Steaming Ahead with Disaster-Resistant Measures

Imagine 11 miles of mineral wool-insulated underground steam lines. Then add millions of gallons of really dirty floodwater that hung around for days on end. The result was a mess of epic proportions.

University of North Dakota steam lines now are better protected from future flood damage.

Like most of the people in Grand Forks, North Dakota, Larry Zitzow, director of facilities for the University of North Dakota (UND), says he was in stunned disbelief as he began tallying the damage from the city's massive flooding in April 1997.

The toll on campus buildings and equipment—an estimated $40 million—was bad enough. Of the university's 230 buildings, 72 were damaged. Half a million square feet of building space had to be scrubbed and sanitized. School for UND's 11,300 students was cancelled for the remainder of the semester.

And then there's the matter of those steam lines. Floodwaters had soaked the insulation surrounding the lines, causing it to fall off. As a result, intense steam heat was transferring from the lines, through a large-diameter steel encasement and up into the ground. The heat was killing trees and grass. It was causing pavement to break up. Portions of the lines were literally blowing up out of the ground as university maintenance workers tried to re-pressurize the system.

Protecting an Investment

So UND officials decided to undertake the mammoth task of replacing the entire system. Because of the enormous replacement cost, UND decided to make changes that will reduce or prevent damage if another flood hits Grand Forks, a city with a long flood history.

"This is a $25 million investment and we want to protect it," Zitzow said. "We could never afford to totally abandon using steam" to provide heating, cooling and hot water to campus buildings. The steam system also supplies 16 fraternities and sororities, two additional schools not connected with the university, the city's only hospital, and a large, adjacent medical office complex.

The replacement project involves digging new trenches, laying new steam lines and new condensation-return lines, and putting in 43 new-and-improved manhole stations with flood-resistant features, Zitzow said. Additionally, several isolation shutoff valves are being added throughout the system.

Most of the disaster-resistant measures hinge on one key premise: keeping the mineral wool insulation dry to avoid a repeat of the problems from the '97 flood. Choosing a different insulation that wouldn't be so impacted by water wasn't an option, Zitzow said, because mineral wool provides the best protection from the intense radiant heat that steam lines produce under normal conditions.

Keeping the lines dry

So UND built new manhole stations with a series of features to provide the greatest level of protection. Each station, a concrete room approximately 12 feet by 16 feet in size, is mostly recessed into the ground and houses shutoff valves, drip legs, pumps and control valves. But the upper portion of each station now extends 12 to 18 inches above ground. The added height provides a first-line defense against overland flooding. With the old system, the manholes were ground level and easily flooded even with a few inches of water.

New trenches were dug and new lines were laid as part of the total steam line replacement.

Then they added a curved vent pipe that extends another 12 to 18 inches above the top of the manhole. For water to get inside the manhole, first it would have to get up into the curved pipe, which is at least 2 feet above ground. Even if that happens, the pipe has a valve midway down into the manhole that can be closed to keep water from reaching the steam lines. At the bottom of the manhole, a drain has been added to remove any water that gets into the station.

New manhole stations feature a number of disaster-resistant measures that are designed to better protect the new steam lines. One measure (far right) is a ground hole drain that keeps water from building up inside the manhole.

To prevent belowground seepage from getting into the system, an impervious sealant has been added to the exterior of the manhole stations. Years of above-average precipitation in much of North Dakota have created high water tables and, therefore, seepage problems.

The university also wanted to better handle repairs to the steam system, regardless of the cause, without impacting a large number of users. Under the old system, workers would have to shut down large sections of the lines to fix even a small problem. As a result, many more buildings than necessary would be without heat and water while a problem was being fixed. Now, with the additional shutoff valves, the lines can be isolated at each building and at each manhole as needed, allowing the rest of the system to function normally while repairs are being made.

Work on the new system began in spring 1999 and will be completed by early summer 2001. The old system was repaired wherever possible to allow the university to function until the new system was installed.

The project is being funded in large part by state and federal disaster recovery money that was made available by a 1997 presidential disaster declaration. The funds can be used to cover eligible costs associated with the repair or replacement of disaster-damaged infrastructure.

Protecting the Water Supply

In a separate but related disaster-resistance project, the university also has created a backup water supply for the steam plant should the city's water plant or distribution system fail for any reason.

During the flood, the Grand Forks water treatment plant had to be shut down after it was inundated by water. As a result, the university had to shut down its entire steam line system because there was no water to heat into steam. The steam system remained down for about two weeks.

Now, if the city water supply is compromised again, the university can pump water from its Olympic-size indoor swimming pool into a condensation-return line that goes back to the steam plant to be heated and redistributed. The pool can supply as much as 500,000 gallons of water, which would enable the steam plant to operate for 10–15 days. The pump installation, completed in December 1999, was done in conjunction with the university's Y2K readiness activities.

Zitzow says he thinks this is the first time that any university in the country has had to replace its entire steam system.

With the disaster-resistant measures now in place, university officials hope it'll be the last time for UND.