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SUPERFUND INNOVATIVE TECHNOLOGY EVALUATION

# Demonstration Bulletin

## Circulating Bed Combustor

Ogden Environmental Services, Inc.

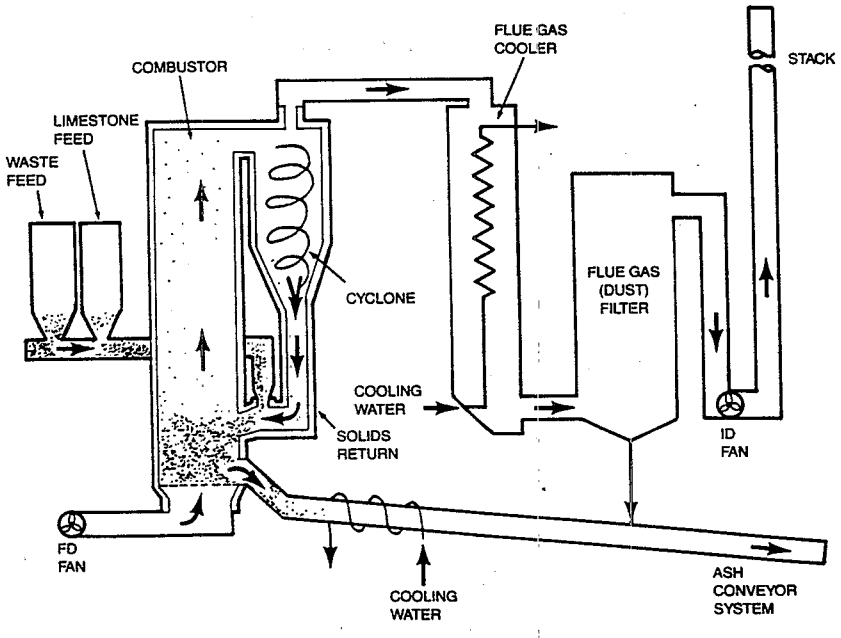
**TECHNOLOGY DESCRIPTION:** The Ogden Circulating Bed Combustor (CBC) is a thermal destruction system that uses high-velocity air to entrain circulating solids in a highly turbulent combustion zone. The combustion gases are separated from the ash and hot solids. The solids return to the CBC, the gases are filtered to the atmosphere and the ash is trapped for disposal (Figure 1).

Solids, slurries, or liquids can be introduced into the chamber loop where they contact hot bed material recirculating through the cyclone. When introduced into the primary combustion zone, the waste heats rapidly and continues to be exposed to high temperatures (up to 1,800°F) throughout its residence time High velocity air entrains the circulating soil, which travels upward through the combustor and into the cyclone. The cyclone separates the combustion gases from the hot solids. The solids then are returned to the combustion chamber via a proprietary non-mechanical seal. Temperatures around the entire combustion loop are uniform to within ±50°F. The hot flue gases and fly ash pass through a combustive flue gas cooler into a baghouse filter which traps the ash. Filtered flue gas then exits to the atmosphere. Heavier particles of purified soil remaining in the combustor lower bed are removed slowly by a water-cooled bed ash conveyor system.

Acid gases and sulfur oxides formed during combustion are captured by limestone added directly into the combustor. Emissions of CO and $NO_x$ are controlled to low levels by the turbulent mixing, low temperatures (1,425°F to 1,800°F), and staged combustion achieved by injecting secondary air at sequenced locations in the combustor.

**WASTE APPLICABILITY:** The Ogden CBC has been used to treat low pH tar-like (asphaltic) residues containing elevated concentrations of organic sulfur, aromatics, and aliphatic hydrocarbons.

**STATUS:** Treatability studies and a demonstration test were performed for the McColl superfund site in Fullerton, California, under the guidance of the EPA SITE Program, EPA Region IX, and DHS. These tests were conducted at the OES research facility in San Diego, California in March 1989 to provide data showing the effectiveness of treating the McColl Waste before bringing a full-scale unit onto the McColl site. A technical evaluation report will be forthcoming (Oct. 1991).



**DEMONSTRATION RESULTS:** Selected drums of McColl waste were sampled to characterize the drum contents and to select representative waste of the McColl site. The site waste material was screened, divided into two sets of feedstock (one blended with sand and the other left as raw waste), and transported to the OES facility for processing. Ogden Environmental Services operated and maintained the CBC, and provided process monitoring and continuous emissions monitoring (CEM). EPA conducted process inlet and outlet stream sampling and analysis to determine the system's operating efficiency and contaminant destruction capabilities. Stack sampling and analysis were designed to provide the data necessary to evaluate the CBC and assess the environmental effects of this technology in a full-scale SITE Demonstration test. Ash analyses were designed to permit an evaluation of the disposal options for the ash product. The McColl waste was processed through the CBC without any difficulty. The organic material was effectively destroyed as evidenced by the destruction removal efficiency (DRE) of 99.992%. Typically, DRE values are not calculated for organic compounds in the waste feed unless they exist at levels greater than 1,000 parts per million (ppm). No significant levels of hazardous organic compounds left the system in the stack gas or remained in the bed and fly ash material, as shown in the table below.

**FOR FURTHER INFORMATION:**

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**FEED AND RESIDUALS CHARACTERISTICS**

| | Waste Feed | Fly Ash | Bed Ash | Stack Gas Emissions |
|---|---|---|---|---|
| ORGANICS (parts per million) | | | | |
| Benzene | 4.9 | not detected | not detected | 0.0008 |
| Toluene | 35.5 | not detected | not detected | 0.0015 |
| Xylene | 165.0 | not detected | not detected | 0.0015 |
| Ethylbenzene | 23.0 | not detected | not detected | 0.0004 |
| 1,1,1, Trichloroethane | not detected* | not detected | not detected | 0.0002 |
| Naphthalene | 30.2 | not detected | not detected | 0.0006 |
| 2-Methyl-Naphthalene | 34.5 | not detected | not detected | 0.0004 |
| PHYSICAL PROPERTIES | | | | |
| Sulfur (%) | 4.4 | 3.6 | 0.9 | --- |
| pH | 2.3 | 12.6 | 12.1 | --- |
| Density (lbs. per cubic ft.) | 57.9 | 76.9 | 88.4 | --- |
| Heat Value (BTU/pound) | 1387.0 | --- | --- | --- |

- "not detected" indicates a value below detection limits.
- Organic feed and heat values are based on unblended waste averages. All other results are based on blended and unblended waste averages. Waste feed, fly ash and bed ash values are weight/weight. Stack gas emissions are volume/volume.

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