CIRCA
ASSOCIATION OF CANADIAN INDUSTRIES RECYCLING COAL ASH

ORIGIN & APPLICATIONS OF BOTTOM ASH

*Photo courtesy of **American Coal Ash Association**, www.acaa-usa.org*

*Photo courtesy of **WILCO Contractors NW Inc.**, www.wilco.ca*

Bottom Ash (pictured left[1]) is a mineral by-product created by burning coal in utility boilers to produce electricity. Heavier than Fly Ash, Bottom Ash falls to a water-filled hopper at the bottom of the boiler during the combustion process (schematic below). [2] Depending on the type of coal and boiler involved, Bottom Ash comprises 15%–30% of the ash produced in coal-fired electricity generation.

A residual by-product of an efficient industrial process,[3] Bottom Ash has consistent properties that render it an ideal filler material or aggregate for certain geo-technical or construction applications and as a component of building products:

- lightweight
- porous
- dark grey to black in colour
- size grades ranging from fine sand to medium gravel
- non-combustible

Applications

Generally speaking, Bottom Ash is suitable wherever sand or gravel might be used as granular fill:

- Granular base or road subbase
- Aggregate in concrete & asphalt
- Lightweight fill material for backfill or embankments
- Raw feed for cement clinker
- Blasting grit
- Snow and ice control
- Roofing materials
- Mine reclamation

Most commonly used as road base material, Bottom Ash serves to ensure proper drainage and provide insulation from freeze/thaw cycles. However, potential uses for Bottom Ash go far beyond roads to include parking lots, storage areas for tractors or farm equipment, berms, road grit for traction in snow and ice, fill material for septic tank beds, and golf courses or sport fields, where it can improve drainage under the playing surface.

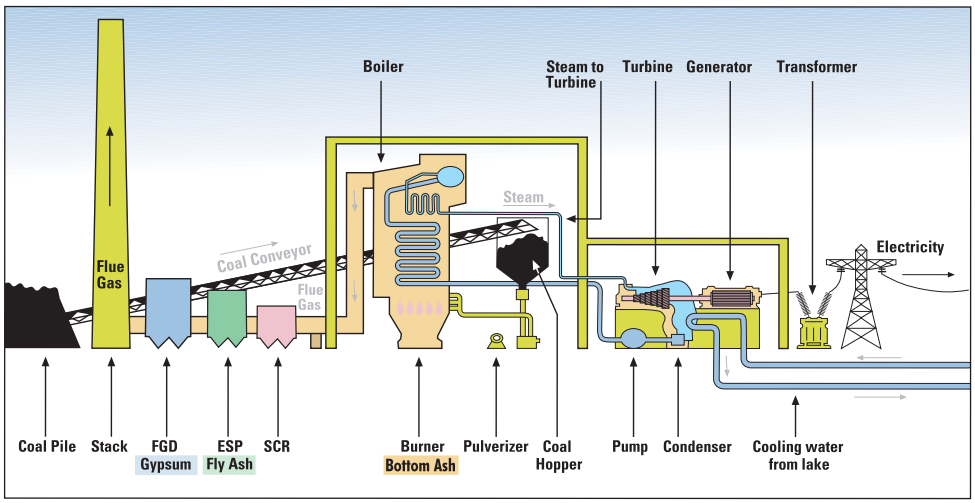
Technical Performance

In some cases, Bottom Ash offers performance improvements over more conventional materials. For example, as an alternative to de-icing salts, Bottom Ash offers improved traction (regardless of temperature changes) without corrosion or degradation of road surfaces caused by chlorides.

The lightweight, insulating and non-combustible nature of Bottom Ash lends itself to productive use in fire-retardant roofing materials. In green roof applications, porous, granular and lightweight properties in combination with its mineral content, render Bottom Ash an ideal component of the growing medium (especially as compared to other materials, such as expanded shale).

The comparatively low eco-footprint and material costs of Bottom Ash are encouraging investigators to qualify the material as an important alternative to more "traditional" materials for an expanding range of uses.

"In keeping with standard construction practices, appropriate pre-testing of region-specific materials is required to assure constructability. Application, together with on-site environmental conditions determine the specific methodology for a particular job."



*Schematic diagram courtesy of **Ontario Power Generation Inc.**, www.opg.com*

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Recognized for improving the responsible use of CCPs in Canada

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*Photo courtesy of **Ash Development Association of Australia,** www.adaa.asn.au/utilisations.htm*

CANADA, PRODUCTION [1] AND USE [2] OF COAL COMBUSTION PRODUCTS (CCPs), 2005 - 2007 AVERAGE	
	Bottom Ash
PRODUCTION	**(000 tonnes)**
Produced	1624
Disposed / Stored	1421
Removed from Disposal	5
USE (DOMESTIC)	
Cement	52
Concrete / Grout	0
Mining Applications	–
Roadbase / Subbase	48
Wallboard	0
Other (4)	2
TOTAL USE	**102**
Use Percentage	6
(1) Reported production of CCPs may include both dry & ponded categories.	
(2) Use (domestic), as reported, includes amounts imported (assumed World Customs Organizations Harmonized Standard code 26.21	
(4) Includes waste stabilization and specialty uses such as mineral filler and flowable fill.	
[5] Source: Minerals and Metals Sector, Natural Resources Canada	
Note: Numbers may not add to totals due to rounding	

Composition & Classification

Chemical composition of Bottom Ash[4] varies, depending on the type of coal burned. It may be processed (i.e.: washed, de-watered, sieved) or otherwise beneficiated to optimize its characteristics for a specific end use.

Bottom Ash has unique engineering properties and characteristics for which standard test methods and specifications have been developed. Some sources of Bottom Ash may provide satisfactory performance as an aggregate in granular, base material applications, but may not fully satisfy all specification requirements for aggregates, such as particle size distribution or abrasion loss require-ments for graded base courses.

Economics

Several factors influence an end user's decision to use Bottom Ash. "These include: the price of Bottom Ash relative to the price of virgin materials for specific uses; the technical fit between Bottom Ash and the use application; access to sufficient quantities of Bottom Ash; and federal or regional regulations associated with the use of Bottom Ash." [5]

Despite the successful use of Bottom Ash in road beds, engineered fills and sport fields, regulators and specifiers in some jurisdictions remain skeptical of its use. Consequently, the onus is on suppliers and contractors to demonstrate application-specific test results to address regulators' concerns. This adds to user costs and can thus inhibit the use of Bottom Ash in viable applications.

Canadian recycling rates of Bottom Ash provide ample room for improvement as most recent figures (2007) indicate only 6% of Bottom Ash produced annually is recycled into beneficial applications [6]. By contrast, the US recycled 43.5% of Bottom Ash produced in 2007. [7]

An Environmentally Responsible Choice
Redirecting Bottom Ash to beneficial use replaces virgin material[8] and avoids unnecessary landfill, reducing both the environmental footprint and the material costs of applications.

As an alternative to sand or gravel, Bottom Ash reduces the need to quarry non-renewable resources, avoiding the energy use and environmental impacts of quarrying operations. The low weight of Bottom Ash, relative to sand or gravel, also reduces fuel consumption and costs for delivery to the customer.

Bottom Ash is a practical, technically sound and economical choice that improves the sustainability of commercial applications.

References

[1] American Coal Ash Association: http://www.acaa-usa.org/CCP.htm
[2] "How Coal-Powered Generation Works", Ontario Power Generation website: http://www.opg.com/power/images/fossil_lg.jpg
[3] Ash Development Association of Australia: http://www.adaa.asn.au/utilisations.htm
[4] "User Guidelines for Waste and Byproduct Materials in Pavement Construction", US Dept. of Transportation and Highways, FHWA-RD-97-148: www.tfhrc.gov/hnr20/recycle/waste/cbabs1.htm
[5] Bottom Ash Fact Sheet, Ontario Power Generation Inc., March 2000.
[6] Minerals and Metals Sector, Natural Resources Canada,
[7] ACAA 2007 CCP Survey: http://www.acaa-usa.org/associations/8003/files/2007_ACAA_CCP_Survey_Report_Form%2809-15-08%29.pdf
[8] "Waste & Materials Flow Benchmark Sector Report: Beneficial Use of Secondary Materials – CCPs", US EPA, Office of Solid Waste, Feb. 2008: http://www.epa.gov/epawaste/partnerships/c2p2/pubs/benuse07.pdf

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