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October 7, 2010

Bob Monok
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PINON RIDGE
COLORODO DEPT. OF PUBLIC HEALTH & ENVIRONMENT
FIRE PROTECTION RELATED QUESTIONS

Dear Bob:

This letter will serve to provide Energy Fuels Resources (EFR) with responses to specific fire protection related questions raised by the Colorado Department of Public Health and Environment (CDPHE) via their Request for Information (RFI) #3. The questions are repeated below along with the responses from Rolf Jensen & Associates, Inc. (RJA).

1. *Page 4-5. Fire Alarm System and Controls. Please confirm that water sprays are appropriate for a potential fire of this magnitude and type. Other facilities use CO_2 –based mitigation systems.*

   RESPONSE: Depending on a number of factors and objectives, water spray, water mist, foam-water, and CO_2 are all potentially appropriate means of controlling and suppressing Class B fires. Until specifics such as tank size, tank materials, openness of the tanks, and other process related conditions have been finalized, it is premature to anticipate or specify that a particular means of fire protection will be provided for the solvent extraction tanks. It is also important to consider that the final fire protection solution may involve the installation of multiple types of fire protection systems to protect various hazards. For example, it may be appropriate to provide a CO_2 system to protect the solvent extraction tanks, while providing a water-based fire sprinkler system to protect the building which the tanks are within. CO_2 is an effective means of fire protection, and is generally specified for enclosed, unoccupied spaces, or as a local application system for relatively small open areas. CO_2 systems will be considered in the final design analysis.

Reference attachments:

- RJA Fire Protection Report dated June 16, 2008
- 2007 NFPA 15 – Section 1.3
- 2007 NFPA 16 – Section 1.3.2
- 2006 NFPA 750 – Annex Section A.4.1

2. *Page 39. 1st full paragraph. It is our understanding that solvent fires should not be fought with water. Either a foam or CO_2 system is recommended by NFPA. Provide documentation showing that a conventional sprinkler system is adequate for the SX circuit or re-design that system to current standards of care. Cotter uses a CO_2 system for its solvent extraction circuit.*

   RESPONSE: See response above and associated attachments. A conventional sprinkler system is not proposed or anticipated for use in protecting the solvent extraction tanks and the associated Class B fire. Conventional sprinklers may however be considered to protect the building and ancillary contents.

3. *Page 41. Building Fire. As mentioned elsewhere, water is not the proper remedy for a solvent fire. These would be considered Class B fires by NFPA. See comment 1 above.*

   RESPONSE: See previous responses and associated attachments

Should you have any questions, please let me know.

Very truly yours,

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FIRE PROTECTION REPORT
ENERGY FUELS RESOURCES
PINON RIDGE, COLORADO

Prepared For:

Energy Fuels Resources
44 Union Boulevard
Suite 600
Lakewood, Colorado 80228

June 16, 2008

Project #: A44964

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INTRODUCTION

This report documents the activities, findings and recommendations of Rolf Jensen & Associates, Inc. (RJA) as they relate to the work performed under our agreement with Energy Fuels Resources (Client) dated April 15, 2008. Our contracted scope of work relates to research and consulting associated with the development of fire protection practices to address the following process related hazards:

- Organic Storage and Distribution
- Solvent Extraction – Mixer/Settlers
- Fire Protection Water Supply

With respect to the hazards above, we have researched applicable NFPA Standards, Factory Mutual Data Sheets, and industry practices. The information presented in this report is intended to summarize applicable fire protection concepts that are based on information made available to date. This report is not intended to address all hazards associated with the Pinon Ridge operations, nor is it intended that all options for protection have been identified within the report. Final design and implementation of the fire protection program at Pinon Ridge is the responsibility of the engineer(s) of record and the Pinon Ridge stakeholders.

BACKGROUND

The Pinon Ridge project will be located in Colorado and is currently under design. The site will be designed for the purpose of mining, milling, and processing of 1000 tons per day of ore and the production of uranium and vanadium oxides as a finished product. One of the operations associated with the production of uranium and vanadium oxides is solvent extraction (SX). Solvent extraction involves the use of an organic solution (kerosene) that includes reagents for extracting the uranium and vanadium from an aqueous leach solution. At Pinon Ridge, the SX process associated with uranium will take place in four stages of open topped fiberglass tanks that are 34 ft. x 12 ft. x 4 ½ ft. deep; note that the vanadium tanks are slightly smaller. The open topped tanks will be provided with a lightweight steel roof structure for fume and vapor control. The edge of the roof will be about 1 foot above the tanks and will not seal at the tank edges. Because the kerosene is a Class II combustible liquid ($100^{o}F<$flash point$<140^{o}F$) this operation represents a significant exposure to fire and associated property damage as well as business interruption loss.

CODE RESEARCH & RECOMMENDED DESIGN PRACTICES

One of the unique aspects of a solvent extraction operation is the fact that the organic solution (kerosene) is continuously being drawn off and replenished from the tanks, which in turn causes the liquid surface to always be moving. While NFPA 30

specifically addresses the protection of flammable and combustible liquids, the standard does not address how these liquids are to be protected under dynamic conditions. NFPA 122 is the standard that is intended to address hazards associated with mining and metal processing facilities; however, this standard does not currently include a section associated with solvent extraction. Although NFPA 36 is titled, *Solvent Extraction Plants*, this standard is applicable to solvent extraction operations that are associated with food processing, not mining operations.

Given the fact that the existing NFPA standards do not specifically address the proposed SX operation, this document incorporates references and applicable guidance from each of the following NFPA standards:

- NFPA 13 (Design and Installation of Sprinklers)
- NFPA 15 (Design and Installation of Water Spray Systems)
- NFPA 16 (Design and Installation of Foam-Water Sprinklers)
- NFPA 24 (Private Service Fire Mains)
- NFPA 750 (Water Mist Systems)

Factory Mutual Data Sheet 7-12/17-17 (Mining and Ore Processing Facilities) was also reviewed, and many of the process related recommendations are based on information provided by this Data Sheet.

SOLVENT EXTRACTION-MIXER/SETTLERS - OPERATIONS

The SX operations take place within a 240 ft x 300 foot building constructed of unprotected steel columns and beams with lightweight steel siding and roofing materials. Within this structure there will be twenty nine open-topped mixer/settler tanks of 34 feet x 12 feet in size. Each mixer-settler tank will be provided with a lightweight steel roof and open sides for the purposes of vapor control. Within the building will also be four closed-top cylindrical tanks of unknown size used as holding tanks for the in-process organic. There will be a significant amount of piping and pumps that are associated with the process. It is not clear at this time as to whether the piping and pumps will be located in trenches or if the piping will be run above grade on racks. It is also not clear as to whether each tank or grouping of tanks will be diked.

Fire protection for the mixer/settler operations is not achieved through the application of a single system or method (e.g. sprinklers) but rather it must be achieved through the implementation of a multi-faceted approach that includes process design, separation of hazards, trenching and/or diking, along with automatic and manual fire suppression systems.

The sections which follow detail RJA's specific recommendations for the selected facets of the solvent extraction operations.

ORGANIC STORAGE & DISTRIBUTION

1. Process areas, piping and storage tanks should be spaced and located such that the effects of pool fires, solvent drainage patterns, and emergency response capabilities are considered and addressed.

2. Buildings, piping systems, process tanks and other vessels should be constructed of non-combustible or fire resistive materials wherever possible.

3. Where plastic or combustible tanks are unavoidable, the use of a structural plastic such as fiber reinforced plastic (FRP) should be considered.

4. Eliminate or reduce the use of below-grade trenches for piping and process equipment. Locate pipes above grade on pipe racks.

5. Consider the use of steel flexible couplings where flexible couplings are required.

6. Use seal-less or mechanical double sealed pumps for solvents.

7. Route instrumentation and safety shutdown systems away from the solvent areas.

8. Use methods to reduce static electricity and mist generation such as submerged nozzles, minimized piping bends and restrictions, reduced solvent velocities, and low turbulence pumps.

9. Provide dikes or other means of drainage or containment for all tanks which contain combustible liquids. The diked area should be provided with automatically actuated foam-waterspray systems designed to control a pool fire within the diked area.

10. Consideration should be given to the fire proofing of structural members associated with buildings, tanks, or processes that are critical to withstand the effects of fire.

11. Protect the 40,000 gallon organic storage tank located outside of the building by providing an automatically actuated foam-waterspray system. The system should be designed to provide 0.25 gpm/sf over the tank and diked area and should be provided with a foam concentrate supply adequate for a minimum 30 minute duration.

MIXER/SETTLER FIRE PROTECTION

Fire protection for the mixer/settler tanks should be provided through the implementation of one of the three following methods.

1. Water Mist – Provide an automatically actuated water mist fire suppression system designed and installed in accordance with NFPA 750 (Water Mist Fire Protection Systems).

   Discussion: A water mist system utilizes fine droplets of water to extinguish fire through cooling and displacement of the available oxygen. Most water mist systems are fully self contained and utilize water that is pressurized by compressed inert gas or through positive displacement pumps. Waterflow rate for each mixer-settler tank is expected to be in the 20 - 30 gpm range, and design duration is typically 30 minutes. This results in an approximate water supply requirement of 600 - 900 gallons. Water can be supplied via one or more standalone tanks or via direct connection to a piped water source. Because of the relatively low flow rate and duration, discharge of a water mist system is not expected to overflow the mixer-settler tanks and would have minimal impact on production and post-fire recovery. When compared to the three systems described herein, the installation of a water mist system is expected to offer the most desirable combination of performance, cost and operational benefits.

2. Deluge Foam System – Provide an automatically actuated aqueous film forming foam AFFF fire suppression system designed and installed in accordance with NFPA 16 (Installation of Foam-Water Sprinkler and Foam-Water Spray Systems).

   Discussion: A foam water sprinkler system is intended for use in the extinguishment of two-dimensional flammable liquid hazards. A foam water system extinguishes fire primarily through the separation of the fuel from the oxygen through the application of a foam blanket on the surface of the buring liquid. This type of system will utilize a foam concentrate tank and a connected water supply. Upon detection, foam concentrate and water are mixed then aspirated and discharged through open nozzles. Anticipated flow rate for each mixer-settler tank is approximately 100 – 120 gpm. Typical design discharge duration for a foam system is 20 minutes. This results in an approximate water supply requirement of 2,000 – 2,400 gallons per mixer-settler. Discharge of a foam system will likely result in the loss of the entrained organic and will require downtime for cleaning, recharge and ramp-up.

3. Open-Head Water Spray – Provide an automatically actuated water spray system designed and installed in accordance with NFPA 15 (Water Spray Fixed Systems for Fire Protection).

   Discussion: Water spray systems utilize open-head nozzles to discharge water at a controlled rate and pattern. The primary extinguishing method of a water spray system is through the cooling of the fuel. A water spray system will require a discharge rate of approximately 160 gpm – 200 gpm. Discharge duration for a water spray system is not specified; however it is reasonable to anticipate a minimum duration of 30 minutes. The discharge rate and duration results in an anticipated water supply requirement of 4,800 – 6,000 gallons per mixer-settler. A water spray system is anticipated to require the least initial cost for installation; however it will use the most water and, depending on tank freeboard discharge of the system, may create a tank overflow condition. Tank overflow would result in loss of product and potential environmental hazards.

Mixer/Settler Fire Protection Summary

While multiple options have been presented for the protection of the mixer/settler tanks, it is RJA's opinion that the installation of a water mist system will offer the most beneficial balance of cost, fire protection effectiveness, water usage, ease of maintenance, durability, and reduced operational downtime in the event of a system discharge. Note that due to the proximity of the mixer-settler tanks to one another, the chosen fire protection system should be designed for simultaneous discharge to the tank of incident plus one tank to each side.

BUILDING FIRE PROTECTION

Fire suppression systems should be considered for installation in all buildings which contain fire hazards. The decision to install fire suppression is one which should be based on the hazards present, the probability of a fire event, the consequences of a fire event, and the training and equipment that is provided for manual fire fighting.

For the mixer/settler building, a dry-pipe, closed-head, foam-water sprinkler system should be considered. With the assumption that the mixer-settler tanks and the organic storage tanks will be independently protected, the foam-water sprinkler system should be designed to provide a minimum density of 0.20 gpm/sf over the most remote 3,600 square feet of building area.

For buildings or equipment which are of a critical nature, fire suppression and/or fire detection systems should be considered for installation based on the criteria described above.

FIRE DETECTION

Each of the above described fire protection systems require a means of fire detection for system actuation to occur. For the SX operations we would suggest that one of the following means of fire detection be installed under the roof of the tanks.

Linear Heat Detection – Linear heat detection utilizes a specially designed two conductor jacketed wire which is attached to the roof structure. When any part of the wire reaches a set temperature, the jacketing melts and the two wires short and an alarm and fire system actuation is initiated. Linear heat detection is durable, easy to install, and not prone to false alarms.

Pilot Sprinklers – A sprinkler system which is charged with air (pilot head system) is sometimes used as a means of detection and system actuation for special hazard systems. A pilot head system detects fire and actuates fire protection system as a result of a drop in air pressure once the fire reaches the temperature of the sprinkler head and the sprinkler operates. A pilot head system is inexpensive, easy to install, relatively durable, and not generally prone to false alarms.

UV/IR Detection – UV/IR detectors initiate alarm and system actuation when light wavelengths that are indicative of fire are detected by the devices. The most significant benefit of a UV/IR detection system is that its response to a fire is nearly instantaneous and therefore alarm and system actuation take place very early in the fire development. While a UV/IR system offers some significant advantages with respect to response time, this type of system is more prone to false alarms and may be more difficult to maintain within the mixer/settler environment.

Fire Detection Summary

While multiple options have been presented for fire detection, it is RJA's opinion that the linear heat detection system will offer the most favorable balance of installation costs, ease of installation, response time, durability, reliability, and limited susceptibility to false alarms. If quick response time is a critical factor to achieve overall fire protection objectives, then UV/IR detection should be considered further.

WATER SUPPLY

Provide a fire protection water supply system throughout the facility that is capable of providing not less 1500 gpm at a working pressure of 80 psi for a 120-minute duration.

Provide two-way hydrants spaced no more than 250 feet apart and arranged such that any part of a building or fire hazard is within 150 feet of a hydrant. Distances should be measured based on the natural path of emergency response and hose lay.

Provide portable hose carts or permanent hose stations that are equipped with not less than 150 feet of 2 ½ inch hose and two 100 foot lengths of 1 ½ inch hose and a 2 ½ inch x 1 ½ inch gated wye.

CLOSING COMMENTS

Sound fire protection and loss control for an operation such as that which is proposed for Pinon Ridge is accomplished through proper planning, operational design, fixed fire protection systems, and manual fire fighting capabilities. The recommendations presented herein represent reasonable and appropriate actions based on applicable fire protection standards and accepted industry practices.

END OF REPORT

ROLF JENSEN & ASSOCIATES, INC.

Report Developed by:

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SAS:JEK/skc
A44964

2007 NFPA 15 – WATER SPRAY SYSTEMS FOR FIRE PROTECTION

1.3 Application.

1.3.1 Water spray is applicable for protection of specific hazards and equipment and shall be permitted to be installed independently of, or supplementary to, other forms of fire protection systems or equipment.

1.3.2 Water spray protection is acceptable for the protection of hazards involving each of the following groups:

(1) Gaseous and liquid flammable materials

(2) Electrical hazards such as transformers, oil switches, motors, cable trays, and cable runs

(3) Ordinary combustibles such as paper, wood, and textiles

(4) Certain hazardous solids such as propellants and pyrotechnics

2007 NFPA 16 – INSTALLATION OF FOAM-WATER SPRINKLER AND FOAM-WATER SPRAY SYSTEMS

1.3.2 Foam-water deluge systems are applicable to the protection of two-dimensional flammable liquid hazards. They shall be permitted to be used for any of the purposes or combinations thereof detailed in 1.3.2.1 through 1.3.2.3.

2010 NFPA 750 – WATER MIST FIRE PROTECTION SYSTEMS

A.4.1 A water mist system is a fire protection system using very fine water sprays (i.e., water mist). The very small water droplets allow the water mist to control or extinguish fires by cooling of the flame and fire plume, oxygen displacement by water vapor, and radiant heat attenuation.
Water mist systems have been proven effective in controlling, suppressing, or extinguishing many types of fires. Potential applications include the following:

(1) Gas jet fires

(2) Flammable and combustible liquids

(3) Hazardous solids, including fires involving plastic foam furnishings

(4) Protection of aircraft occupants from an external pool fire long enough to provide time to escape

(5) Ordinary (Class A) combustible fires such as paper, wood, and textiles

(6) Electrical hazards, such as transformers, switches, circuit breakers, and rotating equipment

(7) Electronic equipment, including telecommunications equipment