HISTORY OF PYROLYSIS

Description of Balboa Pacific Corporation's Technology:

Pyrolytic Gasification is by no means new. The principals were first brought forth in 1958 at Bell Laboratories within the United States of America. Thereafter, a number of universities and organizations around the world started R&D programs. The word Pyrolysis meaning, chemical change brought about by heat is widely used, even by incineration technologies, which have tried to escape their roots in oxidation and combustion because of the problems prevalent with both. Gasification is a term being used to describe the chemical reaction and molecular break down, or degradation of materials.

The first Pyrolytic Gasification systems were brick ovens using indirect heat / low oxygen that were made of firebrick. Waste was placed into the unit - the unit was sealed and heat applied. After the process of degradation was completed, the oven was opened and emptied to make room for the next batch. These systems were known as batch-by-batch systems. This format was first introduced commercially in the early 70's. They were limited by volume and, after some time in operation, were also found to have defects that related to the mortar that was used to bind the bricks together. During the late 70's and early 80's, R&D turned away from batch-by-batch systems, which at that time, had found some commercial success processing Hospital Waste and continual-flow systems, which were a form of rotating Auto Clave. This format was later refined into cone shaped retorts in order to direct the gas stream to a central point for evacuation. This refined cone design first showed up in England, then the US and Germany, followed by Japan, Canada and the Netherlands.

It was during this time that manufacturers of incinerator systems started to run into environmental problems. As environmental laws worldwide became stricter, it became exceedingly difficult to get permitting. The price and installation of incinerators became extraordinarily expensive due to the air quality equipment that had to be added in order to pass air quality regulations. But, whereas, air quality issues could be handled with additional equipment, byproduct leachability could not. In most cases, the average incineration system was eight to ten times over limits set for low volatile metals, which are leachable and carcinogenic if ingested through drinking water.

It was also during this period that the National Aeronautics Space Administration (NASA) was completing their studies into the effects of zero gravity and zero oxygen environment, which were conducted at the end of the Apollo missions and were finished within the first few flights of the space shuttle. The information and technology derived from these studies showed that the oxygen molecule is a binding molecule, which is why incineration, that makes use of high oxygen, has such a high degree of low volatile metals, which are bound by the degree of oxygen content within the retort or firebox and are locked into their byproducts. The binding element of oxygen also causes the formation of dioxins, which is the combination of two oxygen molecules along with others within the gas stream. At this point, in the early to mid-80's, the first pilot and then commercial systems using direct gasification started to show up. These were in the form of Fixed Bed, Entrained Bed and Fluidized Bed Systems. These systems all had draw backs in the form of their byproducts, which were tars that were hazardous, or char and ash, that the oxidation within the process, had consolidated low volatile metals that were leachable. In some cases, the Entrained Bed Systems created a slag that contained leachable metals, but the major drawback was the operational costs.

The Fixed Bed and Fluidized Bed Systems were still found to, at times, create smaller but traceable amounts of dioxins due to the continued use / presence of oxygen.

In the mid 80's, the *Balboa Pacific Corporation* of the United States of America started testing their new design of an indirect pyrolytic gasification system. This system was patented in 1988. A 50 ton-per-day pilot plant was refined and constructed over a two-year period from 1993 to 1995, which was partially funded by Southern California Gas Company and private investors. The plant operated at California Steel for 18 months, during which time, several of the nation's environmental engineers such as Dames & Moore did exhaustive studies on the system's ability to process, on a continuous feed basis, a wide variety of toxic and nontoxic, liquid or solid organic waste streams. Studies and testing of emissions, leachate and byproducts were, in every case, determined to meet or exceed the environmental thresholds and guidelines set forth by the Environmental Protection Agency (EPA), the Air Quality Management District (AQMD) and the State of California Air Quality Control Board. And the efficacy of Balboa Pacific's proprietary technology of molecular decomposition through pyrolytic gasification was determined to be superior for waste management. *The Balboa Pyrolytic Gasification Process makes use of high tech patented ceramics and alloys, as well as patented digitized valving, combined with process secrets; thereby, producing an oxygen-free, high temperature environment within the retort of between 0.05% to a maximum 2.5% oxygen and upwards of 2250 degrees F, resulting in the destruction of 99.999984 percent of any organic toxic or nontoxic feed-stock that is introduced through the system. Once high-density metals are removed through magnetic separation, the process produces an output of non-leachable byproducts.*

Currently, and over the past eight years, a number of companies have experimented with pressurized retorts. Whereas this method can help to maintain an oxygen free environment, it also creates other problems such as how to maintain continuous throughput of waste material. To date, most have been unsuccessful. Pressurized retorts have, however, been used within ash-melting combustion systems. In many respects, these systems are much like blast furnaces. They operate at high oxygen / high heat and produce a byproduct of slag, which still needs special handling and to date, has no market value. Also, the amount of energy needed to operate the system effectively is believed to offset potential returns, much the same as in Plasma Arch technology.

An independent investigation, resulting in a thorough evaluation of Balboa Pacific's proprietary continuous feed Pyrolytic Gasification process, determined that there is currently no technology that can compare to their indirect Pyrolytic Gasification Systems. Most of the technologies discussed were pyrolytic gasification systems of direct heat formats such as, Fixed Bed, Entrained Bed and Fluidized Bed. Other technologies mentioned were rotary kiln low oxygen formats and organic wood digesters/gasifiers, none of which, can handle the waste streams that the Balboa system can, such as, but not limited to: PCB's, hazardous solids and liquids, computer industry waste, plastics, mining industry waste, municipal solid waste (MSW), hospital red-bag waste, illicit drugs and Treasury Department's out-of-circulation currency. Furthermore, many of the burgeoning technologies are just now coming into commercialization, with the exception of EDL/BSC, which for the most part can only handle organic material in a limited format.