"EVAP" PROJECT

GARY MAYHEW, C.E.T.

LEDCOR ALBERTA LIMITED

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AT THE DISPOSAL OF SALT BRINE AT HIGHWAY MAINTENANCE YARDS SESSION

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"EVAP" Project

Background

In 1999, under the terms of the Canadian Environmental Enhancement Protection Act (CEPA), salt was declared harmful to the environment. Salt was declared a "High Priority" substance and was being considered as a potential "Toxic" substance. Although, the federal government has stayed away from classifying salt as toxic, this meant more attention and focus was now expected by road authorities and regulatory agencies on its management.

All road authorities use salt for snow/ice control, so this declaration had a significant impact on regulatory agencies in assessing salt management practices and salt brine disposal. Currently, there is no combined environmentally friendly and cost effective disposal method for salt brine. Salt brine, collected in specialized containment systems or in lined ponds, will eventually require disposal. Given our climate, evaporation ponds do not function with any great effectiveness. Approved disposal methods such as down-hole injection are very costly.

Environmental agencies are applying more energy and resources to monitoring sites used for sand/salt storage, especially those in close proximity to an Environmental Sensitive Areas (ESA) or drinking water supply. The legislation that defines what constitutes a harmful substance or an ESA is open-ended and allows a good deal of flexibility in the assessment of each.

It seems inevitable that wash water from cleansing of plow trucks and/or disposal of brine collected in ponds will not be permitted through municipal sewer systems, in road building or dust suppression operations. Manifests may be necessary as a matter of "due diligence". Dilution may be a solution today but arguably not in the near future. Release of salt contaminated water off site will be prohibited and could well prompt environmental enforcement and legal action.

The increased awareness and focus on salt by both federal and provincial entities and the progression to tighter controls on the usage and disposal of salt laden materials prompted us to look at developing a functional and environmentally friendly disposal method for salt brine, thus commenced project "EVAP".

The idea was simple; apply heat in a low-pressure environment to separate the dissolved solids out of solution. Convert the water from the brine solution to a vapor and then disperse it into the air. As the brine rises in temperature, it becomes less dense and the dissolved solids precipitate out. The system was to focus on the aspects of recycling and energy efficiency. In addition, EVAP needed to be both portable and easy to operate.

The first aspect in the development of "EVAP" was the allocation of funding. The initial funding committed to this project was $220,000 dollars.

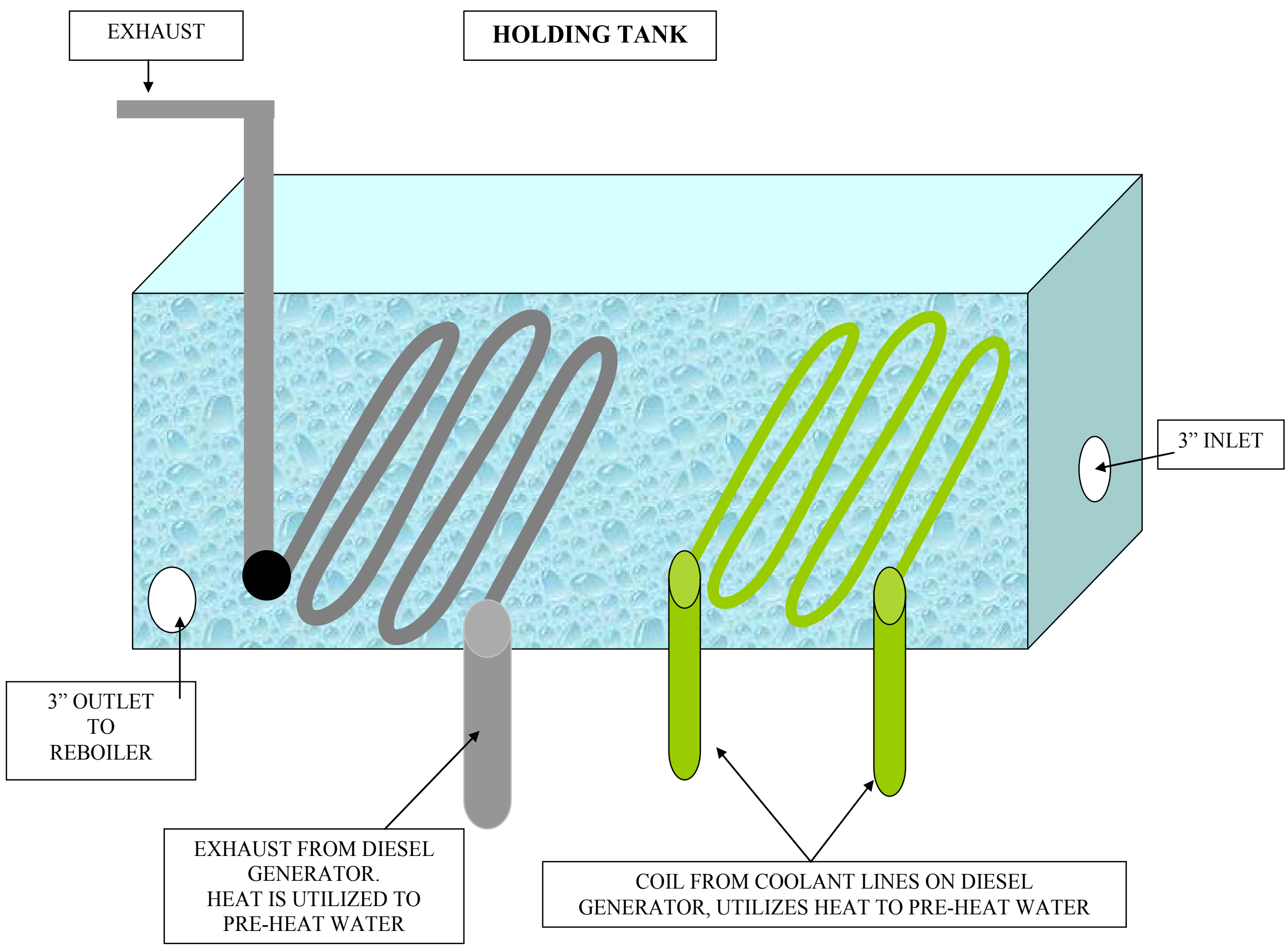
We procured used components where we could. The used components consisted of two boilers, an air coil, and a 45-foot trailer to house the system. To prevent compromising the integrity of the system these components were modified and refurbished.

Economizer, Main Boiler and Air Coil

5th Wheel Trailer

EVAP is designed to be a self-loading system. The holding tank is controlled by an automatic Hi-Low water level shut off.

For energy efficiency, the exhaust of the generator was routed through the holding tank. The generator's coolant lines were also routed through the water tank for an additional pre-heating benefit.

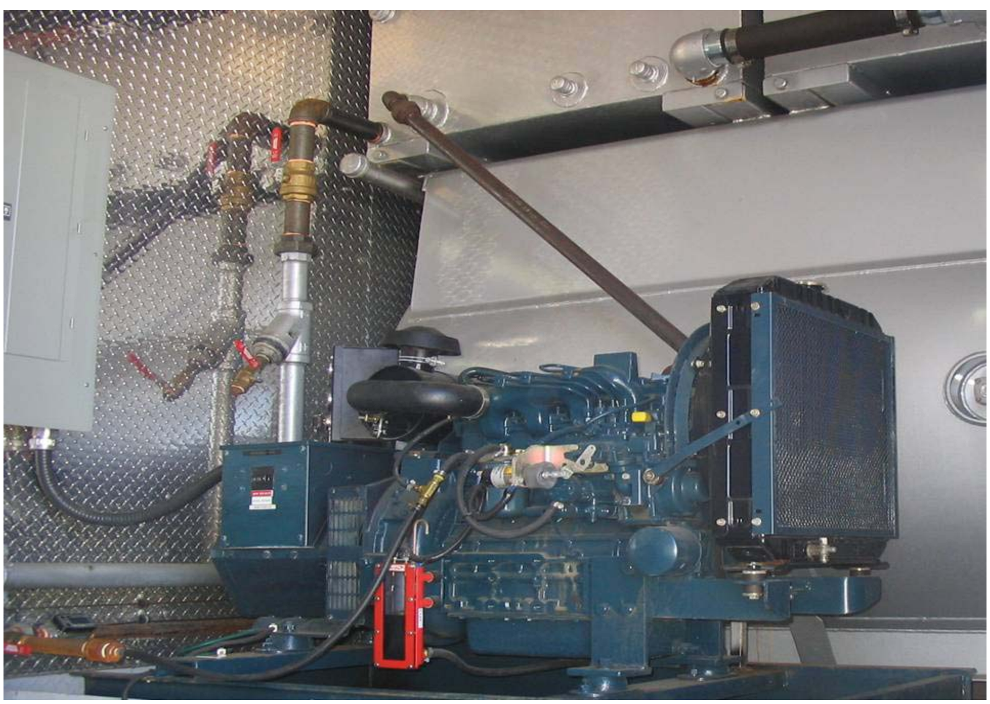


Holding Tank

From the holding tank, the brine is pumped to the economizer. The level of brine is brought back to appropriate levels by a Hi-Low water control sensor, which ensures that the level of brine in the economizer remains constant. The line connected to the economizer from the holding tank has a metering device to track and record the volume of brine being processed. This supports the requirement for a manifest and disposal documentation. The diesel generator is also equipped with an hour meter to better facilitate the correlation of fuel consumption to the volume of brine being disposed of.

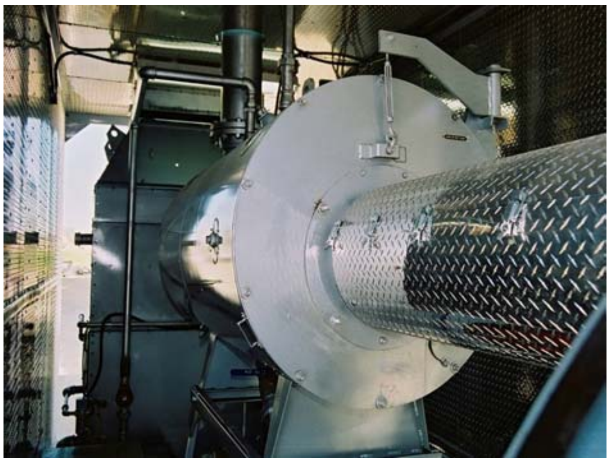
Water Meter

Holding Tank, Fuel Tank, and Generator



Generator

The economizer is smaller in comparison to the main boiler. Its primary function is to provide secondary heat exchange. When the brine water enters the economizer, heat transferred from the main boiler exhaust is utilized to raise the temperature of the brine water. From the economizer, the pre heated brine water transfers to the main boiler. Here, a burner raises the temperature of the brine to roughly 200 degrees Celsius. The burner controls are regulated to ensure that the temperature of the brine is kept constant and to prevent over heating. In case the system was to over heat, an automatic flame guard sensor was installed. Specific to the Economizer, a Hi-Low water sensor was also installed.



Economizer

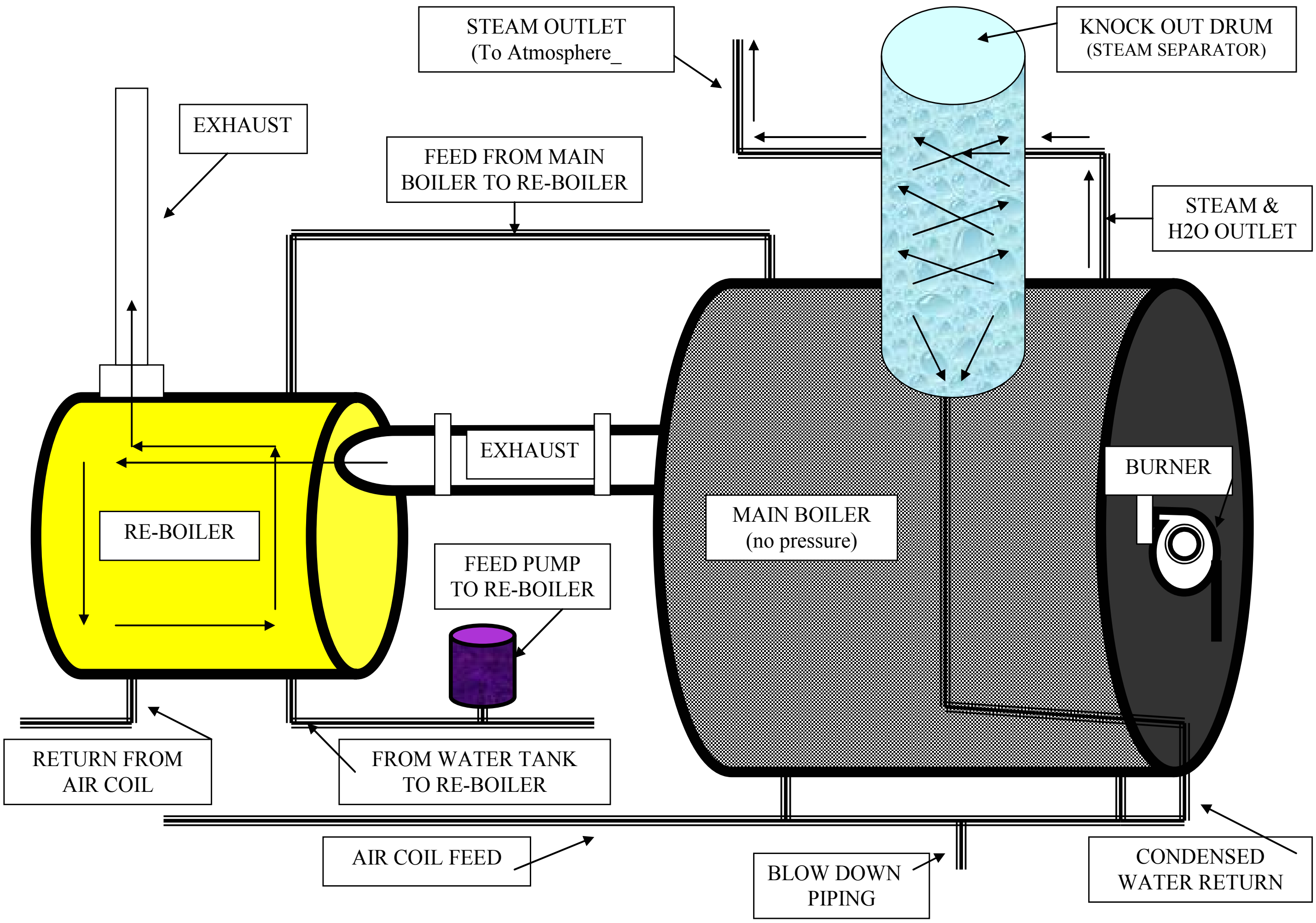
Main Boiler

Given our pressure system is not closed the regulating of the heat applied becomes a factor. The greater the heat the greater the pressure build up, thus the release of not only vapor, but liquid as well. To prevent this we added a knock out drum.

Economizer Exhaust

Knock Out Drum

The stack from the main boiler was incorporated to offset the requirement for a certified boiler man to operate the unit. EVAP was designed to be user friendly; we wanted to be capable of utilizing our existing staff to facilitate its operation. The configuration of the knock out drum allows the boiler to operate at a lower pressure. The knock out drum allows some vapor from the main boiler to be released into the air and prevent any brine from escaping the system. Brine that is forced up the drum is cooled. When this happens, the brine condenses and is returned to the boiler.



The Boiler system

Air Coil

The heated water circulates from the main boiler to the air coil. The water feeds into the top of the air coil and descends by gravity through the air coil's media. As the water passes through the media, it gradually breaks downs into smaller particles. Forced air through the media displaces steam from the air coil into the air. Water that manages to pass through the air coil is circulated back through the system, via the economizer. In this instance, the economizer functions as a re-boiler.

Re-Boiler

The salt that is removed from the brine solution deposits in the boilers, builds up, and has to be disposed of in time. The residue is removed by flushing the boilers. Residue from this process is retained in the primary boiler, the re-boiler, and the air coil. The residue may need to be removed after 15-20 days of continuous operation. The amount of residual solids, namely salt, is dependent on the percentage of dissolved solids. The concentration of salt impacts the frequency that the boilers need to be serviced. To facilitate the cleaning of the boilers discharge outlets were incorporated in the economizer and main boiler. When flushing the boilers the discharge could be loaded into containers or back into the pond. Alternatively, the salt could be recycled. The residual salt can be salvaged and reutilized for snow/ice control purposes.

Steam exiting the air coil was sampled and then tested. Results indicated that the dissolved solids had been reduced to only 5 ppm. This gave the process an efficiency rating of over ninety nine percent. At peak production, the system proved capable of disposing of 1,400 liters per hour. However, heavier concentrations of salt were found to impact the production rate. The dissolved solids in the brine measured from 10 percent to 2.7 percent. The cost of operation varied from $0.045/liter and upwards to $0.06/liter.

Project Highlights

- Recycling of exhaust heat
- By product of the system may be dried and recycled.
- Water discharged is chloride free
- Environmentally friendly process
- Portability
- Ease of Operation
- Safe, built in monitoring, and automatic shut-offs

At the completion of EVAP, the project cost had escalated to a sum of $285,000. In assessing the design of EVAP, all elements of our initial concept were incorporated and fully functional. However, there are areas that we will be looking to enhance such as the production rate, capacity, and energy efficiency. Ledcor has taken a pro-active approach in the development of this technology. Corporately Ledcor is committed to the continued development of new and applied technologies to help facilitate current and future environmental needs in the disposal of salt brine. We have learned a great deal in the initial development of EVAP. This experience will assist us in pursuing future enhancements to the system. In closing, I would like to thank the many the tradesmen and employees that contributed to the development and success of EVAP.