TECHNICAL REVIEW AND EVALUATION OF APPLICATION FOR AIR QUALITY PERMIT No. 88788

I. INTRODUCTION

This Class II air quality Renewal permit is for the continued operation of Energy Fuels Resources (USA) Inc.'s Pinyon Plain Mine (formerly Canyon Mine), an underground uranium mine. Permit No. 88788 renews and supersedes Permit No. 62877.

A. Company Information

Facility Name:	Pinyon Plain Mine
Mailing Address:	225 Union Blvd., Suite 600
	Lakewood, Colorado 80228
Facility Location:	35° 52' 58"/-112° 05' 46", 6,500 ft; 6.5 miles southeast of Tusayan in Coconino County

B. Attainment Classification

The facility is located in Coconino County which is an attainment or unclassified area for the National Ambient Air Quality Standards (NAAQS).

II. PROCESS DESCRIPTION

A. Process Equipment

The proposed mine production rate is 109,500 tons per year (tpy) of uranium ore. No ore processing will be conducted on-site. The ore will be shipped to an off-site processing mill. If the ore cannot be shipped immediately to the mill, it will be placed on site in stock piles within the Ore Stockpile Area (OSA). The OSA will encompass approximately 0.7 acre and can accommodate up to 13,100 tons of stockpile ore. Power for the facility is supplied via overhead electric lines. A diesel generator is used as a source of backup power in the event of power failure. A total of four (4) evaporator fans are currently used to enhance evaporation of water in the evaporation pond.

Rock from the mining operations with less than 0.03 percent uranium will be stored on the surface in the Development Rock Area (DRA) and in mined-out areas of the underground workings. The DRA will encompass approximately 1.54 acres.

B. Process Flow Diagram

A diagram for the process and site described in Section II.A is displayed in Figure 1 below.

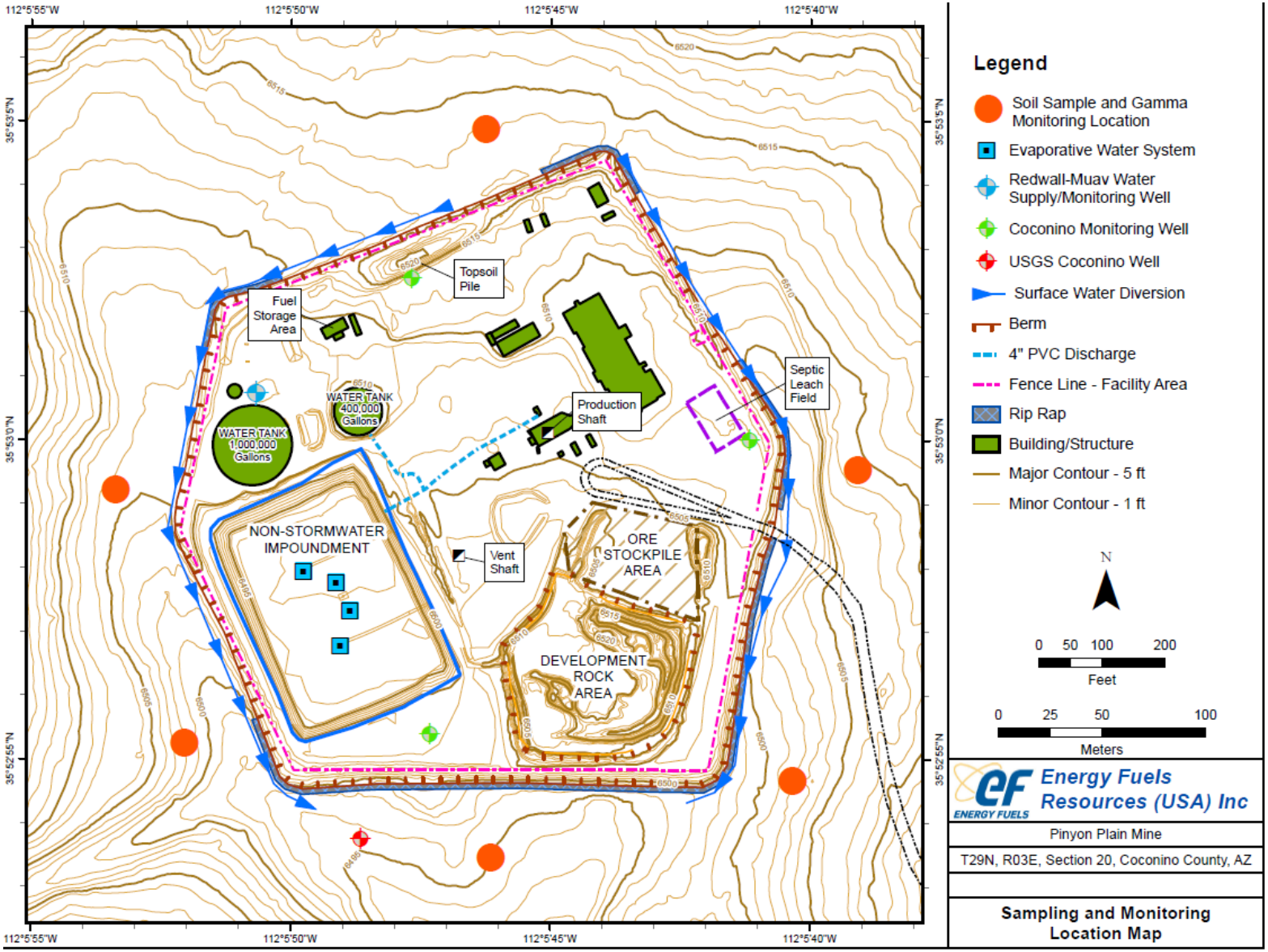

Figure 1: Sampling and Monitoring Map from Permit No. 88788 Appendix 1

III. RADIATION DISCUSSION[1]

Energy Fuels Resources (USA) Inc.'s Pinyon Plain Mine is an underground uranium mining operation. Uranium is a naturally occurring radioactive element, which is present in virtually all soil, rock, and water.[2] The extraction of the Uranium ore from the rock will expose the naturally occurring radioactive material to the environment.

A. Ionizing Radiation

The form of radiation of concern at the Pinyon Plain Mine is ionizing radiation. The ionizing radiation present at the Pinyon Plain Mine site will include x-rays, gamma rays, alpha particles and beta particles. These types of radiation are emitted from the naturally occurring radioactive material found in and around the uranium ore body. 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).

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).

B. Natural Radiation Environment

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.

The natural radiation environment of the Pinyon Plain Mine site consists of cosmic radiation and radioactive elements including Hydrogen-3, Carbon-14, Potassium-40, Rubidium-87, Uranium-235, Uranium-238 and Thorium-232. Uranium-238 and Thorium-232 are ubiquitous in soil with average concentrations in the range of a few parts per million. Each are parent elements of a radioactive decay series. The parents decay to daughters (or progeny), which are also radioactive. Natural uranium is about 99.3% U-238.

C. Airborne & Direct Radiation

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

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1 Radiological Assessment of the Arizona 1 Project Prepared for EFNI by Dr. John W. McKlveen January 25, 1988
2 Radionuclide Basics: Uranium on EPA.gov (accessed April 16, 2019)

Radon gas emanates from earthen materials containing uranium such as natural soil and the ore stockpiles. Once airborne, the gas may 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 per year based on Environmental Protection Agency (EPA) estimates. Thus, the estimated radiation exposure from the site does not present a significant risk to human health.

IV. LEARNING SITE EVALUATION

In accordance with the Arizona Department of Environmental Quality's (ADEQ) Environmental Permits and Approvals near Learning Sites Policy, the Department is required to conduct an evaluation to determine if any nearby learning sites would be adversely impacted by the facility. Learning sites consist of all existing public schools, charter schools and private schools the K-12 level, and all planned sites for schools approved by the Arizona School Facilities Board. The learning sites policy was established to ensure that the protection of children at learning sites is considered before a permit approval is issued by ADEQ.

This renewal will not result in any increase in emissions criteria pollutants greater than the permitting exemption thresholds. Thus, based on the policy and the renewal application, there was no requirement to conduct a learning site evaluation for this permitting action.

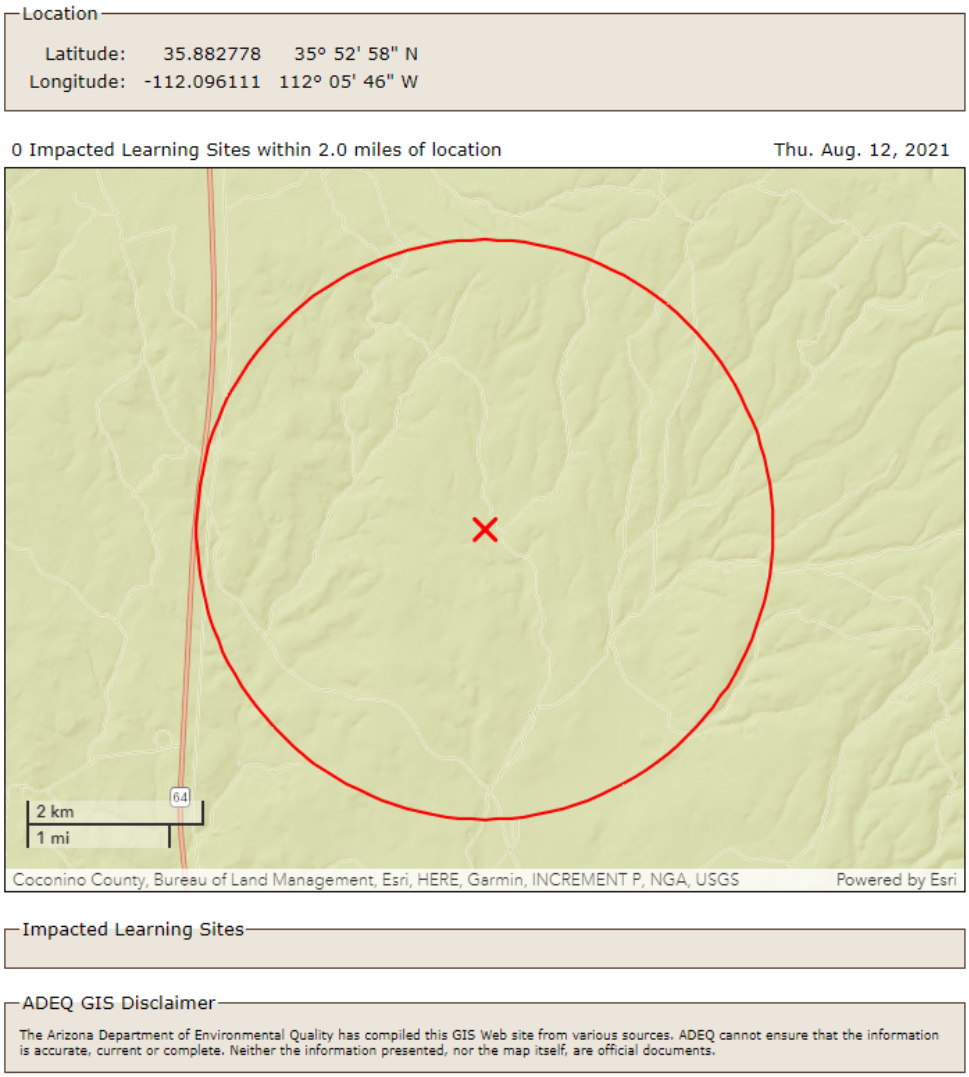

Figure 2 - Learning Site Evaluation for Pinyon Plain Mine

The Department conducted a Learning Site Evaluation in response to public comment. By definition learning sites "consist of all existing public schools, charter schools and private schools at the K-12 level, and all planned sites for schools approved by the Arizona School Facilities Board." Using the Arc GIS tool, it was determined that there are no learning sites are within 2 miles of the facility. This can be seen in Figure 2 above.

V. COMPLIANCE HISTORY

A. Facility Inspections

Pinyon Plain Mine was inspected six (6) times during the last permit term. The dates of inspection were January 18, 2017, March 30, 2017, September 27, 2017, April 4, 2019 and June 17, 2020. A multimedia inspection was conducted on August 13, 2020. The facility was issued a Notice of Opportunity to Correct (NOC) as a result of the March 30, 2017 inspection and is discussed in further detail in Section C below.

B. Report Reviews

During the last permit term, the facility has submitted ten (10) Semiannual Compliance Certifications to ADEQ certifying compliance with the permit. In addition to this, the facility has submitted eighteen (18) quarterly Gamma (Radiation) Monitoring reports, eight (8) Soil Sampling reports (quarterly for the first calendar year, then annually), and five (5) annual 40 CFR Part 61 Subpart B – NESHAPs reports.

1. Quarterly Gamma Monitoring Report for 2nd Quarter of 2020

The facility noted anomalous results for the quarterly gamma monitoring results for the second quarter of 2020. The same difference in order of magnitude from previous monitoring results were found for Arizona 1 Mine and a distant non-mining area. As required in Att. "D", Condition II.B.3.d of Permit No. 62877 the facility submitted a follow up report on August 6, 2020 containing a description of the data, QA/QC analysis, the issues identified, and a corrective action plan.

EFRI reported that there were no new or unusual activities at the facility compared to the previous monitoring periods and the underground areas were not accessed, no ore was removed from underground, and no new ore or development rock was placed above ground at either site. The facility requested the laboratory (Landauer) recount the results to rule out any laboratory error. On August 6, 2020, the laboratory noted, "no unusual conditions were identified and the recount results support the original data."

An annual soil sampling required by the Permit, Attachment D Section 11.B.2.b for Pinyon Plain Mine was conducted on July 13, 2020. The report was received by ADEQ on August 14, 2020. Based on standard procedures, the soil samples were collected in the same area that the Optically Stimulated Luminescence (OSL) badges were used for monitoring. The annual soil sampling report included readings that were below background values indicating that there was no gamma source present. If the results from the quarterly gamma monitoring report were valid, then this increase in radiation would be reflected in the annual soil sampling report. Additionally, the quarterly gamma reports for the third and fourth quarter reported gamma levels similar to the historical levels for the site.

The suspected cause for the anomalous results was the OSL badges being exposed to x-rays during transportation. The badges from this shipment were used at Pinyon Plain Mine, Arizona 1 Mine, and a non-mining area. This suspected cause is further supported by the same anomalous results being found at the two other sites despite the sites being located 6.5 miles and 59 miles from Pinyon Plain Mine. As a corrective action, EFRI implemented a transit badge program to assess and measure any exposures to future badges during transport. No further actions were required.

C. Enforcement

Case No. 169620

During the inspection conducted on March 30, 2017 an ADEQ Inspector observed three (3) Land Shark Evaporators outside the evaporation ponds. A Notice of Opportunity to

Correct (NOC) was issued to Pinyon Plain Mine on April 12, 2017 for failure to obtain a permit revision prior to making a modification to a source subject to regulation.

The facility submitted a Minor Permit Revision Application on April 27, 2017 to install and operate an evaporative water spray system (EWS) on the evaporation pond. The information provided by the facility was sufficient and the compliance conditions had been met. The case was closed on April 27, 2017.

VI. EMISSIONS

Pinyon Plain Mine has the potential-to-emit (PTE) particulate matter nominally less than 10 micrometers (PM_{10}), particulate matter nominally less than 2.5 micrometers ($PM_{2.5}$), volatile organic compounds (VOC), nitrogen oxides (NO_X), sulfur dioxide (SO_2), carbon monoxide (CO), hazardous air pollutants (HAPs), and radionuclides. The emission rates were calculated using the maximum process rates for the facility, applicable control efficiencies, and the corresponding emission factors.

The mine also emits particulate matter (PM), which is considered for determining NSR applicability. Since the mine is not a categorical source pursuant to Arizona Administrative Code (A.A.C.) R18-2-101.23, fugitive emissions were not considered in determining if it is a major source. This mine is not a major source for PM or any other pollutant.

A. Vent Shaft

The vent shaft has the potential to emit PM_{10}, and $PM_{2.5}$ due to underground activities. The emissions were determined using the ventilation rate from the vent opening by an emission factor for particulate emission from MSHA. It was assumed that $PM_{2.5}$ was 34% of PM_{10} based on the particle size distribution for geological material in Guideline on Speciated Particulate Monitoring.

B. Ore/Development Rock Unloading

1. Loading and Unloading

The PM_{10} and $PM_{2.5}$ emissions from the material transfer of ore from the ore storage bins into haul trucks or the ore stockpile area were calculated using the emission factors from AP-42, Section 13.2.4 for Aggregate Handling and Storage Piles. Most of the ore will be shipped immediately and will not remain onsite.

2. Wind Erosion of Stockpiles (Topsoil, Waste Rock, and Ore)

The PM_{10} and $PM_{2.5}$ emissions from wind erosion of stockpiles were determined using emission factors from AP-42, Section 13.2.5 for Industrial Wind Erosion. The emissions are a function of mean wind speed, threshold velocity, the number of disturbances per year, the erosion potential, and particle size.

3. Fugitive Dust Emissions from Vehicle Traffic

The PM_{10} and $PM_{2.5}$ emissions from haul truck and other vehicle travel on unpaved roads were determined using the applicable equations from AP-42, Section 13.2.2 for Unpaved Roads. All roads within the facility boundary are unpaved and the

access road to the main site access is unpaved. The emissions were determined using an emission factor for each vehicle type and the vehicle miles traveled (VMT) for each vehicle.

C. Radionuclide Emissions

To determine the annual mass release rate for all nuclides in the uranium decay chain the U.S.N.R.C. Regulatory Guide 3.59 Methods for Estimating Radioactive and Toxic Airborne Source Terms for Uranium Milling Operations (March. 1987) was used as reference for the methods of calculation. Active mine development and continuous operation were assumed for the following determinations.

1. Ventilation

The potential radon emissions released from ventilation are a function of the effluent flow rate and the radon concentration in the effluent. It was assumed that there was a 500 pCi/l radon concentration in the effluent and that the mine vent would have a ventilation rate of 250,000 actual cubic feet per minute (ACFM).

2. Ore Handling Activities

The potential radon emissions released from ore handling are a function of the amount of ore processed per year, concentration of RA-266 in the ore, and the percent released during ore handling operations. It was assumed that there was a concentration of 1702 pCi/g Ra-226 in the ore and that 10% would release during ore handling operations.

3. Area Sources

The emanation of radon from an area source, such as ore stockpiles, waste piles and topsoil, is a function of the concentration of radon's parent nuclide Radium-226. The stockpiles are assumed to be a high-grade ore at 6000 ppm U_3O_8 to be conservative.

D. Generator

The emission calculations for the generator are based on specifications from the generator manufacturers or engine tier certified emission limits and the permit limit of 100 hours of operation per year. The Caterpillar engine (GEN455) is certified EPA Tier 4i so the emission factors used were the EPA Tier 4i standards at 100% load value. To determine SO_2 emissions, an emission factor based on the composition of the fuel was used. When determining PM emissions, the assumption was made that 100% of the PM emissions are PM_{10}. In addition, when determining VOC emissions, it was assumed that 100% of the total unburned hydrocarbon emissions come from VOCs. The emissions for HAPs were determined using emission factors from AP-42, Section 13.2.2 for Gasoline and Diesel Industrial Engines.

E. Evaporator Fans

The PM_{10} and $PM_{2.5}$ emissions from evaporative fans were determined using the total flow rate, working hours per year, and the applicable emission factors. The emission factors used are based on data provided by the manufacturer for droplet size and size distribution.

The emissions listed in Table 1 below are from generator, evaporator fans, vent shaft and ore/development rock unloading. Fugitive emissions were not considered in determining if it is a major source 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 permit application.

Table 1: Potential to Emit (tpy)

Pollutant	Emissions	Fugitive Emissions	Total Emissions
NO_X	2.61	-	2.61
PM_{10}	4.42	1.374	5.80
$PM_{2.5}$	0.76	0.147	0.91
CO	2.88	-	2.88
SO_2	0.0042	-	0.0042
VOC	0.17	-	0.17
Pb	2.57E-05	2.67E-06	2.83E-05
HAPs	0.0072	3.53E-04	0.0075
Radionuclides	0.0071	1.32E-09	0.0071

VII. MINOR NEW SOURCE REVIEW (NSR)

This permit renewal application does not propose to make any changes that would increase potential to emit in excess of the permitting exemption thresholds. As a result, this renewal permit does not trigger minor NSR.

VIII. APPLICABLE REGULATIONS

Table 2 identifies applicable regulations and verification as to why that standard applies. The table also contains a discussion of any regulations the emission unit is exempt from.

Table 2: Applicable Regulations

Unit & year	Control Device	Rule	Discussion
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

Table 2: Applicable Regulations

Unit & year	Control Device	Rule	Discussion
Internal Combustion Engine	None	40 CFR 60 Subpart IIII	This standard applies for Compression Ignition (CI) engines manufactured after April 6, 2006.
Evaporative Water Spray System	N/A	A.A.C. R18-2-702	The opacity standards from A.A.C R18-2-702 applicable to point source fugitive emissions
		A.A.C. R18-2-730	The standards from A.A.C. R18-2-730 are applicable to unclassified sources.
Fugitive dust sources	Water Trucks, Dust Suppressants	A.A.C. R18-2 Article 6 A.A.C. R18-2-702	These standards are applicable to all fugitive dust sources at the facility.
Abrasive Blasting	Wet blasting; Dust collecting equipment; Other approved methods	A.A.C. R-18-2-702 A.A.C. R-18-2-726	These standards are applicable to any abrasive blasting operation.
Spray Painting	Enclosures	A.A.C. R18-2-702 A.A.C. R-18-2-727	These standards are applicable to any spray painting operation.
Demolition/renovation Operations	N/A	A.A.C. R18-2-1101.A.8	This standard is applicable to any asbestos related demolition or renovation operations.

IX. PREVIOUS PERMIT REVISIONS AND CONDITIONS

A. Previous Permit Revisions

Table 3 provides a description of the permit revisions made to Permit No. 62877 during the previous permit term.

Table 3: Permit Revisions to Permit No. 62877

Permit Revision No.	Permit Revision Type	Brief Description
65899	MPR	This permit revision authorized the facility to install and operate an evaporative water spray system (EWS) on the evaporation pond.

B. Changes to Current Renewal

Table 4 addresses the changes made to the sections and conditions from Permit No. 62877:

Table 4: Previous Permit Conditions

Section No.	Determination			Comments
	Added	Revised	Deleted	
Att. "A"		X		General Provisions: Revised to represent the most recent template language
Att. "B" Section I		X		Facility Wide Requirements: Revised to represent the most recent template language
Att. "B" Section II		X		Mine Vents: • Revised to update formatting. • Particulate Matter (PM_{10}) and Opacity sections have been combined into one section. Visible emission protocol has been removed and replaced with a reference to Condition I.A.2 of Attachment "B".
Att. "B" Section III		X		Internal Combustion Engines: Sections of 40 CFR 60 Subpart IIII have been reorganized and expanded for greater clarity.
Att. "B" Section IV	X			Evaporative Water Spray Systems: Added section to reflect updates made in MPR No. 65899. Renumbered section from VII to IV.
Att. "B" Section V		X		Fugitive Dust Requirements: Revised to represent the most recent template language
Att. "B" Section VI			X	Mobile Source Requirements: Removed from permit.
Att. "B" Section VI		X		Other Periodic Activities: Revised to represent the most recent template language.
Att. "C"		X		Equipment List: Revised to reflect the most recent equipment operating at the facility and to include equipment information provided.
Att. "D"		X		Dust Control and Soil Sampling Implementation Plan: • Removed requirement to take soil samples within 60 days of permit issuance, since sampling schedule has already been established.

Table 4: Previous Permit Conditions

Section No.	Determination			Comments
	Added	Revised	Deleted	
				• Removed requirement to submit siting plan for anemometer. This plan has already been received by ADEQ. • Administrative corrections to numbering and formatting • Updated number of monitoring and sampling locations The Dust Control and Soil Sampling plan has been revised to remove conditions that are no longer applicable. The plan itself has not been changed.
Appendices 1-3		X		Updated appendices to most updated standard operating procedures (SOPs).

X. MONITORING, RECORDKEEPING, AND REPORTING REQUIREMENTS

Table 5 contains an inclusive but not an exhaustive list of the monitoring, recordkeeping and reporting requirements prescribed by the air quality permit. The table below is intended to provide insight to the public for how the Permittee is required to demonstrate compliance with the emission limits in the permit.

Table 5: Permit No. 88788

Emission Unit	Pollutant	Emission Limit	Monitoring Requirements	Recordkeeping Requirements	Reporting Requirements
Mine Vents	Radon-222	10 mrem/yr	Conduct testing with 40 CFR Part 61 appendix B, Method 115 using COMPLY-R or equivalent upon approval.	Calculate and write the annual report of the results and the input parameters used in making the calculations.	Submit annual report to ADEQ and EPA by March 31st of the following year.
	PM; Opacity	20% Opacity	A Method 9 observer is required to conduct a bi-weekly (once every two weeks) survey of visible emissions.	If the visible emissions on an instantaneous basis appears less than or equal to the applicable opacity standard, keep a record of the name of the observer, the date on which the instantaneous survey was made, and the results of the instantaneous survey. If the visible emissions on an instantaneous basis appears greater than the applicable opacity standard, immediately conduct a six-minute observation of the visible emissions.	If the observation shows a Method 9 opacity reading in excess of 20%, report this to ADEQ as an excess emission.

Table 5: Permit No. 88788

Emission Unit	Pollutant	Emission Limit	Monitoring Requirements	Recordkeeping Requirements	Reporting Requirements
Internal Combustion Engines	All	See 40 CFR 60.4202(a)	Record the time of operation of the engine and the reason the engine was in operation during that time.	Maintain a copy of engine certifications or other documentation demonstrating that each engine complies with the applicable standards. Maintain monthly records of the hours of operation for the emergency generator.	
Evaporative Water Spray System	PM	20% Opacity	Perform a quarterly inspection of each spray nozzle on all evaporator fans.	Keep a record of the date and result of each inspection and any corrective action performed.	
Fugitive Dust	Opacity	40% Opacity	A Method 9 observer is required to conduct a weekly survey of visible emissions when operating	Record of the dates and types of dust control measures employed, and if applicable, the results of any Method 9 observations, and any corrective action taken to lower the opacity of any excess emissions.	

Table 5: Permit No. 88788

Emission Unit	Pollutant	Emission Limit	Monitoring Requirements	Recordkeeping Requirements	Reporting Requirements
		Haul trucks speed ≤ 25 MPH on any unpaved roadways	Continuously track and record each haul truck speed electronically or manually as practicable.	Record the odometer mileage and the time each haul truck arrives or leaves the mine site and keep haul truck speed and location data on file and readily available for review by ADEQ.	
Abrasive Blasting	PM	20% Opacity		Record the date, duration and pollution control measures of any abrasive blasting project.	
Spray Painting	VOC	20% Opacity Control 96% of the overspray		Maintain records of the date, duration, quantity of paint used, any applicable MSDS, and pollution control measures of any spray painting project.	
Demolition/ Renovation	Asbestos			Maintain records of all asbestos related demolition or renovation projects including the "NESHAP Notification for Renovation and Demolition Activities" form and all supporting documents	
Dust from unpaved on-site haul roads, transfer of ore from stockpiles to haul trucks, disturbed areas within the	Environmental Gamma		Follow the "Standard Operating Procedure for Environmental Gamma Monitoring" in Appendix 2. Optically stimulated luminescence (OSL)	Maintain records of the action trigger levels for all sampling points, wind speeds tons of ore contained in the ore stockpile, the approximate height of the ore	Provide the results from the OSL monitors and soil samples to ADEQ within 30 calendar days of receiving the respective lab results.

Table 5: Permit No. 88788

Emission Unit	Pollutant	Emission Limit	Monitoring Requirements	Recordkeeping Requirements	Reporting Requirements
property boundaries and other dust producing activities			monitors for gamma radiation will be collected on a calendar quarter basis, at least 90 days prior to active mine operations.	stockpile, all haul truck operator trainings, all soil sampling and environmental gamma monitoring results, and copies of all corrective action plans if applicable.	If the results of the OSL monitors or soil samples exceed the initial action trigger levels or a revised trigger level established at a specific sampling point per Condition II.B.3.f in Attachment "D", notify ADEQ within two business days of discovery of the exceedance. Within three business days of the above notification, submit a follow-up report.
	Uranium (U-Nat) and Radium 226 (Ra-226) from soil samples		Conduct soil sampling in accordance with the facility's Standard Operating Procedure for Soil Sampling in Appendix 3. Soil samples shall be taken annually, or quarterly (if required), at the six sampling locations identified in Appendix 1 of Attachment "D" of the permit.		
	Fugitive Dust	Ore storage pile ≤ 13,100 tons, height ≤ 20 feet			

XI. ENVIRONMENTAL JUSTICE ANALYSIS

The United States Environmental Protection Agency (EPA) defines Environmental Justice (EJ) to include the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income. The goal of evaluating EJ in permitting is to provide an opportunity for meaningful participation in the permitting process for overburdened populations or communities to. Overburdened is used to describe the minority, low-income, tribal and indigenous populations or communities that potentially experience disproportionate environmental harms and risks due to exposures or cumulative impacts or greater vulnerability to environmental hazards.

During the 2016 renewal the EPA's EJSCREEN tool was used to find the size and composition of the population within five miles of the facility. The results indicated that there was no one domiciled within 5 miles of facility, thus there was no affected population. Since that renewal, there has been no change in population counts within 5 miles of the facility and the EJSCREEN tool produced the same results. In addition, the renewal permit does not allow or permit any increases in emissions greater than the permitting exemption thresholds.

XII. AMBIENT AIR IMPACT ANALYSIS

A. 2011 Ambient Air Impact Analysis

In 2011 an Ambient Air Impact Analysis was conducted to demonstrate protection of the National Ambient Air Quality Standards (NAAQS) and visibility criteria. Vent shaft emissions, road dust emissions from haul trucks traveling on unpaved roads, and neighboring source emissions were addressed in the modeling analysis.

Dispersion modeling for the NAAQS was done using SCREEN3 for gaseous pollutants (CO, NO_2, and SO_2) and AERMOD dispersion modeling for PM_{10}. The results demonstrate that the Pinyon Plain Mine project is not expected to exceed the Ambient Standards in Article 2 of the Arizona Administrative Code. Table 6 presents the results of the modeling analysis, in addition to applicable background concentrations for comparison to the NAAQS.

Table 6: NAAQS Dispersion Modeling Results – Pinyon Plain Mine

Pollutant	Averaging Period	Year	Highest Modeled Cumulative Concentration[a] (µg/m³)[b]	Background Concentration (µg/m³)[b]	Total Cumulative Concentration (µg/m³)[b]	NAAQS (µg/m³)[b]
[1]SO_2	3-Hour	N/A	17.3	73	90.3	1300
	24-Hour	N/A	7.7	16	23.7	365
	Annual	N/A	1.5	3	4.5	80
[1]NO_2	Annual	N/A	23.2	4	27.2	100
[1]CO	1-Hour	N/A	62.5	582	644.5	40,000
	8-Hour	N/A	43.8	582	625.8	10,000
[2]PM_{10}	24-Hour	2003	78.1	46	124.1	150

	Annual	2001	16.1	19	35.1	50

[a] High-first-high modeled concentrations are presented for both short-term and annual averaging periods, per ADEQ request (ADEQ 2007)
[b] Micrograms per cubic meter
[1] Modeled Using SCREEN3
[2] Modeled Using AERMOD

To conduct a visibility analysis for the mine including impacts from haul road dust emissions a refined CALPUFF model was run. The visibility modeling was completed to evaluate potential visibility impacts at the Grand Canyon National Park resulting from the Pinyon Plain Mine operations. The closest part of the Grand Canyon Nation Park to the Pinyon Plain Mine is 7.5 miles away. Model receptors at the Grand Canyon have been developed by the National Park Service for use in CALPUFF analysis.

Output from the CALPUFF was compared to the 5 percent change in light extinction (Δbext) screening level. A change in Δbext from new sources that is less than 5 percent is generally considered acceptable. Modeling results indicate that the predicted visibility impairment is below the 5 percent screening criteria for all days in the 3-year meteorological period modeled.

Table 7: Grand Canyon Cumulative Visibility Impact Modeling Results

Visibility Impacts (% degradation)					
Visibility Parameter	**Averaging Period**	**Pinyon Plain Mine and Haul Road Traffic**			**Screening Threshold**
Modeled Year:		**2001**	**2002**	**2003**	
Grand Canyon National Park					
Max ΔB_{ext} (%)	24-Hour	0.54	0.63	0.38	5%
# days > 5%	N/A	0	0	0	N/A
# days > 10%	N/A	0	0	0	N/A

The Federal Land Managers (FLM) have identified a new approach to calculating modeled visibility impairment in their revised FLAG document (USFS, NPS, and USFWS 2008)[3]. This new approach uses a modified visibility algorithm, uses monthly relative humidity values rather than hourly values, and takes the 98th percentile value to screen out seven days of haze-type visibility impairment per year (USFS, NPS, and USFWS 2008). This new approach was also applied to the Pinyon Plain Mine for comparison purposes with the old Method 2 approach. The results of the new visibility impairment calculation approach are presented in Table 8.

3 USFS, NPS, and USFWS. 2008. "DRAFT Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report – Revised." June.

Table 8: Grand Canyon Cumulative Visibility Impact Modeling Results
New Flag Approach

Visibility Impacts 98th Percentile Values (% degradation)					
Visibility Parameter	**Averaging Period**	**Pinyon Plain Mine and Haul Road Traffic**			**Screening Threshold**
Modeled Year:		**2001**	**2002**	**2003**	
Grand Canyon National Park					
Max ΔB_{ext} (%)	24-Hour	0.45	0.42	0.32	5%
# days > 5%	N/A	0	0	0	N/A
# days > 10%	N/A	0	0	0	N/A

In conclusion, the Ambient Air Impact Analysis conducted in 2011 demonstrated that the operation of the Pinyon Plain Mine do not interfere with attainment and maintenance of the NAAQS, or adversely impact the visibility of the Grand Canyon National Park. This renewal permit will not result in any increase in emissions so this facility is exempt from the ambient air impact re-analysis.

ADEQ reviewed the 2011 Ambient Air Impact Analysis and confirmed that the assessment is still valid and defensible. The background concentrations selected are representative and somewhat conservative. The 2011 Analysis used a background of 46 $\mu g/m^3$ for 24-hour PM_{10} based on the monitoring data collected from Flagstaff Middle School. Since this monitor was inactivated, ADEQ reviewed the most recent monitoring data collected from Grand Canyon NP, which show a significantly lower background concentration of 15 $\mu g/m^3$. Additionally, ADEQ examined how the updates in AERMOD and meteorological data affect the modeled results. ADEQ reran the model for PM_{10} using the most recent version of AERMOD along with the most recent 5 years of meteorological data. These updates yielded slightly lower modeled concentrations in comparison with those reported in the 2011 Analysis.

B. 2021 Ambient Air Impact Analysis

To address the public's comments, the Department has updated the modeling analysis for PM_{10} and performed an additional ambient impact analysis for $PM_{2.5}$. The 2011 permit application did not include $PM_{2.5}$ modeling because at that time the Department implemented the EPA's PM_{10} Surrogate Policy, which was designed to enable sources to demonstrate compliance with NSR requirements for PM_{10} as a surrogate for requirements for $PM_{2.5}$. It should also be addressed that EFRI is not required to conduct any modeling analysis in this permit renewal because the proposed emission increases are below permitting exemption thresholds.

Compared to the 2011 modeling efforts, this modeling analysis has made the following updates:

1. Incorporated the evaporative water system (EWS) emissions into the modeling analysis.

The Department re-examined the emissions estimates for EWS using the manufacturer's droplet size distribution data, the wind data collected from the Grand Canyon National Park (GCNP) Airport, and a conservative total dissolved solids (TDS) content of 10,000 ppmv in the evaporation pond. Because emission rates increase as wind speed increases, the Department estimated the emission rates based on six wind speed categories as specified in EPA's AERMOD dispersion model. In general, the obtained EWS emissions for PM_{10} and $PM_{2.5}$ are relatively low because the APEX 2.0 evaporators in the Pinyon Plain Mine facility are designed to mitigate environmental contamination by controlling the dry aerosol drift.

2. Utilized the meteorological data collected from the Grand Canyon National Park Airport for the modeling analysis.

   The use of most recent 5 years (2016-2020) of National Weather Service (NWS) data was sufficient to capture the meteorological conditions of concern such as high wind speed episodes.

3. Updated the sources locations for storage piles and vent shaft.

   The Department modified the locations for Ore Stockpile Area (OSA) based on the adjustments to the mine operation. The Department also corrected the location for vent shaft as the previous modeled location was incorrect.

The Department performed the modeling analysis with the latest version of the EPA's AERMOD modeling system (version 21112). The modeled results are presented in the following table.

Table 9: Grand Canyon Cumulative Visibility Impact Modeling Results
New Flag Approach

Pollutant	Averaging Period	Modeled Concentration ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)*	Total Cumulative Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
PM_{10}	24-Hour	42	46	88	150
$PM_{2.5}$	24-Hour	6.6	12	18.6	35
	Annual	1.6	5.4	7.0	12

* The Department estimated the background concentrations based on the historical monitoring data collected from Flagstaff Middle School, which were conservative. The most recent monitoring data collected from Grand Canyon National Park show significantly lower background concentrations

As shown in Table 9 above, emissions from the Pinyon Plain Mine facility will not cause or contribute to a violation of the NAAQS for PM_{10} and $PM_{2.5}$ under the operational limits/conditions as proposed in the permit. The ambient impact analysis also revealed that the highest modeled concentrations occurred at the fenceline and the modeled concentration declined sharply further away from the site. Based on the 2021 modeling analysis results, the ADEQ has determined that the issuance of the Air Quality Permit for Pinyon Plain Mine will not interfere with attainment and maintenance of the NAAQS and will not have an adverse impact on the community.

XIII. LIST OF ABBREVIATIONS

A.A.C. ..... Arizona Administrative Code
ACFM ..... Actual Cubic Feet Per Minute
ADEQ ..... Arizona Department of Environmental Quality
AERMOD ..... AMS/EPA Regulatory Model
CFR ..... Code of Federal Regulations
CI ..... Compression Ignition
CO ..... Carbon Monoxide
DRA ..... Development Rock Area
EPA ..... Environmental Protection Agency
EWS ..... Evaporative Water Spray System
FLM ..... Federal Land Manager
ft ..... Feet
HAP ..... Hazardous Air Pollutant
hr ..... Hour
IC ..... Internal Combustion
kW ..... Kilowatt
MPH ..... Miles per Hour
mrem. ..... Millirem
NAAQS ..... National Ambient Air Quality Standard
NESHAP ..... National Emission Standards for Hazardous Air Pollutants
NPS ..... National Park Service
NOC ..... Notice of Opportunity to Correct
NO_X ..... Nitrogen Oxides
NSPS ..... New Source Performance Standards
OSA ..... Ore Stockpile Area
OSL ..... Optically Stimulated Luminescence
pCi ..... pico-Curie
Pb ..... Lead
PM ..... Particulate Matter
PM_{10} ..... Particulate Matter less than 10 µm nominal aerodynamic diameter
$PM_{2.5}$ ..... Particulate Matter less than 2.5 µm nominal aerodynamic diameter
PTE ..... Potential to Emit
SO_2 ..... Sulfur Dioxide
SOPs ..... Standard Operating Procedures
TPY ..... Tons per Year
USFS ..... U.S. Forest Service
USFWS ..... U.S. Fish and Wildlife Service
VMT ..... Vehicle Miles Traveled
VOC ..... Volatile Organic Compound
yr ..... Year
µR/hr ..... Microroentgens per hour