Nuclear and conventional power plants make huge moves on air

Replacing feedwater heaters, exchangers, and multi-ton equipment takes hours instead of days, reducing downtime

There is no universally agreed upon definition of what constitutes "heavy" industry. With over 2,700 fossil and nuclear fueled power plants in the United States, power generation is clearly *big* business all over the country. And while its processes may seem more white-gloved than many of its more intrusive industrial neighbors, its day to day work tasks can be among the heaviest and most imposing. Just ask some of the industrial riggers and engineers who handle them.

Feedwater heaters are a case in point. Common to both nuclear and fossil-fuel fired plants, these gigantic heat exchangers are so large that in some older installations they were actually fabricated and put into place before the plant's walls went up. Often as large as a locomotive and weighing perhaps 40 tons or more, feed water heaters can contain up to two miles of heat exchange tubing. Typically connected in series of four to six units, they are used to gradually pre-heat some 600,000 pounds per hour of water delivered to a steam generating boiler. So far so good. But the tubes—and eventually the feedwater heater itself—wear out and the giant unit must be moved, either for retubing or replacement. The usual feedwater heater may last 20 to 25 years before being retired, while its tubes may be replaced as frequently as four times during its lifespan.

In an ordinary, that is, non-nuclear, plant, moving a feedwater heater is no small task. Clearances are tight at best and in some cases require nearly impossibly tiny or intricate changes of direction to squeak out of and ultimately back into their original locations they are in order to mate precisely again with the boiler-generator-turbine equipment chain.

The replacement feedwater heater is placed on air casters.

Using on-site compressed air, the air caster lifts the feedwater heater

Megaton feedwater heaters glide easily on air casters.

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Loaded on rollers or wheels, the kinds of moving tools that were once commonly used, their enormous weights engendered floor-threatening loads and demanded backbreaking manpower, come-alongs, tuggers, and other powered assists to even budge.

In Colorado, Brian Caparelli and Don Eriksen, managing partners of DC Power Industrial refer to meeting that oversized challenge with inadequate equipment in the past as "the Dark Ages or the Stone Age." Their better solution—mount the feedwater heaters on AeroGo air casters, hovercraft-like inflated diaphragms that lift and glide huge loads in any direction on a nearly frictionless cushion of air. "From the time you set the heater on the ground on wheels or rollers, I'd say it was a 10-hour shift. Putting the heater on the stands we build, putting the air casters underneath them—to air it up and start moving it, you're talking two hours," Caparelli reflected.

The clearances around the feedwater units and along the in-plant pathways through which they must move are often extremely tight, sometimes little more than the breadth of a finger. This presents a dangerous dilemma if the heater is to be moved on rollers or wheels, which run out of "turnaround room" when the load is hard up against an immovable obstacle. According to Caparelli, their AeroGo air casters provide easy multi-directional mobility that eliminates the obstacles posed by tight spots and dramatically reduces both human effort and the need for much additional equipment. "The air caster gives you complete control moving 360-degrees in any direction you want to go," he avers. In the "stone ages (before air casters), you'd be pulling in one direction, then you'd have to pick it up, start pulling in a difference direction, changing the rigging and more. Once we started using

Compressed air Control Box makes it possible for one operator to manipulate the megaton equipment into place.

Overhead view of feedwater heater moving into position.

Air casters are omnidirectional and smooth, making for failsafe positioning in even the smallest spaces or tightest clearances.

the AeroGo air casters, we asked ourselves 'Why did we ever do it the other way?'"

Floor loading limits and safety considerations alone are important reasons why firms such as DC Power Industrial are using air casters to move enormous loads through the constricted spaces, aisle ways and pathways typical of both fossil fuel and nuclear fired power plants. Older methods often required putting down heavy steel plates to increase the footprint of the moving load and distribute it over a wider area to avoid breaking through concrete floors. "Now you don't have to use plate steel," Caparelli said. "Today's way would be putting air casters under there." To mate feedwater heaters to their AeroGo air casters, DC Power Industrial uses their own patented skids custom designed for each heater to create a footprint and load combination that meets each plant's floor loading requirements. "In a current job we're working on, the heaters have a 6' x 6' footprint," Don Eriksen noted. "With our AeroGo air casters, we're putting less than 900 pounds per square foot on the floor load and the safety factor goes up ten fold."

The challenge of moving feedwater heaters or other large and heavy equipment in a nuclear power plant is perhaps even an order of magnitude greater. One longtime materials handling industry expert put it vividly in describing the sensation of losing control over a large piece of equipment in transit on rollers. "You pull, pull, pull—and all of a sudden it moves and goes two inches. If you're lucky there was nothing there. If you're not lucky, you just smashed a main control unit for a nuclear reactor. You want to get somebody's attention, you start breaking instrumentation in a nuclear plant."

Of course engineers in both fossil fuel and nuclear fired power plants work in close concert with plant personnel and rigging contractors to avoid any such thing. Engineering experts typically scrupulously review the materials, metals, methodology and equipment proposed for use in in-plant moves to reduce potential risks and hazards well before contracts are awarded. In nuclear plants the United States government's Nuclear Regulatory Commission similarly reviews processes that take place in nuclear facilities, oversees general work and approves proposed work packages.

In early 2008 Enercon Services, Inc. specified Containers (SECs) loaded with liquid resin wa Pacific Gas & Electric Humboldt Bay nuclear

Enercon senior engineer Joseph Smerciak explained that the plant, preparing for the lengthy process of being decommissioned was holding the low level radioactive waste resin in long term safe storage (SAFSTOR) condition. To effect the move, resin was pumped into a liner, usually either stainless

Save plant downtime by days just by utilizing air casters and a control box.

steel or plastic inside a SEC vessel, lidded, and moved out on air casters where the liner was either transferred to a truck to transport it for offsite disposal or put into another SEC for later transportation.

The SECs utilized for the move were Dufrane Nuclear Shielding, Inc's Model 14-200-S-P, casks or vaults nearly nine feet high and measuring nearly the same in diameter. Constructed of steel reinforced concrete with 16" thick side walls and integral lift anchors, the SECs are sealed with a stepped concrete lid to prevent weather infiltration and together with their lids weigh some 56,000 pounds empty.

Enercon's Bill Rigby, a radiation protection specialist, was overall project supervisor on the job site, and Dave Murnane of Enercon worked to coordinate the actual pumping of the resin into the liners. Discussing the hazards of radiation exposure Smerciak explained. "There are three factors—time, distance and shielding. You want to minimize your time, maximize your distance and the better the shielding, the more you minimize your radiation exposure. So the SEC serves as a big radiation shield." The air caster system also impressively cuts down exposure time simply by being a far faster way to move the SECs.

To move the ponderous and heavily loaded SECs, the company used four AeroGo Model 4K27HDL load modules teamed with an AeroGo Model AG1250E Aero Drive. The Aero Drive is a pendant controlled drive system that allows a single operator to easily move and position SECs. Operating on normal compressed air, the AeroGo systems have very few moving parts and enable SECs to move on a non-fixed travel path, unlike a wheel/rail system. According to Smerciak, a rail system also would have had too large a concentrated load inside the building itself. An Enercon structural engineer also designed a steel plate weight dispersal system to further distribute the weights of the large loads.

In nuclear facilities there is no such thing as too much caution when it comes to safety. A large proportion of the cost of a move such as the Humboldt Bay project comes from the cost of lengthy planning, meticulous preparation and all the documenting paperwork that goes with it. Smerciak explained, "They look at all those things to make sure it's designed properly so the SEC won't tip or spill. All those things are analyzed, even the containers the things are shipped in. They look at the potential of a truck getting in an accident and the container slipping off a lowboy trailer and hitting the ground. Those types of things have been contemplated and things are designed for those types of scenarios. The AeroGo air casters met the technical requirements."

Project supervisor Bill Rigby summed it up in three words: "They worked great."

Further information on AeroGo air casters in the power production industry and other heavy equipment moving applications is available at www.aerogo.com.