Mills.
 - b. Employee health in uranium mills.
 - c. Environmental concerns while processing uranium.
 - d. All of the above.

20. A "Radioactive Materials" sign signifies that in the area:
 - a. There maybe a potential external exposure level greater than 2.0 mrem/hr.
 - b. There maybe a potential external exposure level of 5.0 mrem/hr or greater.
 - c. There maybe drums in the area that contain uranium product.
 - d. All of the above.

21. Bioassay samples must be given:
 - a. Whenever you feel like it.
 - b. Before reporting to your job assignment.
 - c. After you get ready for the day.
 - d. When wearing work gloves.

22. If the personnel scanner alarm goes off, what must one do:
 - a. Hit reset and leave it for the next employee to deal with.
 - b. Walk on by and just sign your name.
 - c. Contact the radiation department.
 - d. Pick up the probe and go through the motions.

23. When required to wear certain PPE, one must wear it:
 - a. Whenever the RSO walks by.
 - b. Whenever you think the supervisors are watching you.
 - c. Whenever you remember.
 - d. Whenever you enter a job assignment that it has been required and until restriction have been lifted.

24. Which of the following materials must be surveyed prior to leaving the restricted area:
 - a. Tools.
 - b. Vehicles.
 - c. Equipment.
 - d. All of the above.

25. Radiation Work Permits (RWP's) are issued by:
 - a. Safety Department.
 - b. Radiation Department.
 - c. Any Supervisor.
 - d. All of the above.

26. The gravel roadway can be accessed by Mill vehicular traffic without going through decontamination?
 - a. True
 - b. False

27. Equipment and vehicles can be scanned out by any supervisor?
 - a. True
 - b. False

28. Where are OSL badges stored?
- a. In one's locker.
 - b. On the OSL badge board.
 - c. At home.
 - d. Wherever you leave at the end of the shift.
29. If your OSL badge is lost, when should you report it?
- a. As soon as you realize it is missing.
 - b. When you get around to it.
 - c. At the end of the quarter.
 - d. It is up to the Radiation Department, not me.

APPENDIX G

SAMPLE RESPIRATORY PROTECTION QUIZ

Name _____

Date _____

Respiratory Protection Quiz 2009

Select the correct answer from the possible choices.

1. If you wear a respirator for only a few minutes, how often must you exchange?
 - a. Daily
 - b. Weekly
 - c. Monthly
 - d. Quarterly

2. If you are experiencing warm air blow back what is the likely cause?
 - a. Warm weather conditions.
 - b. Cartridges are starting to plug up.
 - c. No need for alarm.
 - d. All of the above.

3. When issued a clean respirator you must:
 - a. Fill out a respirator issuance log.
 - b. Fit test with irritant smoke.
 - c. Perform a field inspection of the respirator.
 - d. All of the above.

4. Who may issue a respirator?
 - a. Any supervisor.
 - b. I can check out my own respirator.
 - c. A member of the Radiation/Safety Department.
 - d. My direct supervisor.

5. When you are not wearing your respirator where must your respirator be stored?
 - a. In the zip locked plastic bag that comes with the device.
 - b. In your circuit.
 - c. In the Central Control Room.
 - d. Wherever you want.

6. A field inspection consists of:
 - a. Inspecting for cracks, wear marks and split rubber.
 - b. Checking the seals.
 - c. Checking the face shield.
 - d. All of the above.

7. If you wear your respirator for more than four hours a shift, how often must you exchange the device?
 - a. Daily.
 - b. Weekly.
 - c. Monthly.
 - d. Quarterly.

8. To wear a respirator, which of the following must be done?
 - a. Be clean shaven.
 - b. If you wear glasses, make sure you have a spectacle kit for the device.
 - c. Perform a smoke test.
 - d. All of the above.

9. A full face respirator has what protection factor?
 - a. 10
 - b. 50
 - c. 1,000
 - d. 10,000

10. A PAPR (Powered Air Purifying Respirator) is good for which environments?
 - a. All environments on site.
 - b. Dusty environment.
 - c. Chemical mist environment.
 - d. None of the above.

11. An area posted as "Caution Airborne Radioactivity Area" means?
 - a. Airborne uranium concentration is above 25% of DAC.
 - b. Beta-Gamma levels are at or above 2 mrem/hr.
 - c. You must wear a respirator when you work in the area.
 - d. Both A and C.

12. Of the following which areas are mandatory respirator areas?
 - a. Yellowcake Dryers.
 - b. Vanadium Packaging Area.
 - c. Yellowcake Packaging Area.
 - d. Any area labeled as an airborne radioactivity area.
 - e. All of the above.

13. Occasional respirator use requires device exchange:
 - a. Daily.
 - b. Weekly.
 - c. Monthly.
 - d. Quarterly.

14. A field test is not required every time the seal is broken during usage:
 - a. True.
 - b. False.

15. What type of respirator protection is available at this facility?
 - a. Full face
 - b. PAPR
 - c. SCBA
 - d. All of the above.

16. Who is required to use an SCBA?
 - a. Anyone can use an SCBA
 - b. Only certified individuals
 - c. Only Maintenance Crew Members
 - d. Only Operation Crew Members

APPENDIX H

CONTRACTOR SAFETY RULES

CONTRACTOR SAFETY RULES

Contractor shall be responsible for compliance with all local, State, Federal and Company safety, health and environmental laws and regulations in effect. Contractor shall also be held to understand that this site is a State of Utah Division of Radiation Control licensed facility and is governed by the rules and regulations of the Owner, State of Utah DRC and MSHA. Owner requires that all work conducted by Contractor and its employees be performed in a responsible manner with special attention and mutual cooperation on the part of everyone involved including Contractor, its employees and the employees of the Owner.

As part of its Contractual obligation, Contractor and its employees are expected to abide by all applicable safety rules. Mandatory, (MSHA, OSHA, State or Company, etc.) safety and health training must be received by all workers prior to starting any work on site. The rules listed below are minimum basic Owner Safety Rules and Regulations; they do not in any way contain every necessary rule. If the Contractor has questions concerning Safety Rules and Regulations, Contractor shall consult with Owner's Representative before starting work.

The fact that other applicable rules, regulations or requirements (Federal, State or local) are not printed herein will not be an excuse for any violation. Any violations of these rules and regulations be it accidental or intentional may be cause for termination of this contract.

OWNER SAFETY RULES AND REGULATIONS

I. TRAINING

All contract employees must receive the training required by Owner prior to starting work on site.

II. PERSONNEL PROTECTION

Hardhats, safety glasses, identification badges and steel toe shoes will be required when entering the mill area. whenever, work is performed in an environment, which requires special protection, such as respirators, hearing protection, goggles or face shield, wet suits, etc. this protection must be worn. If there is a question as to whether this special equipment is required, contact the Owner's Representative.

Persons with hair that extends longer than two (2) inches below the tee shirt collar must confine the hair.

If respiratory protection is required a respirator fitness physical and fit test are required. Any question regarding this subject shall be directed to the Owners Representative.

Appropriate fall protection shall be worn at locations where there is a danger of falling and/or where required by Owner.

III. RADIATION PROTECTION

The White Mesa Mill has a radioactive materials license with the State of Utah Division of Radiation Control. Under that license, there are certain items that must be observed by all parties on site. Those are, but not limited to:

- a. Eating, drinking and chewing are only authorized in designated areas. These areas are determined and posted by the Radiation Safety Officer. Potentially contaminated PPE is not allowed in these areas.
- b. All personnel, equipment and vehicles that enter into the restricted area, must be surveyed for radiological release prior to leaving the restricted area. All mobile equipment must travel through the decontamination wash station before being presented for release from the site.
- c. Before work assignments commence, the Contractor must present their job assignment to the Radiation Department. The Radiation Department will determine exposure potential and will issue a Radiation Work Permit if applicable.
- d. All Contractor personnel must submit to periodic bioassay monitoring for the determination of potential uptake or ingestion of uranium.
- e. Respiratory protection may be needed if there is determined that an area is contaminated. If respiratory protection is required, the Contractor will provide medical clearance for their personnel. Respiratory devices will only be issued upon the successful completion of the medical evaluation and onsite respirator fit testing.
- f. Personnel must monitor him or her with the use of an alpha monitoring device prior to leaving the restricted area. Monitoring locations are under surveillance to ensure that proper techniques are being applied. Contractor personnel will be trained in the proper use of these instruments.
- g. Failure to comply with these items and others as deemed necessary by the Radiation Safety Officer will be grounds for immediate termination of services at the facility.

IV. HOUSEKEEPING AND STORAGE

Debris will not be allowed to accumulate. Regular removal to designated areas is a requirement. Tools, equipment and materials will be stored in a safe and orderly fashion that minimizes interference with operations or traffic. Upon completion of the job, Contractor shall remove all construction debris and leave the site neat and orderly.

V. FIRE PROTECTION

- a. Fire extinguishers are to be provided by Contractor and will be kept immediately available when burning or welding in areas adjacent to combustible material. They must not be obtained by removing Owner's extinguishers from established locations.
- b. The White Mesa Mill is a smoke free work place. Therefore smoking is prohibited in the administration building and the restricted area. It is necessary however to post areas as no smoking areas wherever flammables are stored.
- c. No person shall use open flames within 50 feet of where flammable materials are stored.
- d. Combustible material; i.e., grease, lubricants, flammable liquids, etc. shall not be allowed to accumulate where they can create a fire hazard.
- e. Personnel must be familiar with site emergency procedures; i.e. fire drills evacuation drills, etc. as instructed by the Owner's Representative.
- f. Fire alarm procedures will be provided by Owner's Representative.
- g. Flammable liquids (flash points below 100°F) shall not be used for cleaning purposes.
- h. Containers of combustible or flammable liquids shall be bonded and grounded whenever liquid is being transferred; hose must be in metallic contact during transfer.
- i. Flame permits will be used where required by Owner's Representative.
- j. Flammable or combustible materials must be stored in spill proof containers and properly labeled.

VI. GENERAL

- a. Utilities – Connection to or disruption of service of any utility, such as electricity, steam, water, gas, etc., requires notice to and approval of Owner's Representative before action is taken.
- b. Alcohol and Drugs – No person will be permitted to work while under the influence of or in the possession of alcohol or drugs. Persons taking medication will not be permitted to work if it affects their performance or judgment. A drug

and alcohol testing policy is in place at this facility. All Contractor personnel will be subject to random and accident investigation samplings.

- c. Signs and Warnings – Anytime work is performed which could present a hazard to others; the area must be roped off or barricaded. All posted signs and other warnings devices shall be strictly observed.
- d. Horseplay – Horseplay will not be tolerated.
- e. Eating Areas – Eating, drinking and chewing is permitted only in designated areas by the Owner.
- f. Restricted Area – A radiation survey must be performed on all personnel and equipment prior to leaving the restricted area. The restricted area consists of all operational and disposal areas.

VII. SPECIAL PROCEDURES

- a. Lockout procedures – When work is to be performed on any equipment, tanks and lines the “Zero Energy” concept will apply.

Each job, which requires lockout must be authorized by Owner’s Representative before any equipment is turned off or locked out. Owner’s Representative will assist Contractor to assure proper lockout procedure is followed.

To assure that the correct drive switch has been locked out; an attempt must be made to start the equipment before work is started. The assurance can be gained on interlocked systems by attempting to start the equipment at its local control station. If this proves satisfactory, push the stop switch again.

Any gas or chemical lines that enter work locations must be blanked or have the valve locked in the closed position. The valve must be locked or tagged so it can easily be identified as a Contractor lockout. It will be the responsibility of the Contractor, to assure lockout knowledge and compliance from their employees.

- b. Flame Permits – A flame permit will be required and must be displayed when welding or torching anywhere a fire hazard exists. A fire extinguisher and a pressurized water hose must be ready at the job location during all welding and torching. A person must be standing by and able to watch for any sparks which could start a fire.

No welding or cutting will be done within 50 feet of fuel storage areas.

- c. Confined Space Entry – Whenever work is done that involves entry into tanks, bins or similar enclosures, a Confines Space Entry Evaluation and Safe Work Permit will be required.

Other Safe Work Permit area include: working on chemical lines, working on any high pressure system, operating equipment close to electrical lines or any hazardous operation as determined by the Site Safety Coordinator.

Where a hazardous or oxygen deficient atmosphere is possible, special precautions will be needed in addition the normal safety precautions, such as lockout, air fans, respirators, safety ropes, etc. Safety precautions may be found in the Safe Work Procedure, which will be furnished by the Owner's Representative if applicable.

- d. Process Lines – Process lines which contain or may have contained hazardous chemicals or gases can be worked on only with specific approval of the Owner's Representative.

VIII. MOBILE EQUIPMENT

Equipment will be kept in safe operating condition and be checked frequently. All equipment must be operated by experienced operators and will be confined to the work areas or places designated by the Owner's Representative. Drivers must be licensed if driving on public roads. Speed limits and traffic rules will be observed. Owner's equipment has the right-of-way. Observe caution, yield to traffic control signs. Speed limits on property shall not exceed 15 mph.

Cranes, power shovels and similar equipment will be directed by a responsible person on the ground when being moved through congested areas. Special attention must be paid to overhead wires, piping and other obstructions. (The ten-foot rule must apply)

All suspended loads which are being moved by mobile equipment; i.e., winch truck, cherry picker, etc., shall be secured with a tagline to prevent it from swinging.

All persons shall ride inside the cab or truck bed; absolutely no one is to ride on the fenders or running boards. All persons riding in a vehicle shall keep both body and feet within the protective area of the vehicle frame.

Protruding material that extends (2) feet beyond the rear of the vehicle shall be flagged.

Operators of gasoline powered vehicles shall stop the engines and place the ignition in the off position when refueling.

Drilling equipment must not be operated within (50) feet of any energized power line.

IX. HEAVY EQUIPMENT

- a. All self-propelled equipment shall have adequate overhead protectors (Roll-over Protective Structures - ROPS) to insure worker protection.
- b. All self-propelled equipment (except wheeled tractor scrapers) shall be equipped with backup alarms and the alarms must function when equipment is in use. A second person will be responsible to guide tractor scrapers when scrapers are in reverse.
- c. Buckets, lifts or blades shall be left down when equipment is not in use.
- d. Dump truck beds shall be in the down seat position while traveling.
- e. No person shall place any part of his/her body under a suspended load. Push, never pull. A suspended load, thereby keeping one's feet and body in the clear. Whenever possible, use a device to direct the load.
- f. After a piece of equipment has been down, the operator shall walk around and inspect the equipment before moving it.
- g. Persons shall not get on or off moving equipment.
- h. Operators of equipment shall not work under overhanging walls until all safety precautions have been taken and then only after a Safe Work Permit has been issued.
- i. Travel speed of equipment shall be consistent with road conditions.

X. TOOLS AND EQUIPMENT

Tools and equipment will be kept in safe condition with all safety devices and guards kept operable. Electrical tools will be provided with grounding protections (separate ground wire, double insulated and or Ground Fault Interrupter). All portable

electrical lights will be properly guarded. Extension cords hoses; etc. will be kept in good condition and strung so as not to create a hazard. All electrical devices will be checked prior to start of work for resistance to ground to insure proper grounding is provided.

Compressed gas cylinders will be secured in an upright position. Gauged bottles will be protected and guarded and shut off when unattended. Hoses and leads will be checked for leaks prior to each use and repaired or replaced if found defective.

The “quick opening” coupling on compressed air, steam or any other high-pressure hose must be pinned and whip checked. All bull hose must be securely chained.

XI. EXPLOSIVES AND BLASTING

- a. All explosives shall be properly stored per ATF “Table of Distance” as to distance. The construction of the magazine shall meet the ATF specifications.
- b. All magazines shall be licensed.
- c. No open flame shall be permitted in or within 100 feet of any explosive magazine.
- d. Explosives and detonators (primers) shall not be transported together. When being transported in the same vehicle, they shall be in different compartments, with appropriate signs on vehicle (see local regulations).
- e. All unused explosives and detonators shall be returned to their proper magazine.
- f. All blasts shall be properly guarded.
- g. Warning signs shall be used to halt use of two way radios during the loading and blasting cycle when electrical blasting caps are used.
- h. For blasting in open pit works, Owner’s Representative shall be notified of each blast prior to the blast. All blasting plans and guarding procedures shall be approved by the Owner’s Representative.
- i. All blasting materials and magazines will be removed by Contractor upon completion of job.

XII. REGULATORY AGENCIES

Code of Federal Regulations specifies that independent contractors will be held responsible for compliance with all standards. The regulations require that the independent contractor provide Owner with the following;

- a. Contractor's trade name, business address, telephone number, contractor's ID number for MSHA/OSHA or State and name of person in charge of project.
- b. A description of the work to be performed and the place where it will be performed.

Contractor must provide Owner with the same information for each subcontractor before each subcontractor begins work on Owner's Work Site.

XIII. ACCIDENT REPORTING

All accidents and/or injuries shall be reported to Owner's Representative immediately.

XIV. TRAFFIC CONTROL

Only those vehicle authorized by the Owner's Representative will be permitted in the restricted area. All Contractor vehicles, equipment and personnel will be scanned for radiological release prior to leaving the restricted area.

XV. MONITORING CONTRACTOR'S EMPLOYEES

Owner may perform certain monitoring on Contractor's employees, from time to time, to ascertain the exposure of such employees to various substances they may encounter in the course of their work under Contractor's contract with Owner.

Owner will select the times, the conditions and the equipment to be used for such monitoring. Owner will conduct such monitoring using its own personnel, but will do so solely as an agent for the Contractor, and on the Contractor's behalf. Owner's monitoring may have for the protection and surveillance of the Contractor's employees and the performance of such monitoring shall not be deemed a waiver by the Contractor or as an assumption by Owner of such responsibilities.

XVI. ADDITIONS OR CHANGES TO RULES

Additional area restrictions, rules or procedures not defined in the Special Rules, etc., will be provided by Owner's Representative or the department supervisor as

necessary and must be observed. Contractor personnel must immediately contact Owner's Representative if there is any concerns about potential hazards or proper methods before proceeding.

XVII. ARCHAEOLOGICAL DETERMINATION

During the course of any work performed by Contractor, if any archaeological evidence is discovered, i.e., artifacts or remains, the work must cease immediately and Contractor must notify the Owner Representative immediately.

By signing this acknowledgement, each Contractor denotes acceptance of all of the above safety requirements of this Contract and agreement to abide by all federal, state and local laws and regulations.

Name: _____

Date: _____

(Print)

Contractor: _____

Brief

Job

Description:

Signature: _____

APPENDIX I

NRC REG. GUIDE 8.13



U.S. NUCLEAR REGULATORY COMMISSION

Revision 3
June 1999

REGULATORY GUIDE

OFFICE OF NUCLEAR REGULATORY RESEARCH

REGULATORY GUIDE 8.13

(Draft was issued as DG-8014)

INSTRUCTION CONCERNING PRENATAL RADIATION EXPOSURE

A. INTRODUCTION

The Code of Federal Regulations in 10 CFR Part 19, "Notices, Instructions and Reports to Workers: Inspection and Investigations," in Section 19.12, "Instructions to Workers," requires instruction in "the health protection problems associated with exposure to radiation and/or radioactive material, in precautions or procedures to minimize exposure, and in the purposes and functions of protective devices employed." The instructions must be "commensurate with potential radiological health protection problems present in the work place."

The Nuclear Regulatory Commission's (NRC's) regulations on radiation protection are specified in 10 CFR Part 20, "Standards for Protection Against Radiation"; and 10 CFR 20.1208, "Dose to an Embryo/Fetus," requires licensees to "ensure that the dose to an embryo/fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman, does not exceed 0.5 rem (5 mSv)." Section 20.1208 also requires licensees to "make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman." A declared pregnant woman is defined in 10 CFR 20.1003 as a woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception.

This regulatory guide is intended to provide information to pregnant women, and other personnel, to help them make decisions regarding radiation exposure during pregnancy. This Regulatory Guide 8.13 supplements Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Radiation Exposure" (Ref. 1), which contains a broad discussion of the risks from exposure to ionizing radiation.

Other sections of the NRC's regulations also specify requirements for monitoring external and internal occupational dose to a declared pregnant woman. In 10 CFR 20.1502, "Conditions Requiring Individual Monitoring of External and Internal Occupational Dose," licensees are required to monitor the occupational dose to a declared pregnant woman, using an individual monitoring device, if it is likely that the declared pregnant woman will receive, from external sources, a deep dose equivalent in excess of 0.1 rem (1 mSv). According to Paragraph (e) of 10 CFR 20.2106, "Records of Individual Monitoring Results," the licensee must maintain records of dose to an embryo/fetus if monitoring was required, and the records of dose to the embryo/fetus must be kept with the records of dose to the declared pregnant woman. The declaration of pregnancy must be kept on file, but may be maintained separately from the dose records. The licensee must retain the re-

USNRC REGULATORY GUIDES

Regulatory Guides are issued to describe and make available to the public such information as methods acceptable to the NRC staff for implementing specific parts of the Commission's regulations, techniques used by the staff in evaluating specific problems or postulated accidents, and data needed by the NRC staff in its review of applications for permits and licenses. Regulatory guides are not substitutes for regulations, and compliance with them is not required. Methods and solutions different from those set out in the guides will be acceptable if they provide a basis for the findings requisite to the issuance or continuance of a permit or license by the Commission.

This guide was issued after consideration of comments received from the public. Comments and suggestions for improvements in these guides are encouraged at all times, and guides will be revised, as appropriate, to accommodate comments and to reflect new information or experience.

Written comments may be submitted to the Rules and Directives Branch, ADM, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

The guides are issued in the following ten broad divisions:

- | | |
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| 1. Power Reactors | 6. Products |
| 2. Research and Test Reactors | 7. Transportation |
| 3. Fuels and Materials Facilities | 8. Occupational Health |
| 4. Environmental and Siting | 9. Antitrust and Financial Review |
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quired form or record until the Commission terminates each pertinent license requiring the record.

The information collections in this regulatory guide are covered by the requirements of 10 CFR Parts 19 or 20, which were approved by the Office of Management and Budget, approval numbers 3150-0044 and 3150-0014, respectively. The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

B. DISCUSSION

As discussed in Regulatory Guide 8.29 (Ref. 1), exposure to any level of radiation is assumed to carry with it a certain amount of risk. In the absence of scientific certainty regarding the relationship between low dose exposure and health effects, and as a conservative assumption for radiation protection purposes, the scientific community generally assumes that any exposure to ionizing radiation may cause undesirable biological effects and that the likelihood of these effects increases as the dose increases. At the occupational dose limit for the whole body of 5 rem (50 mSv) per year, the risk is believed to be very low.

The magnitude of risk of childhood cancer following in utero exposure is uncertain in that both negative and positive studies have been reported. The data from these studies "are consistent with a lifetime cancer risk resulting from exposure during gestation which is two to three times that for the adult" (NCRP Report No. 116, Ref. 2). The NRC has reviewed the available scientific literature and has concluded that the 0.5 rem (5 mSv) limit specified in 10 CFR 20.1208 provides an adequate margin of protection for the embryo/fetus. This dose limit reflects the desire to limit the total lifetime risk of leukemia and other cancers associated with radiation exposure during pregnancy.

In order for a pregnant worker to take advantage of the lower exposure limit and dose monitoring provisions specified in 10 CFR Part 20, the woman must declare her pregnancy in writing to the licensee. A form letter for declaring pregnancy is provided in this guide or the licensee may use its own form letter for declaring pregnancy. A separate written declaration should be submitted for each pregnancy.

C. REGULATORY POSITION

1. Who Should Receive Instruction

Female workers who require training under 10 CFR 19.12 should be provided with the information contained in this guide. In addition to the information

contained in Regulatory Guide 8.29 (Ref. 1), this information may be included as part of the training required under 10 CFR 19.12.

2. Providing Instruction

The occupational worker may be given a copy of this guide with its Appendix, an explanation of the contents of the guide, and an opportunity to ask questions and request additional information. The information in this guide and Appendix should also be provided to any worker or supervisor who may be affected by a declaration of pregnancy or who may have to take some action in response to such a declaration.

Classroom instruction may supplement the written information. If the licensee provides classroom instruction, the instructor should have some knowledge of the biological effects of radiation to be able to answer questions that may go beyond the information provided in this guide. Videotaped presentations may be used for classroom instruction. Regardless of whether the licensee provides classroom training, the licensee should give workers the opportunity to ask questions about information contained in this Regulatory Guide 8.13. The licensee may take credit for instruction that the worker has received within the past year at other licensed facilities or in other courses or training.

3. Licensee's Policy on Declared Pregnant Women

The instruction provided should describe the licensee's specific policy on declared pregnant women, including how those policies may affect a woman's work situation. In particular, the instruction should include a description of the licensee's policies, if any, that may affect the declared pregnant woman's work situation after she has filed a written declaration of pregnancy consistent with 10 CFR 20.1208.

The instruction should also identify who to contact for additional information as well as identify who should receive the written declaration of pregnancy. The recipient of the woman's declaration may be identified by name (e.g., John Smith), position (e.g., immediate supervisor, the radiation safety officer), or department (e.g., the personnel department).

4. Duration of Lower Dose Limits for the Embryo/Fetus

The lower dose limit for the embryo/fetus should remain in effect until the woman withdraws the declaration in writing or the woman is no longer pregnant. If a declaration of pregnancy is withdrawn, the dose limit for the embryo/fetus would apply only to the time from the estimated date of conception until the time the declaration is withdrawn. If the declaration is

not withdrawn, the written declaration may be considered expired one year after submission.

5. Substantial Variations Above a Uniform Monthly Dose Rate

According to 10 CFR 20.1208(b), "The licensee shall make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman so as to satisfy the limit in paragraph (a) of this section," that is, 0.5 rem (5 mSv) to the embryo/fetus. The National Council on Radiation Protection and Measurements (NCRP) recommends a monthly equivalent dose limit of 0.05 rem (0.5 mSv) to the embryo/fetus once the pregnancy is known (Ref. 2). In view of the NCRP recommendation, any monthly dose of less than 0.1 rem (1 mSv) may be considered as not a substantial variation above a uniform monthly dose rate and as such will not require licensee justification. However, a monthly dose greater than 0.1 rem (1 mSv) should be justified by the licensee.

D. IMPLEMENTATION

The purpose of this section is to provide information to licensees and applicants regarding the NRC staff's plans for using this regulatory guide.

Unless a licensee or an applicant proposes an acceptable alternative method for complying with the specified portions of the NRC's regulations, the methods described in this guide will be used by the NRC staff in the evaluation of instructions to workers on the radiation exposure of pregnant women.

REFERENCES

1. USNRC, "Instruction Concerning Risks from Occupational Radiation Exposure," Regulatory Guide 8.29, Revision 1, February 1996.
2. National Council on Radiation Protection and Measurements, *Limitation of Exposure to Ionizing Radiation*, NCRP Report No. 116, Bethesda, MD, 1993.

APPENDIX

QUESTIONS AND ANSWERS CONCERNING PRENATAL RADIATION EXPOSURE

1. Why am I receiving this information?

The NRC's regulations (in 10 CFR 19.12, "Instructions to Workers") require that licensees instruct individuals working with licensed radioactive materials in radiation protection as appropriate for the situation. The instruction below describes information that occupational workers and their supervisors should know about the radiation exposure of the embryo/fetus of pregnant women.

The regulations allow a pregnant woman to decide whether she wants to formally declare her pregnancy to take advantage of lower dose limits for the embryo/fetus. This instruction provides information to help women make an informed decision whether to declare a pregnancy.

2. If I become pregnant, am I required to declare my pregnancy?

No. The choice whether to declare your pregnancy is completely voluntary. If you choose to declare your pregnancy, you must do so in writing and a lower radiation dose limit will apply to your embryo/fetus. If you choose not to declare your pregnancy, you and your embryo/fetus will continue to be subject to the same radiation dose limits that apply to other occupational workers.

3. If I declare my pregnancy in writing, what happens?

If you choose to declare your pregnancy in writing, the licensee must take measures to limit the dose to your embryo/fetus to 0.5 rem (5 millisievert) during the entire pregnancy. This is one-tenth of the dose that an occupational worker may receive in a year. If you have already received a dose exceeding 0.5 rem (5 mSv) in the period between conception and the declaration of your pregnancy, an additional dose of 0.05 rem (0.5 mSv) is allowed during the remainder of the pregnancy. In addition, 10 CFR 20.1208, "Dose to an Embryo/Fetus," requires licensees to make efforts to avoid substantial variation above a uniform monthly dose rate so that all the 0.5 rem (5 mSv) allowed dose does not occur in a short period during the pregnancy.

This may mean that, if you declare your pregnancy, the licensee may not permit you to do some of your normal job functions if those functions would have allowed you to receive more than 0.5 rem, and you may

not be able to have some emergency response responsibilities.

4. Why do the regulations have a lower dose limit for the embryo/fetus of a declared pregnant woman than for a pregnant worker who has not declared?

A lower dose limit for the embryo/fetus of a declared pregnant woman is based on a consideration of greater sensitivity to radiation of the embryo/fetus and the involuntary nature of the exposure. Several scientific advisory groups have recommended (References 1 and 2) that the dose to the embryo/fetus be limited to a fraction of the occupational dose limit.

5. What are the potentially harmful effects of radiation exposure to my embryo/fetus?

The occurrence and severity of health effects caused by ionizing radiation are dependent upon the type and total dose of radiation received, as well as the time period over which the exposure was received. See Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Exposure" (Ref. 3), for more information. The main concern is embryo/fetal susceptibility to the harmful effects of radiation such as cancer.

6. Are there any risks of genetic defects?

Although radiation injury has been induced experimentally in rodents and insects, and in the experiments was transmitted and became manifest as hereditary disorders in their offspring, radiation has not been identified as a cause of such effect in humans. Therefore, the risk of genetic effects attributable to radiation exposure is speculative. For example, no genetic effects have been documented in any of the Japanese atomic bomb survivors, their children, or their grandchildren.

7. What if I decide that I do not want any radiation exposure at all during my pregnancy?

You may ask your employer for a job that does not involve any exposure at all to occupational radiation dose, but your employer is not obligated to provide you with a job involving no radiation exposure. Even if you receive no occupational exposure at all, your embryo/fetus will receive some radiation dose (on average 75 mrem (0.75 mSv)) during your pregnancy from natural background radiation.

The NRC has reviewed the available scientific literature and concluded that the 0.5 rem (5 mSv) limit

provides an adequate margin of protection for the embryo/fetus. This dose limit reflects the desire to limit the total lifetime risk of leukemia and other cancers.

If this dose limit is exceeded, the total lifetime risk of cancer to the embryo/fetus may increase incrementally. However, the decision on what level of risk to accept is yours. More detailed information on potential risk to the embryo/fetus from radiation exposure can be found in References 2-10.

8. What effect will formally declaring my pregnancy have on my job status?

Only the licensee can tell you what effect a written declaration of pregnancy will have on your job status. As part of your radiation safety training, the licensee should tell you the company's policies with respect to the job status of declared pregnant women. In addition, before you declare your pregnancy, you may want to talk to your supervisor or your radiation safety officer and ask what a declaration of pregnancy would mean specifically for you and your job status.

In many cases you can continue in your present job with no change and still meet the dose limit for the embryo/fetus. For example, most commercial power reactor workers (approximately 93%) receive, in 12 months, occupational radiation doses that are less than 0.5 rem (5 mSv) (Ref. 11). The licensee may also consider the likelihood of increased radiation exposures from accidents and abnormal events before making a decision to allow you to continue in your present job.

If your current work might cause the dose to your embryo/fetus to exceed 0.5 rem (5 mSv), the licensee has various options. It is possible that the licensee can and will make a reasonable accommodation that will allow you to continue performing your current job, for example, by having another qualified employee do a small part of the job that accounts for some of your radiation exposure.

9. What information must I provide in my written declaration of pregnancy?

You should provide, in writing, your name, a declaration that you are pregnant, the estimated date of conception (only the month and year need be given), and the date that you give the letter to the licensee. A form letter that you can use is included at the end of these questions and answers. You may use that letter, use a form letter the licensee has provided to you, or write your own letter.

10. To declare my pregnancy, do I have to have documented medical proof that I am pregnant?

NRC regulations do not require that you provide medical proof of your pregnancy. However, NRC regulations do not preclude the licensee from requesting medical documentation of your pregnancy, especially if a change in your duties is necessary in order to comply with the 0.5 rem (5 mSv) dose limit.

11. Can I tell the licensee orally rather than in writing that I am pregnant?

No. The regulations require that the declaration must be in writing.

12. If I have not declared my pregnancy in writing, but the licensee suspects that I am pregnant, do the lower dose limits apply?

No. The lower dose limits for pregnant women apply only if you have declared your pregnancy in writing. The United States Supreme Court has ruled (in *United Automobile Workers International Union v. Johnson Controls, Inc.*, 1991) that "Decisions about the welfare of future children must be left to the parents who conceive, bear, support, and raise them rather than to the employers who hire those parents" (Reference 7). The Supreme Court also ruled that your employer may not restrict you from a specific job "because of concerns about the next generation." Thus, the lower limits apply only if you choose to declare your pregnancy in writing.

13. If I am planning to become pregnant but am not yet pregnant and I inform the licensee of that in writing, do the lower dose limits apply?

No. The requirement for lower limits applies only if you declare in writing that you are already pregnant.

14. What if I have a miscarriage or find out that I am not pregnant?

If you have declared your pregnancy in writing, you should promptly inform the licensee in writing that you are no longer pregnant. However, if you have not formally declared your pregnancy in writing, you need not inform the licensee of your nonpregnant status.

15. How long is the lower dose limit in effect?

The dose to the embryo/fetus must be limited until you withdraw your declaration in writing or you inform the licensee in writing that you are no longer pregnant. If the declaration is not withdrawn, the written declaration may be considered expired one year after submission.

16. If I have declared my pregnancy in writing, can I revoke my declaration of pregnancy even if I am still pregnant?

Yes, you may. The choice is entirely yours. If you revoke your declaration of pregnancy, the lower dose limit for the embryo/fetus no longer applies.

17. What if I work under contract at a licensed facility?

The regulations state that you should formally declare your pregnancy to the licensee in writing. The licensee has the responsibility to limit the dose to the embryo/fetus.

18. Where can I get additional information?

The references to this Appendix contain helpful information, especially Reference 3, NRC's Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Radiation Exposure," for general information

on radiation risks. The licensee should be able to give this document to you.

For information on legal aspects, see Reference 7, "The Rock and the Hard Place: Employer Liability to Fertile or Pregnant Employees and Their Unborn Children—What Can the Employer Do?" which is an article in the journal *Radiation Protection Management*.

You may telephone the NRC Headquarters at (301) 415-7000. Legal questions should be directed to the Office of the General Counsel, and technical questions should be directed to the Division of Industrial and Medical Nuclear Safety.

You may also telephone the NRC Regional Offices at the following numbers: Region I, (610) 337-5000; Region II, (404) 562-4400; Region III, (630) 829-9500; and Region IV, (817) 860-8100. Legal questions should be directed to the Regional Counsel, and technical questions should be directed to the Division of Nuclear Materials Safety.

REFERENCES FOR APPENDIX

1. National Council on Radiation Protection and Measurements, *Limitation of Exposure to Ionizing Radiation*, NCRP Report No. 116, Bethesda, MD, 1993.
2. International Commission on Radiological Protection, *1990 Recommendations of the International Commission on Radiological Protection*, ICRP Publication 60, Ann. ICRP 21: No. 1-3, Pergamon Press, Oxford, UK, 1991.
3. USNRC, "Instruction Concerning Risks from Occupational Radiation Exposure," Regulatory Guide 8.29, Revision 1, February 1996.¹ (Electronically available at www.nrc.gov/NRC/RG/index.html)
4. Committee on the Biological Effects of Ionizing Radiations, National Research Council, *Health Effects of Exposure to Low Levels of Ionizing Radiation (BEIR V)*, National Academy Press, Washington, DC, 1990.
5. United Nations Scientific Committee on the Effects of Atomic Radiation, *Sources and Effects of Ionizing Radiation*, United Nations, New York, 1993.
6. R. Doll and R. Wakeford, "Risk of Childhood Cancer from Fetal Irradiation," *The British Journal of Radiology*, 70, 130-139, 1997.
7. David Wiedis, Donald E. Jose, and Timm O. Phoebe, "The Rock and the Hard Place: Employer Liability to Fertile or Pregnant Employees and Their Unborn Children—What Can the Employer Do?" *Radiation Protection Management*, 11, 41-49, January/February 1994.
8. National Council on Radiation Protection and Measurements, *Considerations Regarding the Unintended Radiation Exposure of the Embryo, Fetus, or Nursing Child*, NCRP Commentary No. 9, Bethesda, MD, 1994.
9. National Council on Radiation Protection and Measurements, *Risk Estimates for Radiation Protection*, NCRP Report No. 115, Bethesda, MD, 1993.
10. National Radiological Protection Board, *Advice on Exposure to Ionising Radiation During Pregnancy*, National Radiological Protection Board, Chilton, Didcot, UK, 1998.
11. M.L. Thomas and D. Hagemeyer, "Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities, 1996," *Twenty-Ninth Annual Report*, NUREG-0713, Vol. 18, USNRC, 1998.²

¹Single copies of regulatory guides, both active and draft, and draft NUREG documents may be obtained free of charge by writing the Reproduction and Distribution Services Section, OCIO, USNRC, Washington, DC 20555-0001, or by fax to (301)415-2289, or by email to <DISTRIBUTION@NRC.GOV>. Active guides may also be purchased from the National Technical Information Service on a standing order basis. Details on this service may be obtained by writing NTIS, 5285 Port Royal Road, Springfield, VA 22161. Copies of active and draft guides are available for inspection or copying for a fee from the NRC Public Document Room at 2120 L Street NW, Washington, DC; the PDR's mailing address is Mail Stop LL-6, Washington, DC 20555; telephone (202)634-3273; fax (202)634-3343.

²Copies are available at current rates from the U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20402-9328 (telephone (202)512-1800); or from the National Technical Information Service by writing NTIS at 5285 Port Royal Road, Springfield, VA 22161. Copies are available for inspection or copying for a fee from the NRC Public Document Room at 2120 L Street NW, Washington, DC; the PDR's mailing address is Mail Stop LL-6, Washington, DC 20555; telephone (202)634-3273; fax (202)634-3343.

REGULATORY ANALYSIS

A separate regulatory analysis was not prepared for this regulatory guide. A regulatory analysis prepared for 10 CFR Part 20, "Standards for Protection Against Radiation" (56 FR 23360), provides the regulatory basis for this guide and examines the costs and benefits of the rule as implemented by the guide. A copy of the "Regulatory Analysis for the Revision of 10 CFR Part 20" (PNL-6712, November 1988) is available for inspection and copying for a fee at the NRC Public Document Room, 2120 L Street NW, Washington, DC, as an enclosure to Part 20 (56 FR 23360).

APPENDIX J

PRE-NATAL FORM

Subject: Radiation Exposure to Pregnant Women Employees

On this date, I was advised by my employer, Denison Mines (USA) Corp. of the White Mesa Mill, Utah, of the possible risks associated with prenatal radiation exposure and of the precautions that I should I become pregnant and continue to work. I was also advised of the alternatives that I might consider in this regard.

I discussed this subject with my employer and understand the possible risks to children of women who are exposed to radiation during pregnancy and the alternatives that I might consider as explained by my employer as contained in the appendix to Regulatory Guide 8.13 from the United States Nuclear Regulatory Commission, a copy of which was given to me for reference.

Employee

Date

Employer Representative

Date

Hire Date: _____

SSN: _____

Employee Number: _____

FORM LETTER FOR DECLARING PREGNANCY

This form letter is provided for your convenience. To make your written declaration of pregnancy, you may fill in the blanks in this form letter, you may use a form letter the licensee has provided to you, or you may write your own letter.

DECLARATION OF PREGNANCY

To: _____

In accordance with the NRC's regulations at 10 CFR 20.1208, "Dose to an Embryo/Fetus," I am declaring that I am pregnant. I believe I became pregnant in _____ (only the month and year need be provided).

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)