SAN MIGUEL COUNTY

BOARD OF COMMISSIONERS

ELAINE FISCHER ART GOODTIMES JOAN MAY

July 21, 2010

Steve Tarlton, Program Manager, Radiation Control Program
Paul Tourangeau, Division Manager, Air Quality Control Division
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South
Denver, CO 80246-1539

Re: Energy Fuels Piñon Ridge Radioactive Materials License Application
Comments regarding possible Air Quality Impacts

Gentlemen:

The San Miguel County Board of Commissioners is writing with respect to the ongoing review of the Piñon Ridge Mill application. Dr. Mark Williams attended the meeting conducted by Steve Tarlton and Warren Smith on June 10, 2010 in Ophir, where he presented certain comments regarding air pollution dispersion modeling data. Dr Williams' comments suggest that as a result of topographical, climatological, and orographical, influences, the western edge of the San Juan Mountains could be a depositional area for particulates and radionuclides resulting from the mill and associated activities. It is our understanding that Dr. Williams is currently serving as professor at the University of Colorado, associated with several air quality related research projects and is a fellow at INSTAAR - CU Boulder. We are seriously concerned by Dr. Williams' assertions, as he expressed at the Ophir meeting and as set forth in his written "Recommendations to San Miguel County in Response to the Proposed Pinyon Ridge Uranium Mill," a copy of which is attached for your information. Dr. Williams' verbal and written comments have raised significant concerns regarding the environmental impacts associated with the possible radioactive dust deposition in San Miguel County originating at the proposed Piñon Ridge Uranium Mill and its environs.

During CDPHE's recent meetings in San Miguel County members of the public residing in the Telluride, Ophir and Mountain Village communities expressed serious concerns with regard to protection of human health, air quality and water quality in their municipal watersheds. As a result of San Miguel County's longstanding involvement in the state and local permitting process for the proposed Piñon Ridge Uranium Mill, it is the County's considered position that CDPHE's licensing process needs to address the cumulative environmental impacts that the proposed facility and related uranium mining operations may engender, from the Paradox Valley to the eastern section of San Miguel County, including the Towns of Mountain Village, Ophir and Telluride. The Telluride region has expended millions of dollars since 1990 in an effort to mitigate the effects of particulate air pollution.

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If the CDPHE licensing process for the proposed mill is to consider the associated mining jobs that may be related to the proposed mill, the process must also consider the cumulative environmental impacts that the possible radioactive dust arising from such mining and milling operations may have on this region. San Miguel County's citizens have repeatedly expressed their concern that their health be protected from any harmful dust effects originating from the proposed mill and related mining activities located in Montrose County.

As the Telluride Region is a former non-attainment area for Particulate Matter, any additional sources of particulate pollution are of concern. This concern was increased by the potential of radionuclides becoming an increased component of particulates transported from the proposed mill and associated increased mining activity. We believe the Radiation Control Division and the Air Pollution Control Division should require an assessment of the cumulative effects of the mill and reasonably foreseeable associated mining operations on air quality and the potential for depositional accumulation of radionuclides in the Telluride Region.

We understand that while the Air Pollution Control Division may have purview over Particulate Matter and the Radiation Control Division has purview of some monitoring of radionuclides at the facility, other aspects of the proposed mill's operation may be within the purview of the EPA. It continues to be unclear if the standards for monitoring, and the division of monitoring and regulatory responsibilities, address the concerns that have been raised regarding the transport of particulates and the potential for depositional accumulation of radionuclides.

San Miguel County has additional concerns with how the apparent increase in dust storm events could impact our region with the addition of a new mill and associated new mines. The reasons are elaborated in the attached written documentation and references from Dr. Williams framing the concerns and including recommendations regarding dust measurement. From our review of Dr. Williams' written documentation we consider it imperative that the CDPHE Radiation Control Program and the Air Quality Control Division's review of the pending application address the issues discussed on page six of his "Recommendations to SMC." Those issues, as detailed in the following quotation from Dr. Williams' report, include:

- How do the emission rates used in the EF license application conform to peer-review literature on emission rates in arid environments?
- What is the time step used to model particulate dispersion?
- Why do emissions from wind erosion of open areas and storage piles only occur when the wind is above a threshold speed of 12 miles per hour (5.36 m/s)?
- How realistic is this threshold wind speed?
- What is the relationship between wind speed and emission rates above the threshold wind speed? Is it constant, linear, exponential? If constant, how realistic is that?

We concur with Dr. Williams that emergency/worst case scenarios must be considered in the modeling analysis done by the applicant.

We agree with Dr. Williams' specific recommendation for collection and analysis of sediment cores from an alpine lake with no uranium mining in the watershed (such as Clear Lake near Ophir Pass.)

San Miguel County received dust health advisories from CDPHE this spring and on at least one day, particulate pollution exceeded double the Primary Standard. As a result of the serious implications of the current mill proposal exacerbating the existing situation, local governments are considering implementing the long term monitoring recommended by Dr. Williams.

We believe it to be reasonable to request that the applicant, Energy Fuels, establish the air quality monitoring site and conduct a year of data collection identified as a minimum requirement to establish a baseline. Also, the applicant should provide geologic information on the Paradox Valley and uranium ore samples from regional ore bodies. This information should include mineral aggregation and trace mineral analysis sufficient to develop a chemical fingerprint that would allow sampling to determine if the dust originating from these operations is depositing in regional watersheds.

In response to Steve Tarlton's letter of June 29, 2010 to Mike Rozycki, San Miguel County Planning Director, please be advised that if the County intends to submit additional technical documentation regarding the possible environmental impacts associated with the proposed Piñon Ridge Uranium Mill we will do so by September 17, 2010.

San Miguel County wishes to express its appreciation to both the Radiation Control Program and the Air Quality Control Division of CDPHE for the efforts you have made to review and evaluate both the applicant's submittals as well as those received from the concerned members of the public and local governments.

Sincerely,

Elaine R.C. Fischer

Elaine R.C. Fischer, Vice-Chair
Board of County Commissioners
San Miguel County, Colorado

Encls. Dr. Mark Williams' "Recommendations to San Miguel County in Response to the Proposed Piñon Ridge Uranium Mill

Pc. Martha Rudolph, Executive Director, CDPHE
Deborah Lebow, Region 8, EPA
Dr. Mark Williams

RECOMMENDATIONS TO SAN MIGUEL COUNTY IN RESPONSE TO THE PROPOSED PINYON RIDGE URANIUM MILL

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WHY DUST IS IMPORTANT TO MEASURE

Drought and changes in grazing and other land-use practices have increased dust emissions in western North America (Schlesinger et al., 1990; Neff et al., 2005; Fernandez et al., 2008). These regional sources of dust can produce significant quantities of mineral aerosols, with effects on air quality and human health (Mohamed et al. 2007). Dust deposition onto snow cover in the western United States has recently been shown to accelerate melt and reduce snow-cover duration by approximately one month, a finding that has broad implications for water resources in mountainous regions of the United States (Painter et al. 2007).

Neff et al. (2008) evaluated how the quantity and quality of dust deposition has changed over the past 5,000 years in the San Juan Mountains by analyzing sediment cores collected from alpine lakes at elevations about 3,500 m near Silverton, Colorado. They found that dust load levels increased by 500% above the late Holocene average following the increased western settlement of the United States during latter half of the nineteenth century. They suggest that the increased dust deposition was caused by the expansion of livestock grazing in the western US in the early twentieth century. The larger dust flux, which persists into the early twenty-first century, results in a more than fivefold increase in inputs of potassium, magnesium, calcium, nitrogen and phosphorus to the alpine ecosystems, with implications for surface-water alkalinity, aquatic productivity and terrestrial nutrient cycling.

There is a general consensus that the spring of 2010 has been one of the dusty periods in recent history (High Country News, 07 June 2010). The cause of the dusty spring is not known. Potential causes include weird weather patterns, drought, reduced vegetation due to overgrazing, oil and gas development, maybe global warming? Probably all of the above, according to University of Colorado biogeochemist Jason Neff (High Country News, 07 June 2010).

Regardless of the potential increase in mining and milling activities in and near the Paradox Valley, dust deposition is likely to increase in the near future. Continued increases in mean air temperature and drought severity in the western US are expected to increase dust emissions (Marshall et al. 2008), which in turn will affect snowmelt (Painter et al. 2007) and the phenology of seasonally snow-covered areas (Steltzer et al. 2009). Further, rising temperatures and the associated upward advance of the treeline (Grace et al. 2002) may mobilize larger amounts of biological aerosols, such as bacteria, fungi, and pollen. Any increased dust deposition from the proposed mining and milling activities will be added to these other potential sources.

The current situation in the headwaters of the San Miguel drainage is that we already appear to have high levels of dust deposition. There is anecdotal information that dust on snow in 2010 caused snowmelt to occur earlier, reducing the length of the ski season. Present levels of dust deposition thus appear sufficient to move the timing of snowmelt forward and increase the rate of snowmelt, with potential large economic consequences to the ski industry and water resources.

More dust, from whatever source or sources, will likely exasperate an already bad situation.

The quantity and quality of dust deposition today is largely unknown. While dust deposition appears to be increasing, there are no quantitative measurements of the amount of dust. There are no adequate measurements of the particle size distribution of dust, or the mineral composition of the dust. For example, we do not know whether elements such as uranium or vanadium are present in the dust, and if so, what the current background concentrations of these elements are. We do not know how much of total dust deposition is represented by size classes such as PM_{10} and $PM_{2.5}$. Moreover, if elements such as uranium and vanadium are present in current dust deposition, or increase in the future for whatever reason, we do not know if they will be preferentially represented in a specific size class of dust particles.

One reason that dust is difficult to measure is because deposition is episodic in nature. To illustrate, in mid-February 2006, windstorms in Arizona, Utah, and western Colorado generated a dust cloud that distributed a layer of dust across the surface of the snowpack throughout much of the Colorado Rockies; it remained visible throughout the winter (Rhoades et al. 2010). Monthly snowpack solute analysis at the Fraser Experimental Forest near Winter Park Colorado has not documented an event of similar magnitude during its 17-year period of record (Rhoades et al. 2010).

At the Niwot Ridge Long-Term Ecological (NWT LTER) in the Colorado Front Range, dust on snow loading from that storm event in February 2006 was 3.9 g m^{-2} (unpublished data). The aeolian dust deposition from the red snow event would be classified as a silty loam, with 18% clay, 64% silt, and 18% sand. This texture analysis provides provenance information; we know that the dust was generated regionally and not locally. Elements associated with uranium ores were found in the dust: arsenic 6.2 ug/g, uranium 2.8 ug/g, vanadium 55.4 ug/g. Elements associated with uranium mining and milling occur in measurable amounts in recent dust events as far east as the Colorado Front Range.

I think it is imperative that San Miguel County obtain information on current rates of dust deposition and the quality of that dust deposition. San Miguel County needs to be able to determine background levels of elements associated with uranium mining and milling activities, such as uranium and vanadium. In the future, they need to be able to quantify if mining and milling activity result in increased dust deposition, and if that increase in dust deposition reduces the ski experience in and Telluride. They also need to be able to demonstrate if mining and milling activities are causing an increase in either the concentration or loading of elements associated with uranium ore.

CAN DUST EMISSIONS FROM PROPOSED MILLING ACTIVITIES IN THE PARADOX VALLEY REACH SAN MIGUEL COUNTY?

An outstanding question is whether dust emissions from the Paradox Valley can reach eastern San Miguel County. Williams and Manthorn (2001) showed that the dominant wind patterns during the winter season are westerly winds that can potentially entrain air masses from the Paradox Valley to eastern San Miguel County. This qualitative assessment suggests that more quantitative atmospheric modeling is warranted to evaluate whether air masses, and the dust they contain, may reach eastern San Miguel County.

The National Oceanic and Atmospheric Administration (NOAA) provides such a model that is appropriate to compute trajectories of air masses that may transport pollutants (Williams and Manthorn 2001). The Air Resources Laboratory's HYbrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model is a complete system for computing both simple air parcel trajectories and complex dispersion and deposition simulations. The model calculation method is a hybrid between the Lagrangian approach, which uses a moving frame of reference as the air parcels move from their initial location, and the Eulerian approach, which uses a fixed three-dimensional grid as a frame of reference. In the model, advection and diffusion calculations are made in a Lagrangian framework following the transport of the air parcel, while pollutant concentrations are calculated on a fixed grid. The accidental or intentional release of chemical, biological or nuclear agents can have significant health, safety, homeland and national security, economic, and ecological implications. ARL's HYSPLIT model is a tool that helps explain how, where, and when chemicals and materials are atmospherically transported, dispersed, and deposited. Having this understanding is essential for responding appropriately and preventing disaster.

Simple model trajectories using HYSPLIT were conducted from September 2008 to March 2010 to evaluate the potential for air masses originating in the Paradox Valley to reach eastern San Miguel County. All model runs were for 12 hours, with a new run each day, starting at the proposed Pinon Ridge Uranium Mill in Paradox Valley and ending at Ophir in eastern San Miguel County. These trajectories do not include those instances where a change in wind direction after the starting time for the mapped trajectory would have carried the air mass from Paradox to Ophir and environs. Thus, the results are most likely conservative and underestimate the days when air masses in Paradox may reach eastern San Miguel County.

The model runs show that over an 18-month period, there were 53 days that air masses originating in the Paradox Valley reached eastern San Miguel County (Table 1). The majority of these days were during the winter, consistent with Williams and Manthorne (2001).

Table 1. Days with airflow from Paradox Valley to Ophir

Time period	Days
September to December 2008	9
January to December 2009	37
January to March 2010	7

Modeling dispersion and deposition of particulates is difficult. An important variable that needs careful documentation are emission rates from various activities associated with milling activities, such as tailing piles (eg how much dust from tailings piles goes into the atmosphere). An under-estimation of these emission rates will result in under-estimating dust transport and fluxes to down-wind area. Another important variable is threshold wind speed. The question to ask here is: "What is the minimum wind speed needed to cause dust to go into the atmosphere". Another important question is what is the relationship between increases in wind speed and increases in dust emission; is that relationship linear, exponential?

LAKE SEDIMENT CORES AS A PROXY FOR HISTORICAL DUST DEPOSITION

Sediment cores collected from alpine lakes may provide a proxy to evaluate if previous mining activities have resulted in the aeolian deposition of elements associated with uranium mining and milling. These sediment cores provide a historical record of aeolian deposition that goes back in time hundreds to thousands of years. The last 150 years of record can be dated with reasonable accuracy. If the uranium boom of the 1950's and 1960's resulted in increased aeolian deposition of elements associated with uranium ore to eastern San Miguel County, we should see an increase in those elements in the sediment core for that time period. Conversely, if we do not see an increase in those elements, the likelihood is reduced of dust deposition from the proposed uranium mill in Paradox Valley reaching eastern San Miguel County.

Neff et al. (2008) provide a nice example of how sediment cores collected from alpine lakes in the San Juan Mountains can provide historical information on the quantity and quality of dust deposition to this region. Sediment cores were extracted using a Universal Core Head Corer from shallow alpine lakes near Silverton. In the laboratory, the cores were subsampled into 0.5–1 cm increments. Near-surface sediments from lakes were dated using the radiogenic nuclide ^{210}Pb, and deeper sediments at depth were dated by measuring the ^{14}C content of macrofossils. Samples were then digested and analyzed for elemental content.

RECOMMENDATIONS

Quantity of dust deposition

Although many forms of atmospheric deposition are relatively well measured in the US, dust deposition is not. At present there is no national standard for measuring either the quantity or quality of dust deposition. None-the-less, it is important to obtain background measurements of the quantity of dust deposition in eastern San Miguel County. I recommend using the Staplex Model TSP-1NB Brushless Total Suspended Particulate Air Sampling System. This instrument is recommended by an emerging dust deposition network in the Four Corners Area administered by the US Geological Survey, the American Southwest Dust Collection Network (ASDCN); more information on that network at http://moab.colorado.edu/BSNE/Dust2Dust/Home.html. The interpretive power of dust results obtained from eastern San Miguel county are increased by the ability to compare those results with others obtained using the same instrument in the ASDCN program.

More information on the dust collector on an attached pdf file and also in Appendix 1.

Particle size distribution of dust

Measuring the particle size distribution of dust provides helpful information, such as provenance. Provenance means the origin or the source of something. Particle size information helps distinguish local sources of dust from regional sources. That information can be obtained relatively easily with dust collected by the Staplex system. Options for particle size information include a Malvern laser diffraction particle size analyzer and a Micromeritics Sedigraph particle size analyzer. Analytical costs are relatively inexpensive, about $30 per sample.

Elemental composition of dust

An over-riding question is whether elements associated with uranium mining and milling are in dust today, and whether those concentrations increase above those baseline values because of

future increases in milling and mining activities in and near Paradox Valley. We know that elements associated with mining and milling activities occur in present-day dust deposition. Dust collected from the Staplex system should be analyzed for a suite of elements associated with mining and milling activities, including americium, arsenic, plutonium, radium, uranium, and vanadium. These analyses are conducted on a specialized instrument such as an inductively-coupled plasma mass spectrometer (ICP-MS), with standards for the elements of interest. The USGS laboratory in Boulder and INSTAAR at the University of Colorado-Boulder both have such instruments. Costs are on the order of $30 per analyte.

Atmospheric modeling.
The Air Dispersion Modeling Report, Kleinfelder report 83088, follows the guidelines from the APCD Modeling Guidelines for Air Quality Permits. These guidelines may be insufficient to capture actual dust emissions using realistic parameters. Independent atmospheric modeling evaluating trajectories, dispersion, and deposition of particulates between Paradox Valley and eastern San Miguel county should be conducted using peer-reviewed procedures from the scientific literature. HYSPLIT or other atmospheric models that have undergone peer-review evaluation should be used.

Questions about EF's license application to the CDHPE Radiation Unit and / or CDPHE Air Quality Control

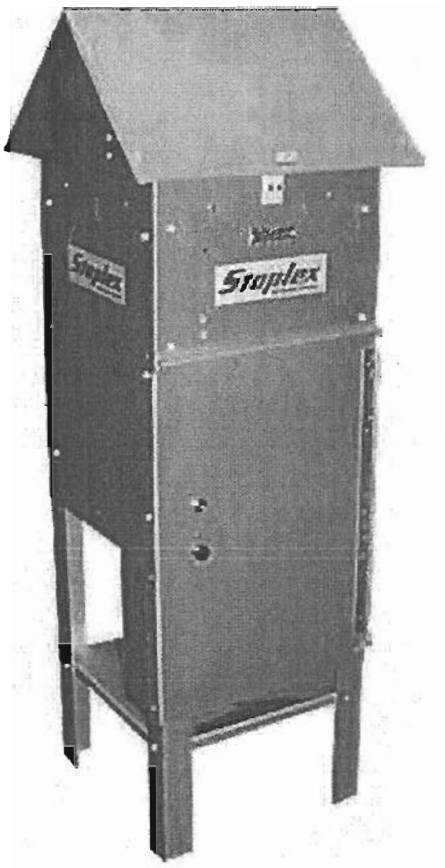
- How do the emission rates used in the EF license application conform to peer-review literature on emission rates in arid environments?
- What is the time step used to model particulate dispersion?
- Why do emissions from wind erosion of open areas and storage piles only occur when the wind is above a threshold speed of 12 miles per hour (5.36 m/s)?
    - How realistic is this threshold wind speed?
- What is the relationship between wind speed and emission rates above the threshold wind speed? Is it constant, linear, exponential? If constant, how realistic is that?

Emergency situations/worst case scenarios
Emergency situations were not accounted for in the modeling analysis because they are considered abnormal operating conditions (Air Dispersion Modeling Report, Kleinfelder report 83088, page 10). The county should insist on air dispersion modeling of emergency situations and worst case scenarios. For example, what happens if control of fugitive dust from tailings piles by sprinkling is not possible for two weeks because of a lack of water (wells run dry; water being trucked-in is stopped because of road closures from forest or range fires, etc) under conditions of high westerly winds?

Sediment cores
I recommend collecting and analyzing a sediment core. The core needs to be collected from an alpine lake with no uranium mining in the watershed. The lake should be in eastern San Miguel County or nearby areas such as San Juan County. The core should be dated using ^{210}Pb back to at least 1850. Special emphasis should be placed on analyzing sediment from the time period of circa 1950 to 1970. Sediment should be analyzed for elements characteristic of uranium ore, as detailed above.

TSP-1NB and TSP-2NB Brushless

Total Suspended Particulate High Volume Air Sampler System with Flow Totalizer, Instantaneous Flow Rate Display, Programmable 7-day On/Off Timer, Elapsed Time Indicator & Flow Data Logger and LCD Display



Staplex Model TSP-1NB and TSP-2NB Brushless Total Suspended Particulate High Volume Air Sampling System is designed for **fast,** accurate collection of suspended particulates in accordance to U.S. EPA specifications.

These complete air sampling systems, available with various modular accessories, are designed to meet the EPA requirements for sampling airborne particulates at a known flow rate for a determined amount of time, allowing for proper calculation of airborne particulate concentrations.

The basic TSP Brushless Air Sampling System includes Staplex Brushless High Volume Air Sampler (Model TFIA-NB 110-120 VAC or Model TFIA-2NB 220-230 VAC); SH810 8" x 10" Filter Holder Assembly and SAM Aluminum Outdoor Shelter.

A Constant Flow Controller maintains air flow through the system at a constant rate, automatically correcting for variations in filter loading, line voltage, temperature and pressure and providing LCD display for instantaneous flow rate and total flow.

An integral 7-day digital timer to turn the system on and off at preset times and elapsed timer indicators are included.

The system includes a built-in data logger that captures time, flow rate and total flow data. Data acquisition software is included so that data is easily uploaded to a personal or notebook computer through an RS-232 port.

Filters, PM10 and PM2.5 Size Selective Inlets, Multi Stage Cascade Impactors and other accessories are also available.

Made in U.S.A. Specifications subject to change.

Ordering Information:
Model TSP-1NB 110-125 VAC
Model TSP-2NB 220-230 VAC
(specify accessory configuration when ordering)

Air Sampler Division

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