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FLEXIBLE BRUSH CLEANS NUCLEAR PIPES QUICKLY, REDUCING WASTE AND EXPOSURE

The decontamination of large-bore water pipes at nuclear power plants is a particular maintenance challenge, largely due to the production of secondary waste materials and exposure risks to plant employees. For any decontamination system to be considered viable, it must minimize secondary waste and be cost effective to operate and maintain with minimal occupational radiation exposure.

Traditional mechanical decontamination includes various grit blasting techniques using either wet or dry abrasives. Yet the costs of operating time plus handling and disposal of contaminated blasting media add to the time and monetary expense associated with these methods.

Chemical decontamination techniques are often implemented that provide adequate shielding to minimize occupational risks; however, radioactive chemical solutions must be produced in high volumes, making disposal burdensome and expensive. Whether chemical or mechanical cleanup methods are employed, the service time plus associated costs and worker exposure to radioactivity can all present economic challenges to nuclear power facilities.

"We normally use mechanical decontamination, which can be very effective, but is also a very expensive," says Dan Stoltz, Radiation Protection Supervisor, at a commercial nuclear plant in the central United States. Stoltz says that it is quite possible for a nuclear power plant to spend many thousands of dollars on blasting oxide layers, yet not necessarily achieve the lowest radiation levels.

Dose rates are a significant consideration because of NRC (Nuclear Regulatory Commission) limits on annual millirems (units of radioactivity environmental monitoring) per worker. When dose rates are high in nuclear plant water pipes, more time and manpower – hence, higher costs – may be required to perform pipe decontamination operations.

"We had used grit blasting for this type of operation, but were looking for a more efficient and possibly more effective mechanical method of doing the work," Stoltz explains. "One of the ideas we discussed was honing. I had seen flexible, ball-type hones used to resurface the cylinder walls of automotive engines. So, I wondered if such a hone could be made large enough for us to use in working on this 14-inch (11-1/2 in. I.D.) pipe. Also, the hone would have to be aggressive enough to remove the tough radioactive oxide layer from the pipe, but controllable so that it would remove very little of the pipe metal."

The decontamination of large-bore water pipes at nuclear power plants is a particular maintenance challenge. Since the low cost Flex-Hone uses no media other than the balls of grit on its filaments, the RAD (Radioactive Absorbed Dose) waste and associated disposal costs are significantly reduced.

Limiting the amount of pipe metal removed is important because of NRC regulations for the minimum pipe wall thickness. Any significant reduction in material could require pipe replacement, which only adds to the time and money. The ideal tool would have to be controllable and flexible enough to operate effectively in pipes that, like most metal pipes, are somewhat elliptical rather than round.

Stoltz explored the Internet and found Brush Research Manufacturing (Los Angeles), a supplier that offers a broad line of Flex Hones, flexible, ball-style hones. Developed by Brush Research, the ball-style hone is characterized by the small, abrasive globules that are permanently mounted to flexible filaments. The product is a flexible, relatively low-cost tool utilized in the manufacturing marketplace for specialized surfacing, including de-burring, edge-blending, plateau honing and deglazing.

"I contacted Brush Research and discussed our potential application,"

Stoltz explains. "The engineering department made some recommendations and sent some different hone models. So, we installed a test facility, equipping it with the same size and type of pipe and conditions, although it wasn't actually radioactive. After we started using the flexible hone we knew immediately that it was going to work, that it was exactly what we were looking for. Brush made some suggestions about the style and grit of the hone as well as the operating speed (RPMs), because we needed to maintain a specific finish on the pipes."

According to Mike Miller of Brush Research, such specific applications often require preliminary testing, which is routinely performed by his firm's engineering department and surface finishing laboratory, which can recommend and perform evaluations on various types of hones and fixtures.

SAVING ON RAD WASTE

Because one of the secondary costs of nuclear plant water pipe decontamination is for the disposal of RAD (Radioactive Absorbed Dose) waste, Stoltz was anxious to see how much of this could be eliminated by use of the flexible hone.

Sandblasting and other mechanical methods of pipe decontamination produce a considerable amount of RAD waste above and beyond the oxide layer because the blast media becomes part of the waste. In addition, there is a need to decontaminate the blast tool itself because it, too, becomes contaminated while doing the decon work.

Since the Flex-Hone uses no media other than the balls of grit on its filaments, the RAD waste and associated disposal costs are significantly reduced. Perhaps more important, the cleanup process itself is less rigorous, saving time and money. Plus, the low-cost tool is considered a disposable, so it requires no decontamination after use in a radioactive pipe.

EXPEDITING DECON

Aquilex WSI Nuclear Services - a welding solutions provider for complex needs of major industries including the energy, petrochemical, steel and pulp & paper sectors, was one of the first contractors to use the flexible hone for removal of radioactive oxides from water pipes in nuclear power plants.

"Traditional removal of radioactive oxides takes a long time and can mean tens of thousands of dollars an hour," says Mark Stoutamire, Aquilex Engineering Manager. "It also generates a lot of contaminated waste that has to be cleaned up and disposed of. With the Flex-Hone you don't have that added radioactive waste. And the work involved is only a fraction of the typical grinding or honing approach, which means that workers experience less exposure – and that also translated to major savings."

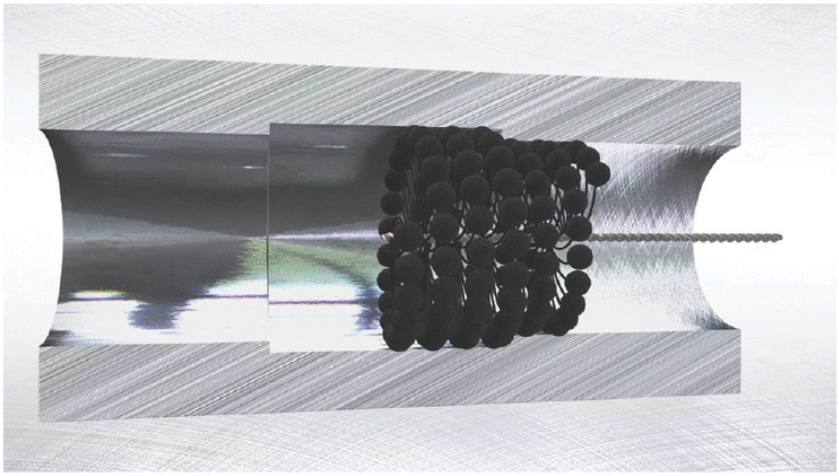
Aquilex, which performs sophisticated projects all over the world, has used the flexible hone to decontaminate water pipes in nuclear plants located in Spain and the U.S.

"What initially led to our interest in the flexible hone was surface preparation of pipes we were going to repair by welding," Stoutamire explains. "We could see that this tool could be lowered and controlled in such a way that it would remove material inside pipes workers could not reach. In some situations, that may involve removing a layer of radioactive oxide, so we decided that would also be an excellent application for

the tool."

Stoutamire adds that Aquilex worked with Brush Research to determine the proper abrasives for their Flex-Hone, as well as the appropriate speeds for the tool to operate.

"This tool is adaptable to the pipe cleanup requirements," he says. "And because it is a contour-following tool – rather than the typical rigid hone – you can control the amount of pipe metal removed, rather than reaming it round and possibly violating NRC pipe thickness requirements."



The ball-style hone was developed by Brush Research, and is characterized by the small, abrasive globules that are permanently mounted to flexible filaments. The product is a flexible, low cost tool used for cleaning, resurfacing, de-burring and edge blending of critical metal surfaces.

LOWERING THE MAN-REM

Because excessive dose exposure can limit workers' availability and thereby require the use of more manpower, the reduction of mrem (man-hours of radioactivity environmental monitoring) can lead to substantial savings in time and money.

Mechanical decon methods may not appear to directly cause excessive worker exposure to radiation, but certainly can contribute to it. In addition to the leavings of the contaminated oxide layer, the radioactive abrasives left behind after the actual blasting process require a mop-up, and that involves both time and exposure.

"This flexible honing method reduced dose rates from about 700 mrem per hour down to approximately 100 mrem," Stoltz says. "Contamination levels were also reduced significantly."

Sometimes referred to as a "dingleberry hone," this is a relatively low-cost tool that is used for cleaning, resurfacing, de-burring and edge blending of critical metal surfaces. The ball-style hone was developed by Brush Research, and is characterized by the small, abrasive globules that are permanently mounted to flexible filaments. The product is a flexible, low cost tool utilized in the manufacturing marketplace for specialized surfacing, including de-burring, edge-blending, plateau honing and deglazing.

The flexible hone uses some grit, which requires cleanup along with the pulverized oxide layer. Nevertheless, the residual contaminated matter is considerably less and cleans up faster. Because it is a controllable honing tool, the Flex-Hone does a more thorough job in removing the tough oxide layer from contaminated piping, which also saves on mrem.

In the decontamination of nuclear water piping, much of the cost comes down to the time consumed to do the work as well the technology utilized. In the case of the recent decontamination project, the results of both criteria were dramatic.

There was originally a 14-hour window requested by the decon service contractor to perform the work, four hours of which were for prep work and cleanup. Use of the flexible hone cut the remaining eight hours budgeted to only one hour of honing through the oxide layer.

When you consider that in the nuclear power plant industry such decontamination can cost up to $40,000 per hour, the dollar savings in just the honing operation were quite significant.