Carbon Burn-Out

TECHNOLOGY PRODUCES LOW-CARBON, HIGH-QUALITY FLY ASH

Fly ash from coal-fueled power plants is known to confer considerable performance benefits to concrete and other high-strength applications. However, plant technologies in use today to reduce NOx emissions make meeting applicable quality standards a continuing challenge.

Use of low-NOx burners, pursuant to Clean Air Act requirements, increases the residual carbon and consequently the loss on ignition (LOI) of fly ash. Similarly, ammonia, a widely used reagent injected into flue gases to lower NOx emissions, must be removed from any ash to levels lower than 100 parts per million if it is to be used in concrete applications.

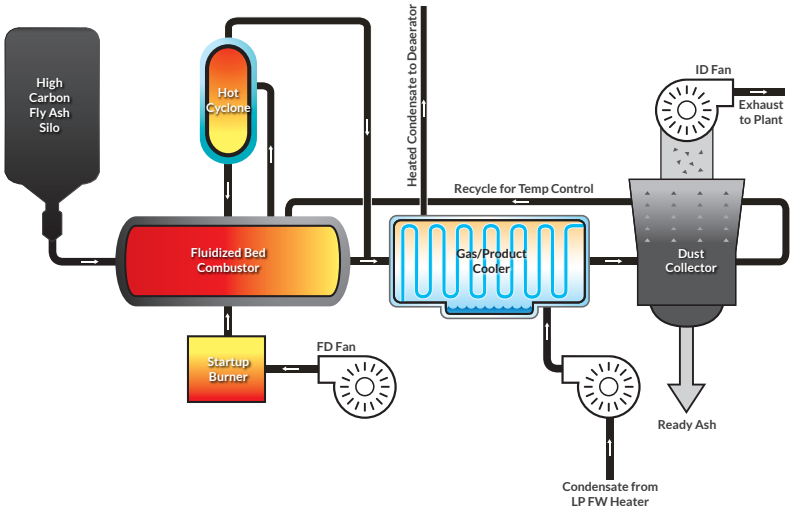
Boral Resources now offers Carbon Burn-Out (CBO), a technology in which residual carbon in fly ash is combusted to produce a consistent low-carbon, low-LOI, and high-quality pozzolan. The process simultaneously decomposes ammonia to nitrogen and water, yielding ash with no detectable ammonia residue.

The Process

CBO is a patented technology designed to maximize beneficial use of fly ash in concrete. The process is fueled solely by the residual carbon within the fly ash, and the recovered heat is returned directly to the power plant.

The process may be used to beneficiate high-carbon fly ash either directly from the power plant or from fly ash that has been stored in landfills or ponds.

During the process, high-carbon raw ash is pneumatically conveyed from the power plant's existing silo(s) (or from the dryer plant if ponded or landfilled ash is being beneficiated) to the CBO silo. A forced-draft fan provides fluidization and combustion air to the CBO fluid bed combustor. An induced-draft fan keeps the combustor freeboard pressure slightly sub-atmospheric *(see diagram).*



Revision Date: 6.13.18

Carbon Burn-Out

TECHNOLOGY PRODUCES LOW-CARBON, HIGH-QUALITY FLY ASH

Feed ash is metered into the combustor, in which carbon burns on a continuous basis. Heat exchange occurs between the hot product ash plus flue gas and the condensate from the power plant. Ready ash is separated from the flue gas by a cyclone and bag house and is then pneumatically conveyed to the storage and load-out area.

Carbon burn-out can accommodate carbon content as high as 90% and as low as 8%. A minimum of 8% carbon is typically required for the process to work solely via the fuel value of the fly ash; for lower-carbon ash streams, support fuel may be needed.

Facilities using the CBO process report that virtually 100% of the fly ash produced at their generating stations is commercially marketable. CBO-produced fly ash meets or exceeds ASTM Class F specifications. The CBO process can also be adapted to beneficiate high-carbon ash reclaimed from ponds or landfills.

Additional Benefits

Boral's CBO process provides additional benefits for power plants, including:

- *Less/no ash in an on-site or off-site landfill or pond:* 100% of CBO's ash is reused.
- *Zero-waste process:* CBO has no solid waste stream; its only products are premium-quality ash and recovered heat.
- *Efficiency improvement:* CBO recovers the residual carbon's valuable heat, measurably increasing the host power plant's generation efficiency by producing the equivalent of 2 to 3 megawatts of power.
- *Lower operating costs:* CBO helps reduce power plants' costs by minimizing direct disposal expenses and future landfill costs without requiring capital investment by clients. Boral can build, own, and operate our ash processing technology at the power plant site.
- *Multiple sourcing options:* Remote ash sources can be readily accommodated and processed through the CBO process, reducing direct disposal costs from a number of plants.
- *Flexible fuel blending:* CBO provides the opportunity for plants with scrubbers to blend fuels such as petroleum coke with coal, providing additional fuel cost savings without forcing landfilling of the resulting ash.
- *CO_2 credits:* CBO fly ash is certified as a partial replacement for portland cement.