Report

File No: **92100-30-064245-R01**

Application No: **2008-064245-R01**

Project: **Elmworth Energy Corporation**
Brine Storage Pond (KC-1)- Natural Gas Exploration
Kennetcook , Hants County

SUMMARY:

Current approval allows disposal of brine generated during exploratory work by:

- trucking to approved disposal site
- use freeze thaw process to dispose excess water on site.

Introduction:

Production of oil and gas is usually accompanied by the production of water. This produced water consists of formation water (the water present naturally in the reservoir), and flood water, injected in the formation during fracking operation.
Elmworth Energy Corporation currently operates a Brine Storage Pond at Kennetcook, Hants County. Brine Storage Pond is located roughly 2.5 km north of Kennetcook accessed off Route 236. This is on map series 11E/04, grid reference 45.191°N, 63.703°W and PID # 45361060.

The original Approval # **2008-064245** allows Applicant to dispose brine from the pond , by trucking it to approved disposal facility as waste dangerous goods. That approval was amended on April 17,2009 (Approval # **2008-064245-A01)** to allow removal of ice from the brine pond for melting and disposal on site. This procedure is primarily a cost cutting measure associated with disposal of wastewater.

This revised application **(2008-064245-R01)**(this one)is going to be issued for one year to allow Applicant to develop alternative disposal method for brine.

Summary:

- Two brine ponds (KC1 and KC2) each having 10,000 m^3 capacity with an engineered design and construction.
- Each has an impermeable 40 mil HDPE liner and a de-watering sump for removal of wastewater.
- The liquid contained in this ponds is a mixture of freshwater taken from Kennetcook River mixed with additives and used in fracking operation, formation water extracted during fracking stimulation, and rain water.

Chemical composition of the brine in the ponds is shown in the Table below :

Parameter	KC1 (mg/l)	KC2 (mg/l)
TDS	40,100 - 118,000	13,000 - 92,100
hardness	2,500	2,000 - 5,100
chloride	24,000 - 72,000	7,800 - 58,000
sodium	14,000 - 44,000	4,800 - 34,000
strontium	4.2 - 30	6.3 - 15
TOC	10	5 - 19
TPH	0.1	3.7
benzene	0.001	0.002

According to application, a following chemicals may have been used in the fracking process, but have not been sampled for: Methanol, Isopropanol, Ethoxylated Alcohol, Trisodium Nitrilotriacetate Monohydrate, Sodium Persulphate, Diethylene Glycol Monomethyl Ether, Methylene Bis (Thocyanate), 2-(Thiocyanomethylthio) Benzothiazole, Acrylamide copolymer, Fatty Acid Esters, Terpene, Alcohol, Alkyl Alkoxylate.
Application states that quantities of chemical used was minimal and they are either biodegradable or volatile and therefore unlikely to persist

Recommendations: ***Renew existing Approval for one year to allow proponent operation of the brine pond, while preparing alternative proposal for brine waste disposal***

REVIEW OF CURRENTLY APPROVED METHODS:
(quoted from existing Approval)

"Discussion:

This Facility will be operated on lands leased by the Approval Holder. A copy of leases have been submitted and are included in the file. The brine ponds are located on a 120 m x 120 m cleared area on the lease property. Currently there is no activity on the site other than routine monitoring of brine pond water levels and periodic removal of brine for disposal. The brine results from a mixture of fresh river water, rainwater and waste waters from previous well fraccing activity in 2007. The well head has been installed and further exploration and development activity on site is suspended pending the results of further exploration.

There is approximately one (1) metre of ice on the pond surface during winter months (2500 cubic metres) which is proposed to be removed by an excavator with a mechanical claw device capable of retrieving ice from the surrounding berm and placing it outside the engineered brine pond berm. This procedure is currently recommended as a one time disposal method for this site.

Freeze - Thaw applications are recognized by the Oil and Gas industry in the treatment of exploration formation water. The ice was analysed for sodium chloride and iron which are expected to be the primary contaminants of concern based on the analysis provided on the original brine waste water. The freeze - thaw sequence has reduced the concentration of chloride in the wastewater from approximately 50,000 mg/l to 1,000 mg/l and the iron levels from 110 mg/l to non detect in the ice.

CCME freshwater aquatic guidelines recommend a maximum 600 mg/l of chloride and an iron concentration of 0.3 mg/l. Melted ice from the pond is not expected to negatively influence the iron or chloride concentrations of any receiving stream or groundwater

aquafer based on volumes of melt ice, dilution and separation distance to the nearest watercourse.

The closest watercourse is a Burns Brook located approximately 300 metres to the south from the site through a wooded area. The site is also about 2 kilometres to the nearest domestic well. There is currently no known negative offsite impacts.

Environmental Impact:

The main environmental impacts associated with the proposed operation are the potential inadvertent discharge of high salinity wastewater into receiving watercourses, wetlands or groundwater. Noise, dust, surface runoff, and rehabilitation are other relevant issues.

The brine pond is a 10,000 m^3 containment with an engineered design and construction. It has an impermeable 40 mil HDPE liner and a de-watering sump for removal of wastewater.

Air Emissions (Dust) & Noise:

Environmental impact from noise and dust are expected to be minimal. Noise and dust will be further restricted to the limits set forth in the approval and shall be monitored at the Department's request.

Surface Runoff:

Environmental impact from surface runoff will be controlled via standard erosion/sedimentation controls so that surface runoff is retained prior to leaving the site. The closest watercourse is a tributary to Burns Brook located approximately 300 metres to the south from the site through a wooded area. There is currently no evidence of negative offsite impacts.

Surface water runoff from the operation will be restricted to the limits in Nova Scotia Environment approval. Surface runoff will be monitored by the Approval Holder at the departments request. Groundwater monitoring or mitigation may be required in the event spill or release of brine. The site is about 2 kilometres to the nearest domestic well. The company has prepared a contingency plan to address mishaps associated with the brine ponds.

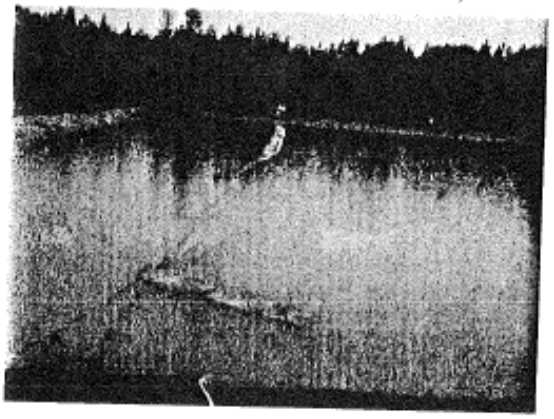
Rehabilitation:

The Approval Holder plans to immediately restore all disturbed areas via grading and vegetation once works are completed or prior to expiry of the approval.

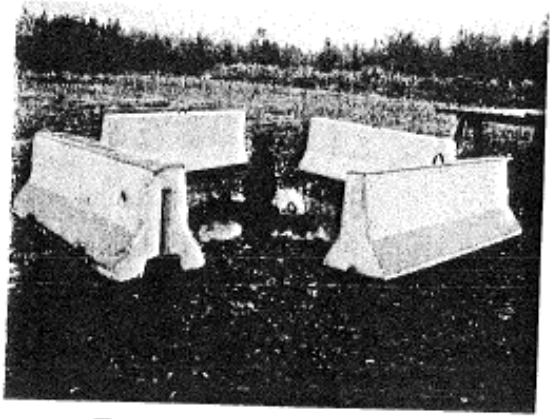
Recommendation: It is therefore recommended that Elmworth Energy Corporation application for the operation and reclamation of a Brine Storage Pond for natural gas exploration at Kennetcook, East Hants County, be approved subject to the appended terms and conditions."

End of quotation

Tad Czarnik, P.Eng.
Regional Engineer



Typical Brine Pond



Typical Exploration well