# Attachment Q
# Surface Noise Emission Evaluation

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# MEMORANDUM

To: Scott Bakken, Director, Permitting & Environmental Affairs
cc: Ryan Ellis, Jaime Massey
From: Andrea Reither

Date: 7/10/2015

RE: Surface Noise Emission Evaluation of Energy Fuels' Underground Uranium Mines

## 1.0 INTRODUCTION

Energy Fuels Resources (USA) Inc. (Energy Fuels) has a variety of underground uranium mine projects located in the western United States. While each project is unique, they contain similar sources of surface noise including aboveground ventilation fans, generators, and vehicle traffic. This memorandum introduces basic noise concepts and applicable regulations, and then discusses typical sources of noise at mines and their potential impacts.

## 2.0 BASIC NOISE CONCEPTS

Sound is mechanical energy characterized by the rate of oscillation of sound waves (frequency), the speed of propagation, and the pressure level (amplitude). The human ear experiences sound as pressure on the ear. The sound pressure level is the logarithmic ratio of that pressure to a reference pressure, and is expressed in decibels (dB). A value of 0 dB corresponds to the approximate threshold of human hearing. Environmental sounds are measured with the A-weighted scale of a sound level meter. The A scale simulates the frequency response of the human ear by giving more weight to the middle frequency sounds and less to the low and high frequency sounds. A-weighted sound levels are designated as dBA (i.e., A-weighted sound levels expressed in dB). Table 1 provides the typical nighttime and daytime sound levels for populated and unpopulated areas, and to provide context, Table 2 lists the approximate range of sound levels of common indoor and outdoor activities.

**Table 1. Typical Sound Levels Based on Land Use**

| Land Use Description | Nighttime Average (dBA) | Daytime Average (dBA) |
|---|---|---|
| Wilderness | 25 | 35 |
| Rural Residential | 30 | 40 |
| Quiet Suburban Residential | 40 | 50 |
| Normal Suburban Residential | 45 | 55 |
| Urban Residential | 50 | 60 |
| Noisy Urban Residential | 55 | 65 |
| Very Noisy Urban Residential | 60 | 70 |
| Source: EPA, 1974. | | |

**Table 2. Typical Indoor and Outdoor Sound Levels**

| Outdoor Activities | Noise Levels (dBA) | Indoor Activities |
|---|---|---|
| Jet flyover at 1,000 feet | 100 – 110 | Rock Band |
| Gas Lawn Mower at 3 feet | 90 – 100 | Inside Subway Train (New York) |
| Diesel Truck at 50 feet<br>Noise Urban Daytime | 80 – 90 | Food Blender at 3 feet<br>Garbage Disposal at 3 feet |
| Gas Lawn Mower at 100 feet | 70 – 80 | Shouting at 3 feet<br>Vacuum Cleaner at 10 feet |
| Commercial Area<br>Heavy Traffic at 300 feet | 60 – 70 | Normal Speech at 3 feet |
| | 50 – 60 | Large Business Office<br>Dishwasher Next Room |
| Quiet Urban Daytime | 40 – 50 | Small Theater, Large Conference Room (Background) |
| Quiet Suburban Nighttime | 30 – 40 | Library<br>Bedroom at Night |
| Quiet Rural Nighttime | 20 – 30 | Concert Hall (Background) |
| | 10 – 20 | Broadcast and Recording Studio |
| | 0 – 10 | Threshold of Hearing |
| Source: FHWA, 1980. | | |

Because sounds in the environment usually vary with time they cannot simply be described with a single number. One method used to describe variable sounds is the equivalent noise level (Leq), which is derived from a large number of moment-to-moment A-weighted noise level measurements.

The Leq is the constant sound level that in a given period has the same sound energy level as the actual time-varying sound pressure level. Leq provides a methodology for combining noise from individual events and steady state sources into a measure of cumulative noise exposure. It is used by local jurisdictions, the Federal Highway Administration (FHWA), and state departments of transportation (including Utah Department of Transportation [UDOT]) to evaluate noise effects. The day-night average noise level (Ldn) represents the 24-hour energy average noise level with a 10-dBA penalty (addition) applied to noise levels between 10 p.m. and 7 a.m.

A key concept in evaluating potential noise effects is the perceived effect of incremental increases in existing noise levels. An increase of 3 dBA is barely perceptible, an increase of 5 dBA is noticeable, and a 10-dBA increase would be perceived by someone to be a doubling of the noise level (loudness) (FHWA, 2011). Increases of 5-10 dBA would tend to be noticeable to most people but not substantial. An increase of 10 dBA or more would be perceived by most people as a substantial impact.

Generally, noise is most audible when traveling along a direct line-of-sight; noise levels from a point source will attenuate (weaken) at a rate of approximately 6 dB for each doubling of distance over hard surfaces (FHWA, 1980). Barriers, such as walls, berms, or rows of buildings that break the line-of-sight between the source and the receptor can greatly reduce noise levels from the source because the barriers block sound.

# 3.0 APPLICABLE REGULATIONS

Although there are no Utah state noise regulations directly applicable to stationary or mobile noise sources associated with mining, guidance can be found in Federal regulations that apply to highway noise effects. These include the applicable FHWA noise abatement criteria (NAC) (23 CFR Part 772), which have been interpreted and implemented for projects in Utah by UDOT.

**Table 3. Federal Highway Administration Noise Abatement Criteria**

| Activity Category | 1-Hour Leq (dBA) | Description of Noise Category |
|---|---|---|
| A | 57 (Exterior) | Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose. |
| B | 67 (Exterior) | Residential |
| C | 67 (Exterior) | Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings |
| D | 52 (Interior) | Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios. |
| E | 72 (Exterior) | Hotels, motels, offices, restaurants/bars, and other developed lands, properties or activities not included in A–D or F. |
| F | -- | Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing. |
| G | -- | Undeveloped lands that are not permitted. |
| Source: 23 CFR Part 772 | | |

Many of Energy Fuels projects are located in counties that have no specific noise ordinance, thus Table 4 is provided for context.

**Table 4. Salt Lake Valley Noise Regulations**

| Use District | Night (10 pm – 7 am) (dBA) | Day (7 am – 10 pm) (dBA) |
|---|---|---|
| Residential | 50 | 55 |
| Commercial – Agriculture | 55 | 60 |
| Industrial | 75 | 80 |
| Source: Salt Lake Valley Health Department Health Regulations (#21 Noise Control). | | |

Within active mine areas, worker noise exposure is regulated by the Mine Safety and Health Administration (MSHA). Code of Federal Regulations (CFR) Title 30 Chapter I Subchapter M Part 62 Occupational Noise Exposure was put in place in 2000 "to prevent the occurrence and reduce the progression of occupational noise-induced hearing loss among miners" (30 CFR 62.100). This gives MSHA the authority to regulate the noise that workers are exposed to when on an active Energy Fuels mine. MSHA prepared a Compliance Guide to MSHA's Occupational Noise Exposure Standard (MSHA, 2000) that outlines noise standards,

exposure levels, hearing protection levels, the use of engineering and administrative controls and exposure assessments.

# 4.0 NOISE SOURCES AND IMPACTS

Energy Fuels' underground uranium mines contain similar sources of surface noise including aboveground ventilation fans, generators, and vehicle traffic. Those typical noise emission sources and their general impacts are discussed below. Each project requires different configurations of ventilation equipment, levels of power generation, and sizes of vehicles which dictate specific noise emissions. Project locations in relationship to noise receptors and screening topographic features dictate local noise impacts.

## 4.1 Generators

Large generators can be a dominant source of nose at mine sites that do not receive power from electric utility lines. These generators are usually centrally located within the mines' surface facility area which is restricted from public access. Mines that do not generate all of their own power often rely on smaller generators for emergency backup or temporary, modular power generation needs. Generators' noise emissions vary based on many parameters and are noted in their unit specifications.

Because the large generators are located within the surface facility area, impacts resulting from generator noise are largely felt by mine workers and are minimized by implementation of MSHA guidelines.

## 4.2 Ventilation Fans

Extensive underground ventilation is necessary at underground uranium mines in order to protect underground worker health and safety from the buildup of dust and radon gas. Ventilation is generally provided by drawing air through the mine portals and a series of ventilation shafts that extend from the underground workings to the surface. Fans are mounted within the shafts and/or portal and may run intermittently as intake and/or exhaust points in order to force the necessary air flow depending on underground activities. Ventilation fans are generally assessed to be the noise source with highest potential to affect humans or wildlife.

At Energy Fuels' La Sal Uranium Mine, noise levels were monitored at the Beaver 1800 ventilation fan which is mounted at the surface and contained no barrier at the time of measurement. The noise levels measured 91.7 dBA at a distance of 10-feet away. At a half-mile, with attenuation, the noise level of a surface fan would be reduced to less than 50 dBA. Surface-mounted ventilation fans operated at other Energy Fuels' mines are likely to be similar to those used at the La Sal Mine.

Noise emissions from ventilation fans can be reduced using a variety of techniques. Buffers or shrouds can be placed around surface mounted fans. It is possible to mount ventilation fans in the underground mine workings instead of at the surface. The fans are more difficult to operate, monitor and maintain when they are mounted underground but doing so may reduce noise emissions to the nearest surface receptor by 10 dBA. Other noise emissions in the underground mine workings are high and MSHA noise guidelines must be taken into account prior to planning to place ventilation fans underground.

## 4.3 Vehicle Traffic

Other sources of surface noise at the mine would be typical of most construction sites. The Federal Highway Administration provides a Construction Noise Handbook that presents noise emission reference levels for assorted typical construction equipment based on use of their Roadway Construction Noise Model (RCNM). Table 5 presents a subset of the equipment modeled. This information does not take into account individual equipment sizes or models, but can be used as a guide for noise emissions that would be consistent with equipment used at Energy Fuels' mines.

In general, the backup alarms on the trucks and loaders will generate the loudest noise during loading, unloading and hauling.

**Table 5. RCNM Default Noise Emission Reference Levels**

| Equipment Description | Maximum Noise Emission Limit Based on Equipment Specifications at 50 feet (dBA, slow) | Actual Measured Noise Emission at 50 feet (dBA, slow) (Samples Averaged) | Number of Actual Data Samples (Count) |
|---|---|---|---|
| Compressor (air) | 80 | 78 | 18 |
| Dozer | 85 | 82 | 55 |
| Dump Truck | 84 | 76 | 31 |
| Front End Loader | 80 | 79 | 96 |
| Generator | 82 | 81 | 19 |
| Grader | 85 | N/A | 0 |
| Pickup Truck | 55 | 75 | 1 |
| Warning Horn | 85 | 83 | 12 |
| Source: FHWA, 2014. | | | |

# 5.0 SUMMARY

Based on the noise sources and levels discussed above and typical noise attenuation, if there were receptors within a half-mile of one of Energy Fuels mines' surface facility areas or ventilation shafts, the noise generated by the ventilation fans, generators and vehicle warning horns would be within the sound limits provided for comparison in Table 4. In addition, mines are located in areas open to mineral development and, primarily recreational use, so signs are installed to notify the public about the presence of the mine.

# 6.0 REFERENCES


30 CFR Part 62 MSHA http://www.msha.gov/regs/30cfr/.

23 CFR Part 772 FHWA http://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title23/23cfr772_main_02.tpl.

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Mine Safety and Health Administration. 2000. Compliance Guide to MSHA's Occupational Noise Exposure Standard. March.

Salt Lake Valley Health Department Health Regulations. 2012. Health Regulation #21: Community Noise Pollution Control. August.

U.S. Environmental Protection Agency Office of Noise Abatement and Control. 1974. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (550/9-74-004). March.