Corps of Engineers Incorporates Masonry Heater into Green Design of New Project Office in North Pole, Alaska

Low cost, sustainable, safe and environmentally friendly ways of heating the spaces people live and work in are highly sought in our country. Nowhere in this nation is heating our homes and offices more important than in Alaska's great interior around Fairbanks where the heating season lasts for two-thirds of each year and the temperatures can hover at a high of forty below zero for weeks at a time. Despite having an abundance of natural resources that can all be used to generate heat, Alaska is plagued with the highest heating costs in the country owing to the costs associated with the production and delivery of heat-energy resources coupled with the length of the heating season. The abundance of wood, coal and oil resources in Alaska or elsewhere means little unless these resources can be practically and economically utilized.

In late 2010, the Alaska District seized upon an opportunity to modernize its Chena River Flood Control Project office facility for energy efficiencies by incorporating green building techniques and practices into the design. Significant design consideration was given to marrying form with function, building strong and sustainably utilizing natural materials and employing the latest energy capturing and conservation technologies. Based on these three major design themes, our nomination for the 2011 innovation of the year is a wood burning heating device called a **masonry or Russian heater**. This heater was designed to be a primary heat source for nearly 3,000 square feet of office, conference room and reception area space in the Chena Project office facility. In an emergency, the heater is quite capable of heating the entire Project office by itself.

A masonry heater is a wood-fired, heat storage mass of rock in which short, very intense fires produce large amounts of heat that is stored and slowly released over the course of a day. Used for hundreds of years by peoples living in northern latitudes with sparse firewood resources, this ancient

technology has only recently been rediscovered by energy conscious and conservation minded Americans.

Masonry heaters may resemble fireplaces, but that is where the comparison ends. Most fireplace heat goes up the flue, whereas the heat generated in a masonry heater travels through a maze-like route through thousands of pounds of rock mass being absorbed along the way. The extremely hot burn inside a masonry heater makes them the cleanest wood burning device that exists. They are also one of the safest ways to burn wood because their fires are so short in duration, usually burning no more than a couple of hours. Masonry heaters are remarkably efficient, producing little, if any, creosote and generating almost no wood smoke emissions because of combustion temperatures that can approach 2000 degrees Fahrenheit. They also are fuel misers compared to woodstoves and fireplaces, burning relatively small amounts of wood in only one to two short firings a day.

The arranged marriage of a remote Corps project office in North Pole, Alaska and the concept of a masonry heater seemed a very practical and innovative idea to the Corps employees who proposed and promoted it as an energy-conserving design element. Each year, the Chena Flood Project has almost unlimited supplies of firewood generated from flood and high water events on the Chena River. Trees washed downstream during high stream flows are trapped against the dam and must be bailed from the river following each high water event. This firewood obtained from and delivered by the river as a renewable and recycled resource, makes burning wood for heat at the Chena Project particularly attractive. The ability to efficiently burn this wood for heat in an environmentally friendly manner made much sense to Corps elements within the Alaska District and Pacific Ocean Division. Some resistance, however, was encountered with the engineering firm that was tasked with incorporating a masonry heater into the design. Having never heard of this kind of wood burning device, they struggled with the

concept for some time, designing us fancy fireplaces and calling them masonry heaters before they became educated.

The Chena Project's masonry heater has been in service since its christening in January, 2011 and has been regularly fired through March of this year with outstanding results. It is a focal point and curiosity for all those who visit the project office, providing an outstanding educational and interpretive opportunity for telling one of the Corps stories in Alaska. The Alaska District and Chena Project office are proud to have pioneered the Corps' first masonry heater in the nation and what is likely the first and only radiant mass heater in a federal facility in the United States. It stands as a testament to the Corps approach to problem solving and willingness to embrace new technologies and green design. The Chena Project's masonry heater exemplifies innovation and forward thinking from both inside and outside of the Corps of Engineers.

The masonry heater in use at the Chena Project is an innovation that demonstrates prudent spending of taxpayer money. Project visitors are first drawn to our heater's form and masonry craftsmanship. They then marvel at its function as a sustainable, environmentally friendly and economic radiant heat delivery system. Most are pleasantly surprised to find a government agency like the Corps of Engineers taking the lead in applying new and innovative heating technology with green building design. Few visitors walk by the heater without thoroughly inspecting its construction, touching the rock mantle or asking staff about its use and how it operates. Most importantly, visitors physically experience the heat output radiating from the rock and cannot overcome their inherent desire to gather around a warm hearth. This is an educational and interpretive opportunity for the Corps that can be invaluable in helping people live in more sustainable ways. It also identifies the Corps of Engineers as a federal agency role model associated with energy related innovation.

The financial impact of this innovation cannot yet be fully quantified without a full heating season of use; however, the Project did realize an eighteen hour heat output – days from our masonry heater on one firing per day of fifty pounds of white spruce firewood. Over nearly a two month period, approximately 1.5 cords (3,360 pounds = 67 firings) of project-generated wood was burned to supplement an oil-fired radiant floor heating system. The market price of this wood would have been a little over $300. Had we spent this same amount on heating oil, our boilers would have consumed 75 gallons of heating oil in less than one week. It is quite obvious that significant savings were realized as every British Thermal Unit (BTU) generated by the Project's firewood replaced one BTU produced from purchased heating oil. The Alaska District is anxious to develop a tracking system and offset program in the future to collect reliable heating data and determine the economies of heating with wood in our masonry heater over an entire Alaskan heating season.

The Alaska District hopes to spawn interest in building masonry heaters at Corps projects and federal installations where they are viable across the country. Certainly, there are many water resource development projects with heating needs that also have firewood resources available from flood debris clearing operations or sustainable timber stand improvement activities producing firewood on Corps owned and managed lands.

Masonry heaters may be a sound choice in many locations as a supplemental or emergency backup source of economical heat. In many cases, they may be easily retrofitted to an existing facility and have a useful life of over one hundred years. The benefits of heating with a masonry heater are time-proven. There is not a cleaner, more efficient or economic way to extract heat from wood. The Alaska District is proud to be the Corps' flagship and proving ground for this heating technology at its Chena River Flood Control Project in North Pole, Alaska.