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1110 West Washington Street, 3415A-1
Phoenix, AZ 85007
Submitted via email to airpermits@azdeq.gov

Re: AIR QUALITY CLASS II PERMIT: EZ Mine Draft Permit No. 88789

Dear Mr. Vaidyanathan:

Please accept these comments from the Grand Canyon Trust, the Center for Biological Diversity, and Sierra Club's Grand Canyon Chapter regarding the Class II Air Quality Permit for the proposed EZ mine.

Grand Canyon Trust (the Trust) is a regional conservation organization headquartered in Flagstaff, AZ, with offices in Durango and Denver, CO, and Salt Lake City, UT. It was established in 1985 and has over 3,000 members. The mission of the Trust is to safeguard the wonders of the Grand Canyon and the Colorado Plateau, while supporting the rights of its Native peoples. The Trust has long advocated for protecting air quality in both the urban and rural environment.

The Center for Biological Diversity (the "Center") is a non-profit 501(c)(3) corporation with offices across the nation. The Center works through science, law, and policy to secure a future for all species, great or small, hovering on the brink of extinction. The Center has over 1.7 million members and online activists throughout the United States and the world. The Center is actively involved in species and habitat protection issues worldwide, including throughout the western United States. The Center, its employees, and its members use the public lands subject to the proposed uranium mining for recreational, scientific, aesthetic, and commercial purposes. They also derive recreational, scientific, aesthetic, and commercial benefits from the public lands through wildlife observation, study, and photography. The Center and its members have an interest in preserving the possibility of such activities in the future. As such, the Center and its members have an interest in helping to ensure the continued use and enjoyment of these lands.

The Sierra Club is one of the largest and most influential grassroots environmental organizations

in the U.S., with more than 3.5 million members and supporters. In addition to protecting every person's right to get outdoors and access the healing power of nature, the Sierra Club works to promote clean energy, safeguard the health of our communities, protect wildlife, and preserve our remaining wild places through grassroots activism, public education, lobbying, and legal action. The Grand Canyon Chapter of the Sierra Club, representing 16,000 members and thousands of supporters, has a long history of public education and advocacy to protect public health and the environment in Arizona. Its members recreate in the region and enjoy hiking, camping, backpacking, wildlife viewing, and more.

INTRODUCTION

We are adamantly opposed to the operation of a uranium mine located within a watershed (surface and ground) that drains directly into Grand Canyon National Park and which threatens water, air, and other important resources of the greater Grand Canyon ecoregion, including soil, wildlife, sacred Native American sites, and the health of the people who are exposed to the heavy metals and radiation associated with these mines.

For more than a half-century, uranium mining has permanently polluted our land, air, and water. Its deadly legacy is well documented and yet state and federal agencies are still permitting new mines to open.

The Arizona Department of Environmental Quality (ADEQ) has a responsibility, pursuant to A.R.S. § 49-104 relating to the powers and duties of the department and director, to ensure that it develops policies, plans, and programs "to protect the environment" [A.R.S. § 49-104(A)(1)] and also to "[p]romote and coordinate the protection and enhancement of the quality of water resources consistent with the environmental policy of this state" [A.R.S. § 49-104(A)(7)]. Furthermore, the statute requires that the agency prevent and abate water pollution [A.R.S. § 49-104(A)(10)]. ADEQ also has delegated authority relative to the federal Clean Air Act. Pursuant to A.R.S. § 49-401(A), "The legislature by this act intends to exercise the police power of this state in a coordinated state-wide program to control present and future sources of emission of air contaminants to the end that air polluting activities of every type shall be regulated in a manner that insures the health, safety and general welfare of all the citizens of the state; protects property values and protects plant and animal life." Subsection B states, ". . . the policy of this state that no further degradation of the air in the state of Arizona by any industrial polluters shall be tolerated." It is within this context that ADEQ should examine this permit application and deny approval of any permit that allows for continued operations. ADEQ cannot fulfill its responsibility to protect the environment, the plants and animals, and the health of the people of Arizona and permit this mine.

It is incumbent on ADEQ to protect the Grand Canyon region by requiring the most rigorous air quality standards within its discretion. We are all aware of the disaster still unfolding on the Navajo Nation due to inadequate regulation and irresponsible industry operation. The Grand Canyon State can ill afford to see its lands, waters, and economic driver – the Grand Canyon – contaminated with uranium. We urge ADEQ to implement the changes to the permitting process suggested in the comments below.

The EZ Mine Does Not Exist

The EZ mine doesn't exist. There is no mine facility. The location of Energy Fuels' purported mine is an empty field. In its technical report on the EZ breccia pipes, Roscoe Postle Associates, in an attempt to describe the purported mine's location to readers, states that it is "located by the small green shrub at left-centre of the image." Technical Report on the EZ1 and EZ2 Breccia Pipes at 7-5. In this permitting exercise, by permitting a uranium mine that does not exist, ADEQ facilitates Energy Fuels' ability not to mine uranium, but to tout permits to and raise capital from investors. To be clear, this is speculation, not mining.

Mining the EZ breccia pipes requires federal approval. Energy Fuels can not and will not obtain federal approval during the life of ADEQ's permit. Mining would require a federal Plan of Operations. Energy Fuels lacks an approved Plan of Operation. Mining the EZ breccia pipes would require the Bureau of Land Management (BLM) to initiate and complete an Environmental Impact Statement (EIS). The BLM has not even initiated an EIS. Mining would require a determination of Valid Existing Rights (VER) from the BLM. Energy Fuels lacks such a determination of VER. Mining the EZ breccia pipes would require formal consultations between the BLM and U.S. Fish and Wildlife Service pursuant to the Endangered Species Act. This consultation has not begun because there is no mine plan on which to consult. Mining the EZ breccia pipes would require formal consultation between the BLM and numerous Native American Tribes. Again, for lack of an actual mine, this consultation has not begun. Completion of these and other federal approvals, if those processes are ever even initiated, will take several years, effectively precluding any chance that Energy Fuels will obtain those approvals during the lifetime of the ADEQ's permit. Further complicating matters, this mine is within an area temporarily withdrawn from new mining operations in 2012, and will need to demonstrate Valid Existing Rights prior to commencing mine development.[1]

Demonstrating the unlikelihood of developing this mine claim during the life of ADEQ's permit were requirements in ADEQ's early 2011 and 2016 permits that condition "The Permittee shall not conduct active mining at the EZ Mine while the AZ I or the Pinenut mines are being actively mined." 2011 permit, Attachment B, Section 2.A.1., on p. 18 of 40; 2016 permit, Attachment B, Section I.A.1., p. 17 of 44. *This provision needs to be added back into the 2021 proposed permit.* We should not allow any mines to open prior to the shutdown and reclamation of extant mines.

Scientific research has shown that we don't know how to contain contaminated dust and soil around uranium mines in a way that keeps wildlife safe, we don't know how to clean up soils at closed uranium mines, and we will need to commit to long term monitoring and management of previously mined areas.[2] As one United States Geological Survey (USGS) study of the risks created by uranium mines around Grand Canyon found:

"Risk to wildlife posed by inorganic constituents was not eliminated regardless of the

[1] *See generally* U.S. Department of Interior. 2012. Record of Decision. Northern Arizona Withdrawal Mohave and Coconino Counties, Arizona. 24 pp.

[2] Hinck, J.E., G. Linder, J.K. Otton, S.E. Finger, E. Little, and D.E. Tillit. 2013. Derivation of soil-screening thresholds to protect the chisel-toothed kangaroo rat from uranium mine waste in northern Arizona. Archives of Environmental Contamination and Toxicology 65:332-344.

> reclamation status of the formerly mined areas…. Concentrations of arsenic, cadmium, copper, lead, nickel, thallium, uranium, and zinc were increased in weathered mine wastes compared with surface soils inside and outside reclaimed and unreclaimed mine sites…. Concentrations of inorganic contaminants in mine waste samples from reclaimed mines (Hack Canyon and Pigeon mines) were the greatest of all samples measured and consistently exceeded soil-screening thresholds to protect [endemic] juvenile and adult kangaroo rats...If further remediation is not planned for these sites, then management of the potential source area, including monitoring of contaminant releases over time, is warranted. Future exposure may occur as cover over waste materials weathers over time at any particular mining site."[3]

A follow up paper reported:

> "Our results indicate that biota have taken up uranium and other elements (e.g., arsenic, cadmium, copper, molybdenum, uranium) from exposure to ore and surficial contamination, like blowing dust. Results indicate the potential for prolonged exposure to elements and radionuclides upon conclusion of active ore production. Mean radium-226 in deer mice was up to 4 times greater than uranium-234 and uranium-238 in those same samples; this may indicate a potential for, but does not necessarily imply, radium-226 toxicity. Soil screening benchmarks for uranium and molybdenum and other toxicity thresholds for arsenic, copper, selenium, uranium (e.g., growth effects) were exceeded in vegetation, invertebrates, and rodents (*Peromyscus* spp., *Thomomys bottae*, *Tamias dorsalis*, *Dipodomys deserti*)."[4]

Chronically low uranium prices have delayed not only mining at Energy Fuels' existing mines, but also their remediation, resulting in decades of perpetually unremediated non-operation at each mine. This evidence raises real questions as to whether the EZ breccia pipes will ever be mined. For these and other reasons, we encourage ADEQ to wait to issue an air quality permit until it is able to review Energy Fuels' plan of operations, mining protocol, and proposed location of radon vents as described in the future Plan of Operations. This would also allow ADEQ to benefit from the full National Environmental Policy Act (NEPA) review undertaken as part of the EIS process. We also encourage ADEQ to note in the permit that the EZ mine will be a new uranium mine not a reactivated mine as currently stated.

ADEQ Should Require Robust Baseline Monitoring

Insofar as ADEQ does issue a permit for a mine that does and will not exist during that permit's life, ADEQ should require Energy Fuels to collect data on an ongoing basis to establish robust baseline conditions against which to measure future air quality impacts in the unlikely event that Energy Fuels obtains approvals to construct and operate the EZ mine. Energy Fuels should be required to collect and report data on an ongoing basis in ways and frequencies that provide baseline data sufficient to generate statistically valid measurements of departure from those

[3] *ibid.*

[4] Cleveland, D., J.E. Hinck, and J.S. Lankton. 2021. Elemental and radionuclide exposures and uptakes by small rodents, invertebrates, and vegetation at active and post-production uranium mines in the Grand Canyon watershed Chemosphere 263:1-15.

conditions during mining for all air pollutants relevant to all applicable state and federal laws and regulations. Data should be collected in a way that is sufficient to inform the potential for uranium mining to cause and/or worsen impacts, such as those discussed in the following section.

The draft permit's current obligation to begin soil sampling and gamma monitoring 90 days prior to ore extraction is completely insufficient, because this will not occur until after the site has seen months or years of activity involving truck traffic and shaft and facility development. (Draft Permit, Attachment "D", Section II) As demonstrated at Canyon/Pinyon Plain Mine, contamination of soils and nearby vegetation can occur during mine development. long before ore extraction commences.[5]

ADEQ Must Analyze and Avoid Known Impacts Resulting from Uranium Mining

Studies in the Four Corners region, where most American uranium mines are located, show impacts from uranium mining that ADEQ should both consider prior to the issuance of this permit, and avoid.[6] Chief among those studies is the 2011 Northern Arizona Withdrawal Final Environmental Impact Statement (EIS), which combined pre-existing information with extensive new surveys and analyses.[7] Among other things, the EIS and other studies have shown that: (1) radon gas, a uranium decay product, delivers almost twice the radiation dose to humans as previously thought, meaning that previous dose estimates for miners need to be doubled to accurately reflect lung cancer risk;[8] (2) "long term ingestion of uranium by humans may produce interference with kidney function at the elevated levels of uranium found in some groundwater supplies;"[9] (3) bone is a likely target of uranium toxicity in humans, and even low uranium concentrations in drinking water can cause toxic effects on the kidneys;[10] (4) chromosomal abnormalities in babies born within the vicinity of uranium mining operations;[11] (5) babies born from mothers who lived near a uranium tailings dump exhibited abnormally high rates of birth

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[5] Hinck, J.E., D. Cleveland, W.G. Brumbaugh, G. Linder, and J. Lankton. 2017. Pre-mining trace element and radiation exposure to biota from a breccia pipe uranium mine in the Grand Canyon (Arizona, USA) watershed. Environmental Monitoring and Assessment 189:56. https://doi.org/10.1007/s10661-017-5765-1.

[6] U.S. EPA, About Radioactive Waste From Uranium Mining and Milling, https://www.epa.gov/radtown/radioactive-waste-uranium-mining-and-milling, accessed 6/17/21.

[7] *See generally* Chapters 3-4; *see, e.g., id.* at 3-41 to 3-42, 3-99 (describing updated hydrological studies and soil surveys) *in* U.S. Department of Interior. 2011. Final Environmental Impact Statement Northern Arizona Proposed Withdrawal.

[8] R. Taubenfeld, et al., High Risk – Low Return: The Case Against Uranium Mining in Queensland, 12 (Mar. 2013), *available at* http://qnfa.files.wordpress.com/2013/03/180313highcost-lowreturn-uinqld.pdf, accessed 6/17/21.

[9] M. L. Zamora, et al, *Chronic Ingestion of Uranium in Drinking Water: A Study of Kidney Bioeffects in Humans*, 43 Toxicological Sciences, 68-77 (1998)

[10] P. Kurttio, et al., *Bone as a Possible Target of Chemical Toxicity of Natural Uranium in Drinking Water*, Environmental Health Perspectives, 72 (Jan. 2005), *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1253712/, accessed 6/17/21;
P. Kurttio, et al., *Renal Effects of Drinking Water in Uranium*, Environmental Health Perspectives, 337-42 (Apr. 2002), *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1240795/pdf/ehp0110-000337.pdf, accessed 6/17/21..

[11] W. Au, et al., *Biomarker Monitoring of a Population Residing near Uranium Mining Activities*, 103 *Environmental Health Perspectives*, 466-70 (May 1995), *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1523284/pdf/envhper00354-0058.pdf, accessed 6/17/21..

defects;[12] (6) a link between high rates of systemic lupus and living near a uranium processing facility;[13] (7) soil properties affect uranium mobility and uptake by plants and animals;[14] (8) while dissolved uranium is bioavailable under a wide range of geochemical conditions;[15] and (9) uranium decay products bioaccumulate.[16] Reflecting our better understanding of these and other adverse effects, EPA in 2000 set new (and more stringent) drinking water standards for uranium.[17]

Additionally, uranium mines are often harder and costlier to clean up than anyone expected. A 2012 report issued by the U.S. Government Accountability Office (GAO) found that BLM and the Forest Service "do not have reliable data on the number and location of abandoned uranium mine sites on federal land or a definitive cost for their cleanup."[18] The GAO separately identified a $60.6 million gap between the amount BLM estimated for financial assurance requirements and the actual value in place in plans of operations at abandoned hardrock mines.[19] A recent survey in New Mexico identified 259 abandoned mines, 139 of which had no record of reclamation.[20] A 1999 Energy Information Agency report indicated that the Department of Energy (DOE) had spent $1.5 *billion* on remediation of uranium mill sites.[21] In August 2014, the DOE issued a report to Congress regarding defense-related abandoned uranium mines that identified their location, impacts, and remediation feasibility and cost.[22]

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[12] L. M. Shields, et al., *Navajo Birth Outcomes in the Shiprock Uranium Mining Area*, 63 *Health Physics* 542-51 (Nov. 1992), *available at* http://www.ncbi.nlm.nih.gov/pubmed/1399640, accessed 6/17/21..

[13] American College of Rheumatology, Uranium Exposure Linked to High Lupus Rates in Community Living Near a Former Refinery (Nov. 10, 2012), *ScienceDaily*, *available at* http://www.sciencedaily.com/releases/2012/11/121110155813.htm, accessed 6/17/21.

[14] Canadian Council of Ministers of the Environment, Canadian Soil Quality Guidelines for Uranium: Environmental and Human Health, 22-23, 25, 28 (2007), *Obtainable at https://ccme.ca/en/summary-table, accessed 6/17/21*.

[15] Croteau, M., C.C. Fuller, D.J. Cain, K.M. Campbell, and G. Aiken. 2016. Biogeochemical controls of uranium bioavailability from the dissolved phase in natural freshwaters. Environmental Science and Technology 50:8120-8127. https://doi.org/10.1021/acs.est.6b02406, accessed 6/15/21.

[16] National Research Council, *Uranium Mining in Virginia*, at 210 (citing C.I.E. Wiramanaden, et al., *Selenium distribution in a lake system receiving effluent from a metal mining and milling operation in Northern Saskatchewan, Canada*, 29 ENVTL TOXICOLOGY & CHEMISTRY 488, 606-616 (2010), *available at* http://onlinelibrary.wiley.com/doi/10.1002/etc.63/pdf), accessed 6/17/21.

[17] U.S. EPA, Basic Information about Radionuclides in Drinking Water, *available at* http://water.epa.gov/drink/contaminants/basicinformation/radionuclides.cfm, accessed 6/17/21.

[18] GAO-12-544 at 30.

[19] *Information on Abandoned Mines and Value and Coverage of Financial Assurances on BLM Land: Oversight Hearings on Hardrock Mining Before the S. Comm. on Energy and Natural Resources*, 110th Cong. 29 (2008) (statement of Robin M. Nazzaro, Director, Natural Resources and Environment, GAO).

[20] New Mexico Senate Joint Memorial 15, Urging Congress to Appropriate Funds for the Cleanup of Abandoned Uranium Mines Opened and Operated for the Benefit of the Federal Government (Mar. 17, 2009), *available at* http://www.nmlegis.gov/Sessions/09%20Regular/final/SJM015.pdf, accessed 6/17/21.

[21] U.S. EIA, *Remediation of UMTRCA Title I Uranium Mill Sites under the UMTRCA Project Summary Table: Uranium Ore Processed, Disposal Cell Material, and Cost for Remediation as of December 31, 1999* (1999), *available at* http://www.eia.gov/nuclear/umtra/, accessed 6/17/21.

[22] *See* U.S. DOE, Office of Legacy Management, Abandoned Uranium Mines Report to Congress (2014), *available at* https://www.energy.gov/lm/downloads/defense-related-uranium-mines-report-congress-august-2014, accessed 6/17/21.

It is Premature to Issue a Permit for EZ Mine Before Other Mines are Reclaimed

The maximum proposed mine production rate at EZ mine is 146,000 tons per year of uranium ore. The ore will be hauled off-site to the Blanding, Utah mill and at times it cannot be hauled, Energy Fuels will stockpile up to 13,100 tons on site. The stockpile area will encompass one acre.

Energy Fuels stopped ore extraction at the Arizona 1 mine in 2015. The mine is now on standby, with no estimated time to resume operations. The company may decide to reopen it at some indeterminate time in the future. Or, as occurred at Kanab North mine, it may allow dust from the industrial site to contaminate the surrounding public lands for decades, before initiating reclamation operations.

In addition, ADEQ should require the renewal of Pinenut mine's air permit. Pinenut mine is no longer operating. The shaft is filled in, and the mine is almost fully closed. When operating, the mine had a production rate of 109,500 tons per year of uranium ore. The company shipped ore to the White Mesa Mill near Blanding, Utah, and stockpiled the ore on-site when it could not be shipped. The Ore Stockpile Area, which accommodated up to 67,230 tons of ore, the entire mine site, and dirt roads where ore was transported are contaminated. ADEQ should require systematic monitoring of these areas until sustained monitoring demonstrates the absence of contamination.

Pinyon Plain Mine, formerly known as Canyon Mine, is proposed to produce approximately 109,500 tons of uranium ore per year. The ore will be hauled off-site to the Blanding, Utah mill. At times it cannot be hauled, Energy Fuels will stockpile up to 13,100 tons on site. Although the development of Pinyon Plain Mine began more than 30 years ago, no ore has been extracted from the mine.

Until other mines are shut down and cleaned up, there is no reason to develop EZ Mine.

ADEQ Must Take Utmost Caution in Permitting Mines Because Grand Canyon National Park's is a Class I Attainment Area Under The Federal Clean Air Act

Grand Canyon National Park is a Class I Attainment area. R18-217(B)(4) says all national parks that exceed 6,000 acres in size and were designated as a national park before 1977 shall be classified as Class I Attainment areas. Grand Canyon National Park is over one million acres in size and was designated as a national park in 1919; therefore, it is a Class I Attainment area. R18-217(B)(4) of the A.A.C. implements Title I Part C of the Federal Clean Air Act (CAA). The primary function of that part of the CAA is to "preserve, protect, and enhance the air quality of national parks…and other areas of special national or regional natural, recreational, scenic, or historic value." In order to achieve that purpose, the CAA also states that all decisions to increase air pollution in any area where Title I Part C applies will be made only after "careful evaluation of all the consequences of such a decision…"

EZ mine is located less than 20 miles from Grand Canyon National Park. Therefore, ADEQ should accord heightened care to the decision of whether to permit this facility. Indeed, the fact

that the air emissions for this facility is below major source thresholds is obviated by the fact that the cumulative effect from the uranium mine threatens Grand Canyon National Park's Class 1 Attainment Area. See Arizona Administrative Code (A.A.C.) R18-2-302.B.2.a.ii.

While modeling was conducted for the mine and according to ADEQ ". . . will not adversely impact visibility in the Grand Canyon National Park," we have some significant concerns that the modeling does not adequately address the fugitive dust issues. ADEQ doesn't even know how many trucks will drive to and from the mine because this proposed mine has no Plan of Operations. Without knowing the details of the proposed mine's operations, any predictions are spurious.

ADEQ has the responsibility to preserve and enhance the air quality of Grand Canyon National Park. ADEQ is issuing a permit for the EZ Mine before its Plan of Operations has been approved. Given ADEQ's duty to carefully evaluate all the consequences of the decisions to operate uranium mines, it should conduct new studies that take into consideration any changes in conditions and information that have occurred during the past 20 years. For example, drought-induced plant mortality, off-road vehicle-caused soil degradation, grazing, and other factors are increasing mobility of soil throughout the region. People are recreating on public lands in increased numbers, and cumulative dust impacts, as well as risks to visitors from dust originating at southwestern uranium mines, must be considered.[23]

In 1989, EPA promulgated new Clean Air Act regulations to regulate certain underground uranium mining operations.[24] Among other things, the regulations require operators to comply with specific standards for radon emissions and obtain a permit from EPA.[25] In 1996, the U.S. Fish and Wildlife Service reintroduced the endangered California condor to northern Arizona. The condor is attracted to mining structures and water pits that are typically part of mining operations like the EZ Mine.

ADEQ Must Protect the Public and Environment by Requiring Fine Particulate Monitoring (PM 2.5) and Mitigation

In order to regulate air emissions in a way that insures the health, safety, and general welfare of citizens, and in a way that protects animal and plant life, the ADEQ must monitor and impose measures to prevent dispersion of fine particulate matter known to cause severe health effects. Ore and waste rock piles at uranium mines in northern Arizona can be sources for airborne fine particulate matter. For example, the USGS completed a fairly detailed site assessment of surface contamination at mines on the Arizona Strip.[26] At the Kanab North mine near Kanab Creek,

[23] Beisner, K.R., T.M. Marston, and D.L. Naftz. 2010. Assessment of nonpoint source chemical loading potential to watersheds containing uranium waste dumps and human health hazards associated with uranium exploration and mining, Red, White, and Fry Canyons, Southeastern Utah, 2007. USGS and BLM SIR 2010-5108.

[24] EPA, National Emission Standards for Hazardous Air Pollutants; Radionuclides, 54 Fed. Reg. 51,654 (Dec. 15, 1989), as amended, 65 Fed. Reg. 62,151 (Oct. 17, 2000) (codified at 40 C.F.R. Part 61).

[25] *See generally* 40 C.F.R. § 61, Subpts. A-B.

[26] Otton, J.K., Gallegos, T.J., Van Gosen, B.S., Zielinski, R.A., Johnson, R.H., Hall, S.M., Arnold, L.R., Yager, D.B., 2010. Effects of 1980s uranium mining in the Kanab Creek area of northern Arizona. In: Alpine, A.E. (Ed.), Hydrological, Geological, and Biological Site Characterization of Breccia Pipe Uranium Deposits in Northern Arizona. U.S. Geological Survey Scientific Investigations Report, pp. 43e134 USGS SIR 2010-5025.

researchers found an extensive downwind uranium delta believed to be the result of wind-dispersed fine particulate uranium dust:

> "Kanab North Mine: Mined waste rock, uranium ore, pond sludge, and local wind- and water dispersed fine particles on the unreclaimed mine site (all of which contained high concentrations of uranium and other trace element constituents such as arsenic) were exposed to the ambient environment for about 20 years at the Kanab North partially mined site. Offsite, only one soil sample approximated background uranium concentrations, suggesting that dispersion extends beyond the limit of sampling, about 420 feet. Soil samples (n=20) collected within about 420 feet outside of the fenced mine site had an average uranium concentration of 27.8 parts per million (more than 10 times background concentration) and arsenic concentration of 12 parts per million. Wind appears to be the dominant process dispersing material offsite..."[27]

USGS has conducted several additional studies since the establishment of the Northern Arizona Mineral Withdrawal in 2012, to determine the impacts of uranium mining in the Grand Canyon region on soils, water, dust, insects, plants, and wildlife. A range of wildlife species can and do bioaccumulate uranium when living in close proximity to uranium mines in the Grand Canyon region.[28] The source of bioaccumulation is from soils, dust, food, and water, with the potential to cause various health effects including decreased food intake, inhibition of plant growth, loss of DNA integrity in blood cells, immunosuppression, and potentially lesions, which were more prominent in rodents at a mine with a long history of contamination than at a newly operating mine.[29] However, the other contaminants that are found near uranium mines pose risks to wildlife species and need to be monitored during and after mining activity.[30]

Tailings piles, truck loading areas, and roadways should be monitored for fine dust particles smaller than 2.5 microns. Currently, only particles smaller than 10 microns are being monitored. Without monitoring fine particulate matter, and without imposing measures that prevent fine particulate dispersion from uranium mining facilitates, the ADEQ cannot insure that air polluting activities of uranium mines are being "regulated in a manner that insures the health, safety and

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[27] p. 49 *in ibid.*

[28] Croteau et. al 2016;
Hinck, J.E., D. Cleveland, W.G. Brumbaugh, G. Linder, and J. Lankton. 2017. Pre-mining trace element and radiation exposure to biota from a breccia pipe uranium mine in the Grand Canyon (Arizona, USA) watershed. Environmental Monitoring and Assessment 189:56. https://doi.org/10.1007/s10661-017-5765-1, accessed 6/15/21;
Cleveland, D., J.E. Hinck, and J.S. Lankton. 2018. Assessment of chronic low-dose elemental and radiological exposures of biota at the Kanab North uranium mine site in the Grand Canyon watershed. Integrated Environmental Assessment and Management 15:112-125;
Henry, B.L., M. Croteau, D.M. Walters, J.L. Miller, D.J. Cain, and C.C. Fuller. 2020. Uranium bioaccumulation dynamics in the mayfly Neocloeon triangulifer and application to site-specific prediction. Environmental Science & Technology 54:11313-11321. https://doi.org/10.1021/acs.est.0c03372, accessed 6/15/21;
Cleveland et. al 2021.

[29] Cleveland et. al 2018; Henry et al. 2020; Cleveland et. al 2021 and references within.

[30] See, for example: Hinck, J.E., D. Cleveland, and B.E. Sample. 2020. Terrestrial ecological risk analysis via dietary exposure at uranium mine sites in the Grand Canyon watershed (Arizona, USA). Chemosphere 265;
Hinck, J.E., G. Linder, A.J. Darrah, C.A. Drost, M.C. Duniway, M.J. Johnson, F.M. Mendez-Harclerode, E.M. Nowak, E.W. Valdez, C. van Riper III, and S. Wolff. 2014. Exposure pathways and biological receptors: baseline data for the Canyon Uranium Mine, Coconino County, Arizona.

general welfare of all the citizens of the state; protects property values and protects plant and animal life." Fine particulate matter is difficult to contain, readily inhaled, readily suspended and transported by wind, and can contain many heavy metals as well as uranium.

Dust content must be monitored. Dust associated with uranium mining has been found to carry multiple contaminants into the surrounding landscape: enriched elements in soil near Grand Canyon-area breccia pipe uranium mines include uranium, sulfur, arsenic, molybdenum, copper, selenium, cadmium, lead, cobalt, nickel, thallium, and zinc.[31] Fine particulate matter is of concern because it is small enough to enter the bloodstream when inhaled and has been linked to cancer, neurotoxicity, immunotoxicity, cardiotoxicity, and increased morbidity/mortality.[32] Fine particulate uranium dust is of particular concern because if inhaled and absorbed into the bloodstream, sensitive living tissue can be exposed to alpha radiation. The resulting biological damage increases the risk of cancer; in particular, alpha radiation is known to cause lung cancer in humans when alpha emitters are inhaled.[33]

Prior to issuing a permit the ADEQ should conduct its own modeling for PM10 and PM2.5. ADEQ should subject its modeling assumptions and results to independent science peer review; it should make that modeling, its results, and peer review thereof available for public review on the ADEQ website prior to permit issuance.

Prior to issuing a permit, the ADEQ must develop and require a fine particulate monitoring system whose spatiotemporal extents, frequencies, exceedance triggers and mitigation measures are sufficient to insure against mine-related dust dispersion under the range of high-wind events that can occur at mining sites. Monitoring opacity and visibility are not enough. We strongly encourage ADEQ to confer with independent scientists (non-agency, non-industry) with experience in uranium dust and alpha emitter effects to develop an adequate monitoring system for fine particulates.

Because Energy Fuels has a clear financial conflict of interest erring against costs associated with sufficiently extensive, frequent, and transparent monitoring, the ADEQ should conduct monitoring itself. Monitoring systems must include a system whereby air quality exceedances, if and when detected, trigger additional dust mitigation measures. Those triggers and measures should be vetted publically and with independent (non-agency, non-industry) scientists prior to permit issuance. The ADEQ should further require that bonding, dust mitigation plans, and all resources necessary to implement those plans be in-place prior to issuing a permit. The scope of bonding and mitigation plans should include cleanup of off-site pollution in addition to the prevention of initial dust suspension on site. The monitoring plan should include a measurable, quantitative trigger for mine shut down if mitigation fails to curtail exceedances. In its permits, ADEQ should commit to making all monitoring results, including exceedances, publically

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[31] Hinck et al. 2013; Bern, C.R., K. Walton-Day, and D.L. Naftz. 2019. Improved enrichment factor calculations through principal component analysis: Examples from soils near breccia pipe uranium mines, Arizona, USA. Environmental Pollution 248:90-100.

[32] See, for example: https://www.epa.gov/radiation/radiation-health-effects#tab-3, accessed 6/17/21.

[33] See, for example: Jonathan M. Samet, M.D., M.S., Daniel M. Kutvirt, B.A., Richard J. Waxweiler, Ph.D., and Charles R. Key, M.D., Ph.D.N Engl J Med 1984; 310:1481-1484 June 7, 1984, https://www.nejm.org/toc/nejm/310/23/ DOI:0.1056/NEJM198406073102301, accessed 6/17/21

available on its website in real time or near real time.

Soils Must be Monitored in a way that Protects them from Contamination

The monitoring regime in the draft permit is inadequate to detect problems with soil contamination as they develop. The monitoring regime will not detect contamination until it is several times background levels, widespread, and beyond thresholds that could cause human and ecological harm. The sampling locations and trigger levels are inappropriate to identify soil contamination before it becomes a problem.

ADEQ has a responsibility to protect the "to protect the environment" [A.R.S. § 49-104(A)(1)] and "to control present and future sources of emission of air contaminants to the end that air polluting activities of every type shall be regulated in a manner that insures the health, safety and general welfare of all the citizens of the state; protects property values and protects plant and animal life." ADEQ must, at the least, make the following changes to future uranium mine air quality permit requirements in order to protect the environment, human health, and plant and animal life:

- **More gamma and soil sampling locations are needed.** The EZ Mine draft permit describes a sampling regime for soil and gamma monitoring with four sampling locations, each 100 feet from the fenced mine perimeter. Only one of these locations is downwind from the ore piles in the prevailing wind direction (sampling on the northeast side of the piles). Only one sampling location is within 250 feet of the ore pads. The ore pads are likely to be the source of the most hazardous dust transport and soil contamination that could exceed biological thresholds, and therefore must be monitored more closely.[34]

- **ADEQ must require a science-based sampling regime, consistent with historic and ongoing research.** ADEQ should improve the sampling design, possibly by considering the use of both incremental sampling methodology and by targeting locations most likely to accumulate dust from the mine, as has been done by USGS researchers attempting to determine patterns of contaminant dispersion and distribution.[35] Researchers using both methods at Grand Canyon-area uranium mines found that for most mines, the targeted method was best for discovering contamination; at Canyon (now Pinyon Plain) mine, the incremental sampling methodology captured contamination that the targeted method would not have.[36] ADEQ should consult with USGS to determine the most effective sampling strategy so that information gathered at the mine can contribute to longer term data sets and be consistent with work USGS has already been doing.

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[34] i.e., Otton et. al 2010; Hinck et. al 2013; Hinck et. al 2017; Cleveland et al. 2018; Cleveland et. al 2021.

[35] *This duplicate method was used in* Bern et. al 2019, *and refers to methods in the following two papers*: ITRC (Interstate Technology & Regulatory Council), 2012. Incremental sampling methodology. The incremental sampling methodology concept has since been expanded upon and more information can be found at https://clu-in.org/conf/itrc/ISM/, accessed 6/17/21; Lamothe, P.J., Meier, A.L., Wilson, S. Naftz, D., Walton-Day, K., 2016. Establishing a pre-mining geochemical baseline at a uranium mine near Grand Canyon National Park, USA. Geoderma Regional 7, 76e92. https://doi.org/10.1016/j.geodrs.2016.01.004, accessed 6/17/21.

[36] Bern et. al 2019.

- **ADEQ must require a suite of chemicals to be monitored in soil.** According to the draft permit, soil will only be monitored for uranium and radium 226. This is insufficient to protect biota near the mine. Enriched elements in soil near Grand Canyon-area breccia pipe uranium mines include uranium, sulfur, arsenic, molybdenum, copper, selenium, cadmium, lead, cobalt, nickel, thallium, and zinc.[37] Many of these elements bioaccumulate and several pose risks to wildlife species; they need to be monitored before, during, and after mining activity.[38]

- **ADEQ must require trigger levels derived from ecologically based screening thresholds.** The trigger levels in the draft permit for the EZ Mine are based on "potential exposure of a recreational/camper receptor who spends 14 days per year on a reclaimed mine site."[39] The dose is based primarily on "groundshine," or gamma exposure from materials on the ground.[40] The model used to determine the dose specifically omits "ingestion of plant foods," ignoring the fact that some members of the public, particularly Tribal members, do collect and consume plants on public lands for food and medicinal purposes.[41] The model claims to consider "inhalation of dust" and "ingestion of soil" but it appears to consider only the exposure that would occur to an adult during the hypothetical 14 days.[42] As discussed elsewhere in these comments, the risks from radioactive dust inhalation and ingestion last long after the dust enters the body. Also, it is unlikely that the dose from "ingestion of soil" is considering the potential impacts to children. USGS researchers have identified ecological screening thresholds and methods for arriving at these thresholds; ADEQ should require trigger levels that are justifiably linked to biological processes.[43] The triggers ADEQ intends to use are arbitrary and not based on sound science.

- **ADEQ should require monitoring for rate of change, so that operational improvements can be made before problems occur.** The screening threshold of 40pCi/g or 60mg/kg is likely an order of magnitude greater than background uranium levels in the soil at the proposed EZ Mine site.[44] By the time this extremely high level of uranium is detected, the cost of cleanup operations is likely to be extremely expensive - and cleanup may be impossible, leading to the need for containment or soil removal instead. ADEQ should require monitoring for change over time so that problems are identified before they escalate.

ADEQ Must Monitor and Regulate Transportation-related Dust

The 2010 USGS report also found contamination around the closed and reclaimed Pigeon and

[37] Hinck et al. 2013; Bern et. al 2019.

[38] See, for example: Hinck et. al 2020; Hinck et. al 2014.

[39] Arcadis. 2016. Development of the Proposed Trigger Levels for Energy Fuels' Arizona Mines, Draft. 20pp.

[40] *ibid.*

[41] *ibid.*

[42] *ibid.*

[43] Hinck et. al 2013; Hinck et. al 2021; Cleveland et al. 2021. See also DOI 2011, Environmental Impact Statement for Northern Arizona Mineral Withdrawal.

[44] Arcadis 2016.

Hermit mines, north of the Grand Canyon, and found elevated levels of uranium in soils near roads that likely originated from ore trucks. The Pigeon Mine operated from 1984-1989 and the Hermit Mine operated for less than a year in 1989. Similarly, testing near the 1979 Church Rock, New Mexico mining disaster, revealed elevated uranium in soils near haul roads.[45] Roads where trucks travelled 20 years before still had uranium dust contamination along them. The mining is supposedly safer now, yet the operating procedures are the same as those from 30 years ago.

The Church Rock Uranium Monitoring Project (CRUMP) Report for June 2003 to May 2007 conducted field investigations and data analysis in an area where past uranium mining was concentrated and found gamma radiation rates were significantly elevated over background along public highways and roads, on Navajo grazing lands, and in certain residential areas in close proximity to three abandoned uranium mines and a closed uranium mill and tailings disposal facility that is a federal Superfund site, even though mining and milling had ceased twenty years before. This finding suggests that the residual effects of deposition of uranium ore from haul trucks operating at the site in the 1960s, '70s and early 80s can still be observed in the environment more than 20 years later:

> "Surveys conducted with hand-held instruments confirmed the presence of elevated gamma radiation along the highways and roads. The use of mechanized and hand-held detectors in tandem generated evidence of long-term radiological contamination of publicly accessible areas along highways and roads and next to occupied residences, especially those in the Red Water Pond Road area (Study Area A-1)."
>
> The principal source of the high gamma rates detected along State Route 566 in the vicinity of the Old Churchrock Mine was likely uranium ore hauled in trucks from the mine to the UNC mill from the mid-1970s through the early-1980s." (Report of the Church Rock Uranium Monitoring Project (CRUMP) 2003-2007, p.37).

From the EZ Mine, haul trucks will travel an unpaved road 7.3 miles to the Mount Trumbull Road, then 20.1 miles to a paved highway, State Route (SR) 389. Trucks would then travel 6.8 miles on SR 389 to U.S. Route (US) 89, then 74.8 miles through Fredonia, Arizona and Kanab, Utah to SR 98 near Page, Arizona. The trucks then travel 75.5 miles to US 160, then 26.4 miles to US 191 and north into Blanding, Utah.

The hazards of uranium exposure are most serious when the dust is ingested or inhaled, or when it is consumed in water. Trucks will pass through many communities, and should not leave the mine site without being completely sealed. Trucks should be required to contain dust more securely than with tarps. Energy Fuels has stated that more secure trucks would be "extremely expensive." What would it cost to clean up a mess or compensate an exposed population? This ore should be treated like contaminated soils from a Superfund site, or at least, covered with a solid lid that has extra protection along seams.

There is also a history of truck accidents related to previous uranium mining activities in the area. According to a May 14, 1986 article in *The Arizona Republic* about a uranium ore spill,

[45] Statement of Chris Shuey before the Subcommittee on National Parks, Forests, and Public Lands, Natural Resources Committee, U.S. House of Representatives, March 28, 2008

"[Tribal environmental specialist Levon] Benally said that when tribal officials arrived on the scene on the day after the accident, crews were removing the truck and spreading sand over the uranium ore to hide it. The company has had an agreement for the past several years with the tribe to transport uranium ore across the reservation."[46]

The CRUMP study was conducted to address Navajo community concerns about possible long-term environmental impacts of past uranium mining and processing in residential areas and along major highways and roads in the Church Rock Mining District. The CRUMP investigation was a collaborative effort by community, local, state, federal and private entities. Considering that the trucks will be traveling through tribal lands, several communities and in places where emergency response may take some time, ADEQ, and the Department of Transportation should require that the trucks provide something more than a tarp, considering the potential risk to these communities if an accident occurs.

Environmental Justice

The permit for this mine has serious environmental justice implications relative to Native American Tribes. ADEQ has the responsibility to inform Tribes about this permit and to respond to their concerns about impacts to cultural sites, transport routes, public health, plant populations, and other issues. Potentially affected Tribes include but are not limited to: the Kaibab Band of Paiutes, Shivwitz Band of Paiutes, Navajo Nation, Ute Mountain Ute, Hopi, Havasupai, Hualapai, and Zuni, among others. ADEQ should communicate with all Tribes that have lands along or adjacent to the haul route, as well as Tribes with cultural affiliations to Grand Canyon.

Issuing this permit will violate many of the tenets of Environmental Justice including: "demands that public policy be based on mutual respect and justice for all peoples, free from any form of discrimination or bias"; and "mandates the right to ethical, balanced and responsible uses of land and renewable resources in the interest of a sustainable planet for humans and other living things."[47]

There is a legacy of contamination from uranium mining in the Southwest including more than 520 abandoned uranium mines throughout the Navajo Nation. The mines expose Navajo Nation residents to uranium through airborne dust and contaminated drinking water. The draft permit associated with the EZ mine will impact the traditional homeland for several tribes including the land of the Navajo and Kaibab-Paiute as trucks pass through their reservations. ADEQ should require additional protections and should engage in additional analysis to evaluate the environmental justice implications of these mines and must ensure significant consultation with the affected tribes.

In light of these innumerable concerns and deficiencies, ADEQ should deny the air permit renewal. ADEQ cannot fulfill its responsibility to protect the environment, the plants and animals, and the health of the people of Arizona if it continues to permit mines to pollute the Grand Canyon region.

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[46] Navajo officials concerned about spill of uranium ore" *The Arizona Republic*, 1986.

[47] http://www.ejnet.org/ej/principles.html Accessed 6/17/21.

Thank you for your timely and careful consideration of our comments.

Sincerely,

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