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Hans Halverson maintains a VFD-powered pump at the Missoula Medical Center.

# Peace of mind

## Radiant, geothermal systems provide comfort to Montana cancer center.

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By John McNally | mcnally@bnpmedia.com

# Peace of mind

## *Montana cancer center benefits from radiant and geothermal systems.*

Photo by Mark Bryant.

**The Missoula Medical Center in Montana recently opened its 30,000-sq.-ft. Oncology Center featuring a geothermal system running off the Misoula Aqauifier. The building also has in-wall radiant panels in its 16 chemotherapy rooms.**

The team of engineers at Missoula, Mt.–based Associated Construction Engineering strives to provide the right level of comfort on every commercial application it designs for its clients.

Then there are projects such as the Community Cancer Care building – also known as the Oncology Center – at Missoula's Community Medical Center. Patients that unfortunately have to come to the cancer care facility already are facing a difficult challenge. Ensuring these patients' comfort was the most important aspect of the entire project.

"There is not one pleasant thing about receiving chemotherapy treatments," says **Jared Swartz**, a longtime A.C.E. team member integral in the design of the Oncology Center. "So a design criterion for the heating system was to make the physical atmosphere as comfortable as possible for patients that will already be uneasy and distressed."

The Oncology Center had a leg-up in finding its comfort wishes even before construction started in early 2013. The facility sits just 40 ft. above the large, underground Missoula Aquifer, which is what remains of the prehistoric glacial Lake Missoula. At its peak, Lake Missoula held as much as 600 cubic miles of water or nearly half the contents of Lake Michigan.

The water in the aquifer consistently hovers around 50–54°F and the

Photo courtesy of Taco.

**Associated Construction Engineering set up its redundant, base-mounted Taco pumps to serve the building's secondary heating loop. If one of the pumps goes down, or has to be serviced, the building can still be cooled.**

There are four VFD-powered pumps that serve the Oncology Center's heating and cooling demands.

water flows 3 to 4 ft. per day. The flow rate is incredibly faster compared to the majority of aquifers, which only cover that distance throughout a year.

Reaching those optimum comfort levels at the 30,000-sq.-ft. Oncology Center starts with the groundwater system. Engineer **Brodie Karabensh** and the A.C.E. team designed a "pump-and-dump" groundwater cooling system that taps into the aquifer's resources. Water is taken from the ground and pumped through a Alfa Laval large plate-and-frame heat exchanger. A.C.E. utilized 10-in. bore extraction wells for the system with each well dug 130 ft. deep. Each supply well has a 20-hp submersible pump and the water flows at a 350-gpm clip through the heat exchanger and is sent back into the aquifer. None of the actual groundwater flows through the physical building.

"There are two withdrawal wells set up with submersible pumps," Swartz says. "Those wells are 100% redundant. In case one of the wells went down or had to be serviced there still is the ability to cool the whole building. There is one reinjection well; essentially we're bringing it in and sending it through the flat-plate heat exchanger and dumping it back into the ground."

The facility uses a 15-hp, variable-frequency drive-powered Taco FI301 pump to send a glycol-based solution up to the rooftop air-handling units. The air-conditioning units are ducted and the domestic hot water is supplied by a 100-gal. gas-fired water heater, which is critical because boilers don't have to run during the summer season.

## Chemotherapy rooms

The Oncology Center has 16 rooms – four private, 12 open – that provide the chemotherapy infusion patients need in order to battle the disease. A.C.E. designed in-wall radiant panels in each room. The 16 rooms are split into four zones.

The heat comes from two, 1.5-million BTU condensing Aerco Benchmark boilers. A.C.E. set the boilers up in a lead-lag fashion and there is a Taco 300 MBH brazed-plate heat exchanger that pulls heat from the center's 180° F, 6-in. primary heating loop. The loop supplies water to the radiant panels at 120° F.

If more heat is needed for the infusion rooms – as well as heat for the building's offices and waiting areas – high-temperature water is pumped up to the rooftop air handler and the multiple variable-air volume boxes placed throughout the building. These areas get heat from a big, primary loop that utilizes a Taco 7.5 hp, VFD-powered base-mounted pump.

"The initial source of heat is the radiant-wall panels," Karabensh says of the lead-lag design. "The VAVs then come on to produce any extra heat needed."

Swartz adds: "Obviously, chemotherapy patients' immune systems are down. The people can get cold easily. The architectural space of the patient rooms is really wide open with

Photos courtesy of Taco.

A.C.E. works closely with Missoula, Mt.-based contractor 4G Plumbing and Heating. Project Manager Cory Hanninen programs a VFD for the building. A.C.E. spent nearly three months designing the system and utilized building information modeling on the project.

# Peace of mind

The Oncology Center's common areas are heated by hot water pumped up to a rooftop air handler and the many VAV boxes placed throughout the facility.

a lot of windows, a lot of glass and high ceilings. Our thought with the radiant-wall panels was to give the area an extra bit of warmth to protect against any cool-air infiltration of the windows and the natural convection of that space."

The people working daily at the Missoula Community Medical Center, such as Missoula Community Medical Center Vice President of Operations **Devin Huntley**, have been incredibly satisfied with the facility. More importantly, so have the patients and their families that are facing the tough battle with cancer.

"Before this building was completed, we enjoyed a very high satisfaction with our cancer-treatment services, but we wanted a facility that could offer even more," Huntley states. "With the new facility we set out to provide the best atmosphere and service possible. Patients and family members now tell us every day how much they love it. I can honestly say this is the first project I've worked on in a long time that far exceeded my expectations."

## Snow-melt and seismic activity

Montana's snow season runs a bit longer than the rest of the United States. From October to April, the Oncology Center must be vigilant that its sidewalks are clear and dry for patients and employees coming and going from the facility. The heat exchanger warms the 2,400-sq.-ft. sidewalk area that stems out from the main entrance. Before the concrete was poured, 4G Plumbing and Heating, A.C.E.'s longtime contractor partner, installed 3/4-in. Watts Radiant PEX+ to handle the workload.

Missoula, which is in western Montana near Lolo National Forest, isn't a hotbed for earthquakes, but it's a precaution the Oncology Center had to prepare for in case of emergency. There was a need for seismic restraints for the potable lines, while the pumps and boilers were anchored down to the concrete slabs.

"We provide a performance specification document based on the seismic zone the building is located within," Swartz says. "Obviously, in the situation of building a medical center there is more importance placed on this then, say, a shopping mall. It requires a little more bracing of the boilers and the larger ductwork."

Karabensh, Swartz and A.C.E. spent nearly three months designing the project and working with the architects to make sure every piece of the puzzle came into place. Unfortunately there were space limitations that came with Oncology Center, particularly with the mechanical room.

"We spent as much time as we could designing the space, however as with any project, during construction you're going to run into some unknowns," Karabensh says. "We did spend a lot of time up-front designing the space, but ultimately it goes back to the contractor and their ability to install as close to our design as possible."

Karabensh designed the space using a REVIT building information modeling program. The team was given a large mechanical room to work with, but space was taken up quickly and there was limited in-ceiling room to work within.

"The design of the mechanical room went through a few iterations with close coordination with the architect due to the physical constraints for the space," he says. "Using REVIT allowed us to incorporate all the disciplines within the engineering side, the structural building and the architectural aspects. The three-dimensional representation allowed us to ensure all the equipment would fit into the space, as well as piping to and from the equipment."

## Time and money

Thanks in part to the design and using the Missoula Aquifer, the cost of health care in the area has been kept down.

"The hospital received a $43,000 rebate from the local utility for installing the groundwater cooling system," Swartz says. "We've calculated that the system also provides an energy savings of around 150,000 kWh per year when compared to a traditional chiller system. That is an additional benefit of about $11,000 per year."

Time was of the essence for Swartz and A.C.E. as the Oncology Center owners wanted to begin building and have the first phase operational by the end of 2013.

"We were pushed a little bit on the schedule because the owners of the facility wanted to break ground," Swartz states. "From start to finish it was 12 months from design to completion."

A.C.E. and the Missoula Medical Center are currently working on Phase 2 of the Oncology Center. This includes a high-dose radiation room and a linear accelerator room. Linear accelerators can pinpoint where a cancerous cell ends and a healthy cell begins. Having the ability to use technology is critical since cancer tumors and lesions don't stay in the same place after each radiation therapy session.

"Each of those rooms presents its own set of challenges with tempering the space and certain equipment requirements," Karabensh says.

Swartz adds: "The second phase has been a design/build project. We're very fortunate to have great contracting partners on this project. They're good firms. We've done a lot of medical projects together in the past and they sure make a project go smoothly from a design aspect."

There's nothing more freightening than facing and battling a cancer diagonis for a patient and their loved ones. A.E.C. did everything in its power to make that fight easier for everyone involved. pme

Photo by Mark Bryant.