

## THE HISTORY OF BUELL REFINERY THIRD STAGE SEPARATORS (TSS)



The first Buell Refinery Third Stage Cyclone System was installed in 1962 in the Sinclair Hartford (IL) Refinery for the protection of an expander turbine. It was part of a pilot program designed to determine if it was practical to produce energy from regenerator off gases. The unlined cyclones were ¼" carbon steel plate. The system ran for seven years, providing an additional 25% of air to the regenerator. Unfortunately, the expander used in this program was the largest manufactured by the supplier. Multiple turbines would have been required to recover energy from all of the regenerator flue gas. Since others produced expander turbines large enough to pass the total gas flow from a regenerator, this system

was not commercialized. However, during the seven years of operation no repairs were made on the cyclones and only minor maintenance was performed on the expander turbine. The operation was stopped because the refinery replaced the regenerator vessel and the air blower.

During the 1970s Buell Refinery supplied a number of third stage cyclone systems for air pollution control. Tests run on these systems showed collection efficiencies between 70% and 80%.

In 1978, Ingersol-Rand (I-R) sold a cyclone-expander turbine system to a Chinese refinery. When the refinery refused to pay the royalty charged by another supplier of third stage cyclone systems, I-R invited Buell Refinery to supply a cyclone system. This was the second installation of Buell Refinery third stage cyclones preceding an expander turbine.

Following the China installation, Buell Refinery continued to supply third stage cyclone systems with collection efficiencies of over 75% for air pollution control<sup>1</sup>, but it was 1993 before the next systems ahead of expander turbines were supplied. Two systems were supplied to Mobil Oil, one for the Beaumont (TX) Refinery and one for the Joliet (IL) Refinery. A third system was supplied to a PEMEX Refinery in Mexico. Following this, three systems were supplied for PETROBRAS Refineries in Brazil. The first two systems were initially for air pollution control, but they now precede expander turbines. The third system was installed with an expander turbine. An addition system in Brazil is installed with an expander turbine. One of the most recent USA installations is in a Houston (TX) Refinery. This system was a replacement of a Shell Third Stage Separator that was not performing as promised.

<sup>1</sup>Why Buell Third Stage Cyclone Separators achieve collection efficiencies over 75%, while other Third Stage Separators have efficiencies of only 40% to 50% is explained in a paper entitled Third Stage Cyclone Separators for FCC Regenerator Gases.

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