INPROHEAT INDUSTRIES LTD.

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SubCom® Case Study: Cameco McArthur River - Mine Water Heat Pump Project

Cameco

Location: McArthur, Saskatchewan

Year Completed: 1997

Deliverables: 6 MM Btu/hr Mine Water Heater

Project Overview

In early 1997, Inproheat supplied a 6 MM Btu/hr pond water heating system for the Cameco operated McArthur River Project in northern Saskatchewan. The McArthur River Project was one of the new generation uranium mines located at a remote location 620 air kilometers north of Saskatoon. The mine went into production in late 1999. Two deep underground shafts provide access to the ore body. Mining is done by remote controlled boring machines to minimize worker exposure to the high grade ore.

The mine is subject to inflow of groundwater, which has to be pumped to the surface and stored in several large plastic lined ponds to prevent seepage into the underlying soil and hydrological regimes. Before the water is pumped out and discharged to the river, it has to be chemically treated and filtered to remove heavy metals and radiological components. Since the ponds are located outside, and winter temperatures can fall below -40° C (-40° F), a thick layer of ice is forms on the surface. The ice can be as thick as 8 feet, reaching almost to the pond bottom. This creates a two-fold problem. Firstly, the ice formation reduces the pond capacity, and secondly, the ice cap moves when the water is pumped into or out of the pond. In the process, ice can damage the plastic liner, leading to the contamination of the surrounding soil and water system.

The Challenge

To reduce ice formation and minimize the potential loss of water containment, Cameco identified a need for an energy efficient heating system capable of handling up to 1,000 USgpm of pond water containing a high TDS which could very easily form a scale on traditional heat exchanger surfaces..

The system had to be able to handle a wide range of flows.

Unattended heater operation and absence of a certified boiler operatoron staff also had to be taken into consideration.

The requirement for high efficiency was driven not only by economics but also by the logistics of trucking propane and fuel oil for several hundred kilometers and storing it at a remote location.

The Solution

Inproheat designed and manufactured a 6 MM BTU/hr submerged combustion system.

The unit was skid-mounted prepackaged and prewired including the heating tank, submerged combustion burner, combustion air blower, propane fuel train, and control panel. The fabricated steel vent stack was shipped in two sections. Cameco designed and supplied their own water supply valves and piping, discharge pump box, pump, and fabricated steel platform. The pump box was located below the platform on which the Inproheat heating system was placed to enable gravity discharge into the pump box.

Manual inlet valves were used to control the water flow into the heater, while an overflow weir controls the level built in the SubCom™ tank. To attenuate the momentum of water inlet velocity at 1,000 USgpm flow, an internal perforated flow distributor was also incorporated into the inlet system. Cameco provided the pump box level control system. The SubCom™ burner fuel train was connected to a 15 psig propane supply. The unit is located in a water treatment building and operates without operator intervention.

Inproheat commissioned and started up the system in March 1997. A number of combustion tests were conducted. The water discharge temperature was set at 12° C (54° F), with stack temperature between 11 and 13° C (52 and 55° F). The resulting overall system efficiency was calculated at 98.5% of the propane higher heating value, compared to a typical 82% efficiency of other types of heating methods.

REQUEST INFORMATION:

Inproheat Industries Ltd.
1-888-684-6776 / (604) 254-0461
info@inproheat.com