Dole Packaged Foods, LLC, operates a 700,000-square-foot fruit processing facility in Atwater, Calif., where emissions standards are among the most stringent in the country. The San Joaquin Valley Air Pollution Control District requires less than 5 ppm NOx emissions for new boilers with an input of 20 million BTU or greater.

In 2012, when Dole was in the market for a new boiler, Doug Vickery, boiler sales engineer for R.F. MacDonald Co., Modesto, Calif., advised the management team to purchase a Cleaver-Brooks 700 HP CBEX Elite with fully condensing economizer. R.F. MacDonald is the authorized Cleaver-Brooks representative in the states of California and Nevada. According to Dole’s Director of Atwater Operations David Shankel, the CBEX was selected due to its controls technology and low NOx capability without selective catalytic reduction (SCR). In addition, he said the CBEX complemented the existing firetube boilers in the facility.

Dole currently operates three Cleaver-Brooks firetube boilers. The units, which range in size from 400 HP to 800 HP, were installed between 1970 and 2002 when the facility operated as J.R. Wood Inc., a frozen fruit producer. Dole bought the company in 2004. After purchasing the company, Dole tapped R.F. MacDonald to retrofit the facility’s existing boilers to local regulations, which required NOx levels to be below 30 ppm. More recently, to meet increasingly stricter requirements, R.F. MacDonald upgraded the existing Cleaver-Brooks units to meet the NOx requirement of sub 9 ppm.

When Dole commissioned its new CBEX boiler in early 2012, the facility began monitoring NOx and CO levels. That summer, during the facility’s peak operating season, the first CBEX source test was conducted. The test revealed an average NOx level of 3.7 ppm and CO of 1.4 ppm, corrected to 3% O₂. The CBEX Elite is the first boiler in the industry to achieve these ultra-low emissions levels without SCR.

In addition to achieving low emissions levels, Shankel expects the CBEX to be highly efficient based on its design. He said, “This is the first design change in a millennium. I’ve been running firetube boilers for 25 years and large, industrial watertube boilers before that, so I have an appreciation for good capabilities and controls. I would have thought the concept of two-pass would be less efficient, but so far so good.”

The CBEX boiler is 15% smaller and weighs 20% less than a traditional firetube. One of the reasons the CBEX is smaller is due to its more effective heat transfer, which is a result of an improved helical tube profile. Cleaver-Brooks engineers improved the tube profile using a combination of computational fluid dynamics.

“The CBEX Elite is the first boiler in the industry to achieve these ultra-low emissions levels without SCR.”
finite element analysis and mathematical modeling. Their efforts resulted in the
design of an advanced heat transfer spiral tube that utilizes 100% of the tube
diameter and increases heat transfer by 85% compared to a bare tube.

Following this advancement, Cleaver-Brooks engineers maximized the heat transfer
in the furnace radiant zone to achieve the optimum balance of high heat transfer
with the lowest pressure drop. By optimizing the heat transfer of both the tubes
and furnace, the CBEX requires less square footage of heating surface to achieve
the same BTU output as a traditional firetube boiler.

Designing a larger, geometrically optimized furnace with lower heat release
translates into lower NOx and better combustion. Better combustion results in
high turndown and minimum excess air, which leads to greater energy efficiency
and lower operating costs.

Dole’s Manager of Atwater Facilities and Utilities Dan Winans was notably excited
about the CBEX design. He said, “I like the CBEX because there is no rear door
to pay for anymore. Being that it’s a water-cooled rear end, I don’t have to deal
with pulling a rear door out every 10 years and doing a refractory and getting a
replacement. That is a big cost savings.”

The overall performance of a boiler is based on the ability of the burner, boiler and
controls to work together seamlessly. Managing the CBEX Elite is the Cleaver-
Brooks Hawk, an integrated control system, embodying precise boiler/burner
management and safety with logic-based ancillary devices and functions.

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- Dan Winans, Manager of Atwater Facilities
Dole Packaged Foods

Winans said the Hawk control is graphically appealing and easy to operate. He
especially likes the delay that is built in during water column blowdown. Winans
said, “That’s really a nice feature because we have to do hourly monitoring here,
and obviously you have to check the blowdown in the water column to make sure
it’s clear, and the water returns in a lively manner.”

Shankel and Winans agree that the CBEX Elite enables Dole to meet emissions and
efficiency standards, and minimize maintenance costs.