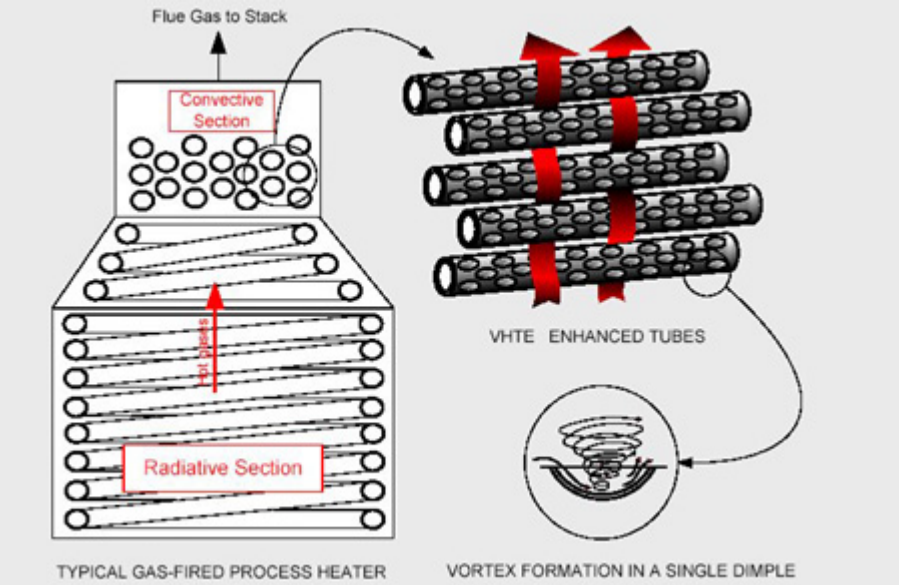
Technology for Chemical Industry Process Heaters

Most of the existing heat transfer enhancement techniques are effective in increasing heat transfer rates. However, this increase is invariably accompanied by an associated increase in pressure drop, as well as, for heaters firing "dirty" fuels, increased fouling of the tubes - both of which are highly undesirable.

Vortex Heat Transfer Enhancement (VHTE)—that increases heat transfer without any significant increase in pressure drop. It involves the use of special 3-D profile "dimples" on the heat exchange surface. Cost-effective enhancement occurs due to the vortex flow pattern that is generated by cavities and provides intensive heat and mass transfer between the surface and heating media. Moreover, it is expected the surface dimpling will not increase (or even reduce in some cases) the fouling rate due to columnar vortices that are formed in the dimples and extensively evacuate deposits from the dimpled surface. Below is the application concept that was selected for the ongoing project.



Per laboratory comparison with finned tubes (widely used in the chemical industry) the following benefits were established for the hot flow temperature of 1200°F in the range of flow velocity between 10 and 80 ft/s:

- relative heat transfer coefficient (Nu/Nu_{finned}) ~ 3.0
- relative pressure drop (Eu/Eu_{finned}) ~ 0.4

Dimpled tubes were manufactured for the field trial at the industrial partner's refinery and extensively evaluated for integrity under high-pressure operation. It was established that the safety limit is ten times higher than the operating pressure level.

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Reference:

http://www.gastechnology.org