References

The Exploratorium at Pier 15

Uponor involvement

Project highlights

- 330,000-square-foot renovation
- Strict historical-preservation guidelines
- Largest net-zero energy museum in the U.S.
- LEED Platinum
- 57% more efficient than ASHRAE 90.1 standard

Products used

- Uponor Radiant Heating and Cooling System
- Uponor's Radiant Rollout™ Mats
- ⅝" Wirsbo hePEX™ tubing
- ¾" Wirsbo hePEX tubing
- 82 heating and cooling zones

Museum features unique Uponor radiant heating and cooling application

Learn how the water from San Francisco Bay is used in this unique Uponor radiant heating and cooling application at the... The Exploratorium project at Pier 15 has become a model on innovative sustainable design with the goal of becoming the largest net-zero energy museum in the United States. The 800-foot-long pier, erected nearly a century ago and vacant for a number of years, has undergone a gut renovation, including major structural repairs to its pilings to make it earthquake-safe for the next 100 plus years. The massive construction project yields approximately 330,000 square feet of indoor and outdoor space, and the finishing touch is an all-glass observatory that anchors the back of the new complex at the end of the pier's 800-foot projection into the bay.

Project Facts:

Location
US - West, California

Completion
2013

Application categories
Radiant

Learn how the water from San Francisco Bay is used in this West Coast radiant heating and cooling application

The LEED-Platinum Exploratorium has many notable green features, including offsetting the annual electrical consumption with photovoltaic (PV) solar panels and an innovative radiant cooling system that uses water from the San Francisco Bay to meet comfort demands. Even without the PVs, the renovated facility is projected to be 57 percent more efficient than the ASHRAE 90.1 baseline standard for a typical U.S. museum, thanks in part to its innovative use of water from the bay. Depending on the season, the latter will function as either a heat sink or a heat source for a radiant heating and cooling system that covers approximately 90 percent of the floor space.

The job of raising or lowering the temperature of the bay water is handled by eight, 50-ton, water-to-water heat pumps. These electric-chilled heaters feed a four-pipe system that carries either hot or chilled water to a 200,000-foot network of crosslinked polyethylene (PEX) tubing made by Uponor. The tubing is embedded in concrete slabs on two levels and spanning 82 different heating/cooling zones. Each zone has a control valve and a thermostat to switch between heating and cooling, whatever the need. The use of bay water for the heating and cooling system should save about two million gallons of water annually by eliminating the need for conventional cooling towers to absorb heat during the cooling process. Cooling towers inevitably lose large quantities of potable water through evaporation.

No other type of water-heating is used in the building, nor is there any use of fossil fuels except for highly limited cooking purposes in a small restaurant – thus, the net-zero carbon designation. “We did not wish to sacrifice comfort for energy savings on this project, and radiant is a premium comfort system,” says Joseph Wenisch, project manager for Integral Group, the engineering and systems design company used in this project.

The Exploratorium aims to achieve substantial energy savings over the AHSRAE 90.1 baseline in several areas. But heating and cooling, along with lighting and pumps, are expected to make the biggest contributions: a 55 percent savings in yearly electrical consumption for heating; and 94 percent for cooling. All of which is why the use of radiant slab heating and cooling was an integral part of the Exploratorium plan from the outset, according to Wenisch.

Water, Exchange Heaters and Uponor’s Radiant Rollout™ Mat

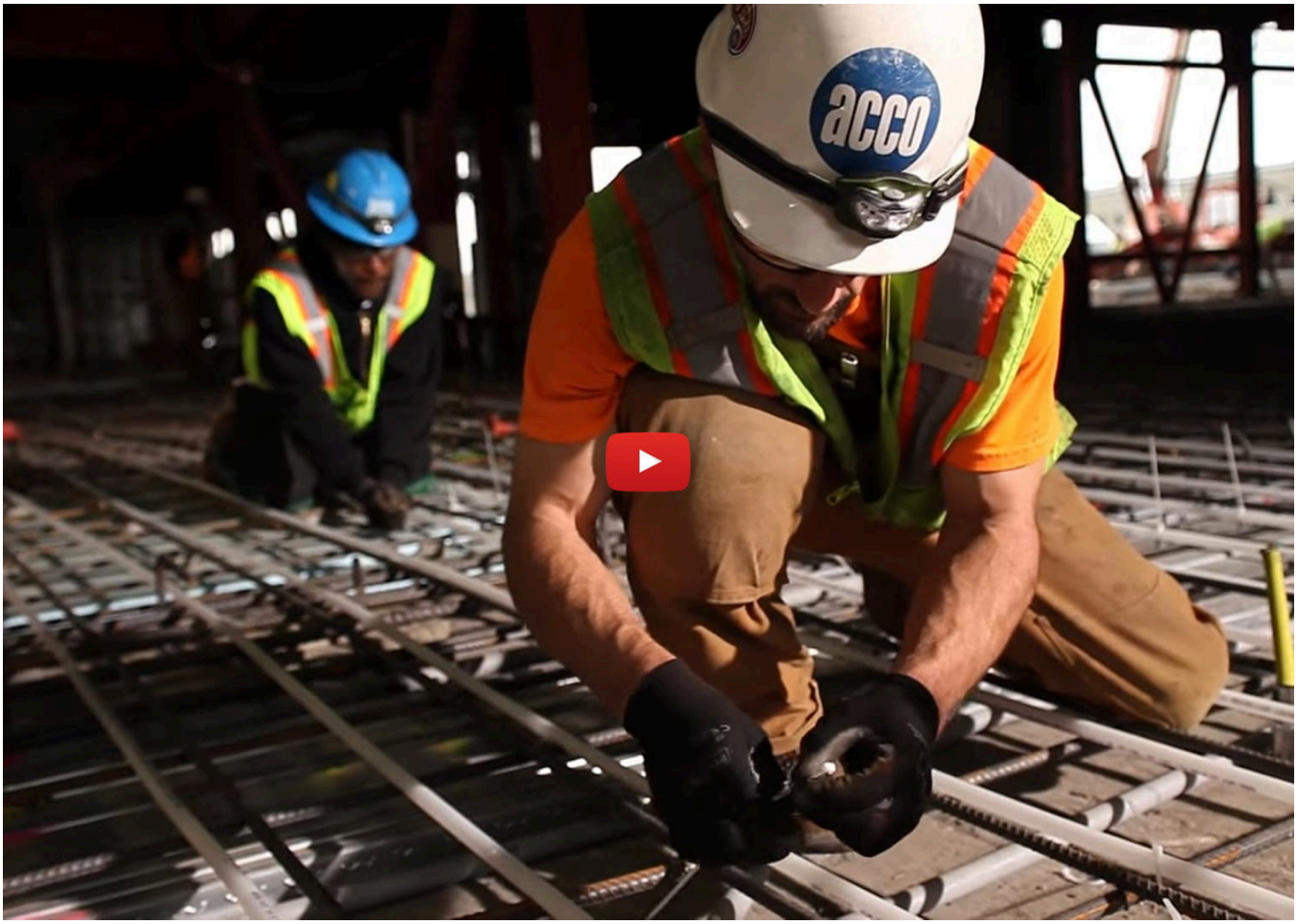
Water from the bay is continuously pumped in and out of the building to a pair of titanium heat exchangers. The bay water never moves beyond the heat exchangers because the salt water would quickly corrode the heat pumps and other mechanical components. Once the heat exchange process is complete, the bay water returns to its source – completely unchanged and with no chemical treatment. In the colder months, when space heating is needed, the bay functions as a heat source and in the warmer months, heat pumps lower the temperature of the bay water before it circulates to the 82 cooling zones.

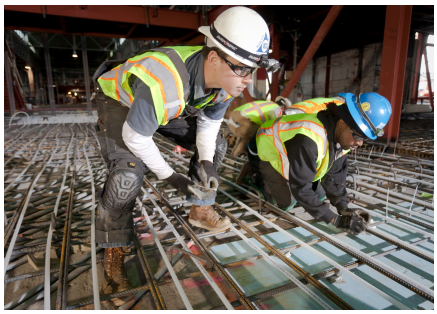
Because of the need for earthquake protection, the specification on the first level of the building was more complex, consisting of two layers of rebar with the PEX loops positioned in between and fastened to the lower stratum. The tubing was specified to sit three to three and a half inches beneath the surface to avoid being punctured by anchors securing the museum’s floor-mounted exhibits. “We couldn’t insulate the first floor in the dowel areas, so we ended up with this

checkerboard of two-inch, rigid insulation covering roughly half to 60% of the area. This checkerboard wasn't particularly easy for the installers to walk on — let alone work on — and that added to the installation time," Wenisch said. But the use of Uponor's Radiant Rollout Mats on approximately 80 percent of the floor surface helped make up for these construction obstacles.

Custom-designed and prefabricated to project specifications by Uponor, the Radiant Rollout Mats are pre-pressurized rolls of PEX-a tubing loops fitted with Uponor ProPEX® engineered polymer(EP) fittings. Once on the job site, the mats roll out like carpeting over the floor space, while requiring fewer ties to secure their position. As a result, the Radiant Rollout Mats can install approximately 85 percent faster than conventional radiant tubing methods.

Pier-15





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