ADEQ Arizona Department of Environmental Quality

TECHNICAL SUPPORT DOCUMENT

TECHNICAL REVIEW AND EVALUATION

OF APPLICATION FOR

AIR QUALITY SIGNIFICANT REVISION NO. 63895 TO PERMIT NO. 59874

I. INTRODUCTION

This Class II air quality control significant revision is for the operation of an underground uranium mine located approximately 36 miles southwest of Fredonia in Mohave County, Arizona. The facility is owned and operated by Energy Fuels Resources (USA) Inc. The facility will has a maximum annual production of approximately 109,500 tons of uranium ore. This is a revision to Permit #59874 in order to include a Dust Control and Soil Sampling Implementation Plan.

Company Information

Company Name:	Energy Fuels Resources (USA) Inc.
Facility Name:	AZ 1 Mine
Facility Location:	36° 30’ 28”; -112° 48’ 21”, 5,450 ft; 36 miles southwest of Fredonia in Mohave County
Mailing Address:	225 Union Blvd., Suite 600 Lakewood, Colorado, 80228

Mohave County is an attainment or unclassified area for the National Ambient Air Quality Standards (NAAQS).

II. PROCESS DESCRIPTION

A. Underground Uranium Mining

The maximum mine production rate is 109,500 tons per year (tpy) of uranium ore. No ore processing is conducted on-site. The ore is shipped to an off-site processing mill. If the ore cannot be shipped immediately to the mill, it is placed on-site in stock piles within the Ore Stockpile Area (OSA). The OSA encompasses approximately 1.0 acre and can accommodate up to 13,100 tons of stockpile ore. The facility also has a 400 kilowatt (kW) standby diesel-powered generator for use as backup power.

Rock from the mining operations with less than 0.03 percent uranium is stored on the surface in the Development Rock Storage Area (DRA) and in mined-out areas of the underground workings. The Development Rock Area (DRA) encompasses approximately 6 acres.

III. RADIATION BACKGROUND[1]

Energy Fuels Resources (USA) Inc.'s AZ 1 mine is a uranium mining operation and as such the potential radiation from the mine must be understood. Radiation refers to energy emitted in the form of waves or particles. There are two main types of radiation which must be considered: Non-ionizing radiation and ionizing radiation. The form of radiation of concern at the AZ-1 Mine is ionizing radiation.
Non-ionizing radiation occurs at the low frequency end of the electromagnetic spectrum. Examples of non-ionizing radiation include: microwaves, radio waves, radar, infrared and some ultraviolet radiation. This type of radiation in sufficient concentration can produce undesirable effects on humans through heating. As the frequency increases through the ultraviolet region, the energy from the electromagnetic radiation becomes sufficient to release orbiting electrons from the surrounding matter. This form of radiation is ionizing radiation. Examples of ionizing radiation are x-rays, gamma rays, and cosmic rays. In addition to wave or frequency type radiation emissions, several particles are also included in this form of radiation. These particles are alpha particles and beta particles.

The negative health effects attributed to this type of radiation depend on many parameters including the amount of radiation received (dose), the rate at which the radiation is delivered (dose rate), and the type of ionizing radiation (alpha, beta, x-ray, gamma). The ionizing radiation which will be present at the AZ-1 Mine site will include x-rays, gamma rays, alpha particles and beta particles. These types of radiation are emitted from the radioactive material found in and around the uranium ore body.

X-rays and gamma radiation have no mass or charge. They may be produced by x-ray machines, by ionization of atoms or molecules, or by the decay of radioactive atoms.

Beta particles have a very small mass and a negative charge. Basically, beta particles are electrons which have been released from inside an atom as that atom decays and seeks a more stable configuration. Some radioactive materials may decay by releasing an alpha particle from its nucleus. The alpha particle has two positive charges and is identical to an ionized helium atom. Alpha particles are about 2,000 times larger and are ejected with about 10 times more kinetic energy than beta particles.

Now that the types of radiation have been identified it is helpful also to understand the natural radiation environment. The natural radiation environment consists of cosmic radiation and many radioactive elements including Hydrogen-3, Carbon-14, Potassium-40, Rubidium-87, Uranium-235, Uranium-238 and Thorium-232. Both Uranium-238 and Thorium-232 are ubiquitous in soil with average concentrations of a few parts per million. Each are parent elements of a radioactive decay series. The parents decay to daughters which are also radioactive. Natural uranium is about 99.3% U-238.

Radioactive materials are present in air, water and soil. Their concentrations are expressed in units of radioactivity per volume or mass. Typical concentrations of naturally occurring uranium and Radium-226 in normal soil are on the order of 1 pico-Curie per gram. A pico-Curie (pCi) is equivalent to 2.22 atoms of the radionuclide decaying each minute. These values may vary considerably depending on the extent of uranium mineralization in the area being examined.

When ionizing radiation deposits energy in living matter it produces a physical and biological effect which may be quantified in terms of dose. The dose to a particular receptor of radiation is expressed in radiological units, known as rems (roentgen equivalent man). However, because this unit is so large it is often useful to divide the value by 1,000 and call it millirem (mrem).

A progeny of U-238 is Radon-222. Radon is a colorless, odorless and inert gas which diffuses into the atmosphere from rocks, soil and building materials. All the radon progeny are particulates and many

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decay by emitting alpha particles. It is the alpha particle emitting progeny of Radon-222 that have been linked to negative effects on humans.

Airborne Radioactivity

Radon gas emanates from earthen materials containing uranium such as natural soil and the ore stockpiles. Once airborne, the gas will be transported by prevailing winds and will decay to its progeny. Uranium and its progeny will be present in dust from the mining operations. The mine shaft vent emissions are subject to limitations set forth of 40 Code of Federal Regulations (CFR) Part 61 subpart B at 10 mrem/year. Radiation exposure from dust associated with the mining operation is dependent on the concentrations of dust in the air and the activity of the compounds in the dust. EFRI is required by the permit to have a Dust Control and Soil Sampling Implementation Plan that will have a radiation monitoring component.

Direct radiation from haul trucks is estimated to be approximately 2 mrem/hr at the truck bed, about 0.3 mrem/hr on the shoulder of the roadbed, and normal background at about 96 feet from the trailer. As a truck passes, individuals standing on the shoulder of the road would receive a dose of radiation too small to quantify. These radiation concentrations can be put in perspective by comparing them to what naturally occurs in various locations. For example, naturally occurring radiation levels for a person living in the Colorado Plateau will receive 400-500 mrem/year based on EPA estimates. Thus, the estimated radiation exposure from the site does not present a significant risk to human health.

IV. EMISSIONS

The emissions listed in Table 1 below are from generator, vent shaft and ore/development rock unloading. Fugitive emissions are not included in calculations since this facility is not a listed category source as defined under A.A.C. R18-2-101.23. Detailed emission calculations are available as part of the installation permit application.

Table 1: Facility Emissions

Pollutant	Emissions (tons per year)
PM	24
PM10	7.7
PM2.5	2.1
NOx	1
CO	0.2
SO2	0.07
VOC	0.38
HAPs	0.035
Radionuclides	0.022

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V. APPLICABLE REGULATIONS

The applicable regulations were identified by the company as part of the application packet. If necessary, the source is required to list any additional regulations that may be applicable. Table 2 displays the applicable requirements for each piece of equipment under the permit.

Table 2: Verification of Applicable Regulations

Unit	Control Device	Rule	Verification

Mine Vents	N/A	A.A.C. R18-2, Article 11 40 CFR 61 Subpart B A.A.C. R18-2-730	NESHAPs requirements for radon monitoring apply to the mine vents. These standards apply for Unclassified Sources
Internal Combustion Engine	None	A.A.C. R18-2-719 40 CFR 63 Subpart ZZZZ	This standard applies to all stationary rotating machinery This standard applies since the engine is an existing emergency CI engine located at an area source of HAPS
Fugitive dust sources	Water and other reasonable precautions.	A.A.C. R18-2, Article 6	These standards are applicable to all fugitive dust sources.
Mobile sources	Water Sprays/Water Truck for dust control	A.A.C. R18-2, Article 8	Opacity requirements for smoke and dust for mobile sources (construction equipment, etc.).

VI. MONITORING AND RECORDKEEPING REQUIREMENTS

A. Opacity Requirements

The permit specifies opacity limitations for the various emission sources found within the facility, including mine vents, and fugitive dust sources. The permit requires the source to perform weekly observations (quarterly for the emergency generator) of the various point sources and non-point sources, and if emissions appears to exceed the opacity standard, a Method 9 observation is to be conducted.

The Permittee is to keep records of the date, time, and results of all visible surveys made, as well as the name of the observer who conducted the survey.

B. Particulate Matter Requirements

The permit specifies particulate matter limits for the fuel-burning equipment, mine vent emissions, and work practice standards for fugitive dust sources. The Permittee is required to keep records of all activities that may produce fugitive dust emissions of particulate matter. In addition, the Permittee must use water or equivalent control to minimize fugitive dust emissions from storage piles and development rock areas.

C. Dust Control and Soil Sampling Implementation Plan

The Permitee has proposed to implement a Dust Control and Soil Sampling Implementation Plan as Attachment “D” of the permit to minimize fugitive dust emissions and mitigate the transport of dust from ore stockpiles, haul truck loading activities, and other dust producing activities. Additionally, this plan requires the facility to conduct offsite periodic sampling of soil around the mine site to determine if any elevated readings of uranium, radium or gamma radiation are detected. This will indicate if dust control strategies are working or if additional dust mitigation strategies need to be implemented. Soil will be sampled and gamma radiation monitors placed approximately 100 feet outside the mine fenceline at locations specified in the permit. Initially, soil will be sampled on an annual basis and gamma radiation monitors collected on a quarterly basis. If the results of the soil sampling show levels of Uranium or Radium above the trigger levels contained in the permit, then soil sampling will be increased to quarterly. In addition, reading above the trigger levels will require EFRI to implement additional dust control strategies contained in the permit, such as reducing the size of the ore stockpiles or installing wind fences or barriers.

D. Radon NESHAPs Requirements

The permit specifies Radon (Rn-222) testing requirements. The permit specifies that Rn-222 concentration and flow rate measurements will be used to calculate the effective dose equivalent resulting from mine emissions. The permit specifies that compliance modeling will be reported each year to EPA and the Department by March 31st of the following year.

E. Internal Combustion Engines

The Permittee is required to keep records of the fuel supplier certification to demonstrate compliance with the sulfur limit and conduct quarterly opacity observations.

This generator is subject to 40 CFR 60 Subpart ZZZZ which requires the facility to maintain the generator by conducting routine maintenance including scheduled oil changes.

F. Dust Control Trigger Levels

The trigger levels are based on conversations between ADEQ and EFRI, and a report written by EFRI's consultant, Arcadis, titled *Development of the Proposed Trigger Levels for Energy Fuels' Arizona Mines (DRAFT)*. This report is available from the Department upon request.

Briefly, the levels were developed using the following procedure:

1. Choosing a target radiation dose of 15 mrem/year, taken from the EPA clean-up level for sites subject to the Comprehensive Environmental Response, Compensation, and Liability Act.
2. Determining the level of uranium ore dust, radon (Ra-226), and gamma radiation that would affect a dose equivalent to 15 mrem/year in a recreational camper spending up to 14 days per year at the site, and that any deposited radioactive materials would remain in the top 5 cm soil layer.
3. Setting the trigger levels at 25% of the level that would result in a 15 mrem dose, found in step 2.
4. Adding a background of 4.21 mrem/week to the gamma radiation trigger levels, based on the highest level recorded at the Canyon Mine site, prior to any ore production. (No background is added to the radon and uranium ore trigger levels)

VII LIST OF ABBREVIATIONS

A.A.C. .... Arizona Administrative Code
CFR. .... Code of Federal Regulations
CI. .... Compression Ignition
CO. .... Carbon Monoxide
DRSP. .... Development Rock Storage Pad
DRA. .... Development Rock Area
EPA. .... Environmental Protection Agency
HAPs .... Hazardous Air Pollutants

Lb/hr.. Pound per Hour
m.. meters
mph.. Miles per Hour
mrem. .... Millirem
NESHAP. .... National Emission Standards for Hazardous Air Pollutants
OSA.. Ore Stockpile Area
pCi.. pico-Curie
PM_{10}. .... Particulate Matter with an Aerodynamic Diameter less than 10 Microns
NO_x .... Nitrogen Oxide
SO_2. .... Sulfur Dioxide
TPY .... Tons per Year
VOC .... Volatile Organic Compound