Ready for Takeoff

A California contractor uses an exothermic epoxy to line an aqueous film-forming foam fire-suppression deluge system in a U.S. Army aircraft hangar

By Scottie Dayton

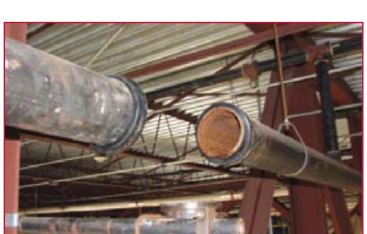
Pinhole leaks, failing joints, and tuberculation in the aqueous film-forming foam (AFFF) fire-suppression deluge system and distribution piping at Fort Drum Aircraft Hangar 2060 in Watertown, N.Y., were causing failures and false alarms.

For repairs, the U.S. Army Corps of Engineers contacted Nu Flow America in San Diego, Calif., having worked with the company before. Nu Flow specified a two-part liquid epoxy blown-in-place coating to rehabilitate the black iron pipes. Although Nu Flow had lined other fire-suppressions systems, this was the first AFFF system.

Project manager Dennis Fort faced the challenges of snow, freezing temperatures, and reassembly of the old distribution system. Despite all that, facility personnel were able to re-energize the AFFF system on schedule.

"We don't use mixing machines because they are occasionally inaccurate. We like to be extremely accurate with what we do."

Dennis Fort



Tuberculation in the aqueous film-forming foam fire-suppression deluge system was one reason for system failures and false alarms.

Logistics

The hangar has six bays, each with its own fire-suppression mixing station, 6-inch vertical riser, and deluge system – manifolds with 66 sprinkler heads spaced 10 feet apart along the ceiling 45 feet above the floor. Each bay has 300 feet of 4-inch pipe feeding the deluge system. Fort and five men cleaned and lined from sprinkler head to sprinkler head.

After military personnel drained a zone, Fort's team removed the open sprinkler heads. Workers on manlifts wore harnesses per OSHA standards. "Some pipes were accessible from catwalks, but most required maneuvering a manlift in and out of the rafters to reach the connections," says Fort.

The men ran pipe cleaners through the sprinkler heads to remove dust, debris and corrosion. When reattaching the heads to the pipes, they polished the ends with a small wire-fitting brush.

Two 1,600-cfm/125-psi, 120-hp Sullair air compressors from Air Engineering Inc. in Mequon, Wis., powered the sandblasting equipment. A filtration system and aftercoolers separated the oil and water they expelled. The diesel-powered compressors and their exhaust fumes were kept outside the hangar. When winter arrived in mid-October, the men propped open the hangar bay doors and ran in the air hoses.

"We blocked drafts from the 8-inch opening with moving blankets," says Fort. "Before long, the compressors were 3 feet deep in snow, and temperatures were below freezing, making them hard to start. Adding block heaters, however, solved that problem." Work finished in mid-December.

Coordinating work on the piping with the movement of Blackhawk helicopters was a daily challenge in the Fort Drum project. (Photos courtesy of Nu Flow America)

The men cleaned and lined one section per bay per day. Mornings began with a 60-minute safety and planning meeting. Fort took extra safety precautions, scheduling equipment walk-arounds, checking that the proper restraints were on the hoses, and testing fastenings on the bands and hoses. Daily challenges were coordinating the movement of aircraft with flight personnel and scheduling fire watches with the Watertown Fire Department.

Deluge systems

The men sandblasted the 4-inch pipes at 1,600 cfm/50 psi and the 6-inch risers at 3,200 cfm/50 psi using garnet grit, a hard, silica-based, low-dust mineral. Blasting removed the corrosion and produced a surface profile which the potable water system #7000 epoxy adhered.

"We dropped 1-inch hoses from each sprinkler head to the floor, then hooked them to the sandblaster," says Fort. "The grit, added directly to the air stream, travels up the hose, through the pipe, and back down to the dust collectors. At this volume and pressure, we cleaned 400 to 600 feet a day."

TOUGH JOB

PROJECT:
Line an aqueous film-forming foam fire-suppression deluge system in an active U.S. Army aircraft hangar

CUSTOMER:
U.S. Army Corps of Engineers, Watertown, N.Y.

CONTRACTOR:
Nu Flow America, San Diego, Calif.

EQUIPMENT:
Potable water system #7000 epoxy, Nu Flow Technologies, San Diego, Calif.

RESULTS:
System lined without affecting flight operations

As the air left the pipe in this closed-loop system, it entered a cyclone dust collection system, then a Torit Downflo Oval dust cartridge filtration system, both from Donaldson Co. Inc. of Bloomington, Minn. Large debris particles and the garnet grit dropped into a pan on the bottom of the cyclone. The finer dust traveled through the center tube and into the filtration system. What exhausted was clean air. "We couldn't have any dust in the pipe or around the aircraft, so we didn't recycle the grit," says Fort.

Technicians used a micrometer to check the thickness of the finished liners.

The men stored the 5-gallon pails of epoxy in the mechanicals room, where it was 90 to 95 degrees F. They measured 70 percent Part A and 30 percent Part B by weight, then homogenized the resin with a mixing paddle and drill. "We don't use mixing machines because they are occasionally inaccurate," says Fort. "We like to be extremely accurate with what we do."

Before lining a pipe, Fort measured the blast surface profile with Press-O-Film CX impression tape by Testex, then double-checked with a micrometer to ensure that the surface had a 2-mil-thick anchor tooth. The 95- to 100-degree resin was blown in at the same volume and pressure as the abrasive.

"We pour epoxy into our shot tubes, hook them to the pipes, turn on the air, and away it goes," says Fort. Lining of the deluge zones used 3 to 4 gallons of epoxy per day; the 6-inch risers used 5 gallons per day.

Once the epoxy is injected into the pipe, its working time is 60 to 90 minutes. "Based on time, we know when the epoxy should reach the exit point," says Fort. "We turned off the air, and a worker on a manlift removed the hose and made a visual inspection. If epoxy was present, he checked the thickness with a wet-film thickness gauge." Coatings, applied in two applications, were 20 to 30 mils thick.

To start the curing process, the team lowered the air pressure to 5 psi, lowered the air volume to 20 to 30 cfm, and turned up the heat. First, a heat exchanger regenerated the heat produced by the air compressors. The warmed air then entered the hangar through two 3-inch hoses and ran through electric inline heaters to a manifold with valves and ports for connecting the 1-inch hoses attached to the pipes. Once the coating hardened, it cured for 24 hours under ambient conditions.

"Everything we do revolves around air volume and heat. Without heat, the air goes behind the epoxy and turns it into foam."
Dennis Fort

Close the doors

The biggest challenge was temperature. "Everything we do revolves around air volume and heat," says Fort. "Without heat, the air goes behind the epoxy and churns it into foam." All the hoses were insulated to prevent heat transfer.

When Flight Operations opened the bay doors to move a helicopter, the freezing air rushing in cooled down the host pipes, making it difficult for the men to work. Normally, flight personnel notified them 30 or 60 minutes before opening the doors. "We'd shut down and wait until the doors were closed and the air temperature came back up in the hangar," says Fort.

In the single instance when the team was not notified, the epoxy transferring through 100 feet of 1-inch pipe solidified. The men replaced the sealed section and lined the new pipe.

Reassembling the old distribution system with its worn unions and threads was another challenge. "We kept at it until they went together, or we bought new fittings," says Fort. "Next time, we'll consider using outside pipefitters or mechanical contractors to break down and reassemble the plumbing."

Aqueous film-forming foam is not hazardous, but it bubbles up violently in sewers. Consequently, Fort contracted Davis-Ulmer Sprinkler Co. Inc. from Latham, N.Y., to test the fire suppression system after completing the lining.

They diverted the flow of the charged system into semi-tankers, tested the mixture for the appropriate proportions, and disposed of the waste. The rehabilitated system was again ready to protect the $18 million Black Hawk helicopters in Hangar 2060. ■

MORE INFO:

Donaldson Company, Inc.
952/887-3131
www.donaldson.com

Nu Flow Technologies, Inc.
800/834-9597
www.nuflowtech.com

Testex
302/731-5693
www.testextape.com