



UNITED KINGDOM
QUALITY ASH
ASSOCIATION

FURNACE BOTTOM ASH (FBA) - A LIGHTWEIGHT AGGREGATE

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Technical Director

THE UKQAA IS ...

- ◉ A non profit making trade association:
 - Wholly funded by the members
 - ◉ Representing the:
 - Scientific - Promotion and funding of research and development
 - Technical - All aspects of the products, standardisation, etc.
 - Industrial - Production, plant, etc.
 - Environmental - Ensuring that it is fairly treated
 - Educational - Seminars, exhibitions, lectures, etc.
 - Legal - Monitoring laws, EU Directives, etc.
- interests of the members**
- ◉ ***NB: We do not cover commercial aspects***



THE FULL MEMBERS:

- ◉ EON UK
- ◉ RWE - Generation Aggregates
- ◉ ScotAsh Ltd
- ◉ CEMEX - Rugby
- ◉ SSE (Scottish & Southern Energy)
- ◉ EDF Energy
- ◉ International Power
- ◉ Power Minerals Ltd (Drax Power Ltd)
- ◉ Eggborough Power Ltd (British Energy)



UKQAA ASSOCIATE AND AFFILIATE MEMBERS:

- ◉ H+H UK Ltd
- ◉ Hanson - Thermalite
- ◉ Paragon Materials/Ash Solutions Ltd
- ◉ Matrix Materials Ltd
- ◉ Lafarge Cement

Associate Members

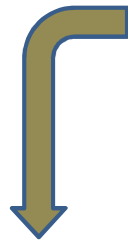
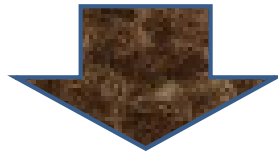
- ◉ Omnicem Testing Ltd
- ◉ Forkers Ltd
- ◉ M&J Drilling Services Ltd
- ◉ Fred Sherwood Group
- ◉ Omya Fillite Ltd
- ◉ Shanks Waste Management Ltd
- ◉ Fairport Engineering Ltd
- ◉ Drakelow Site Services Ltd
- ◉ GRS Roadstone Limited
- ◉ Tetron Point LP
- ◉ FCC Environment Co UK

Affiliate Members



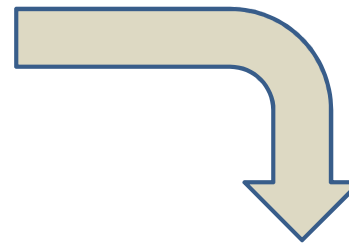
COAL BY-PRODUCTS

Pulverised Coal



Furnace Bottom Ash (FBA)

~ 10%

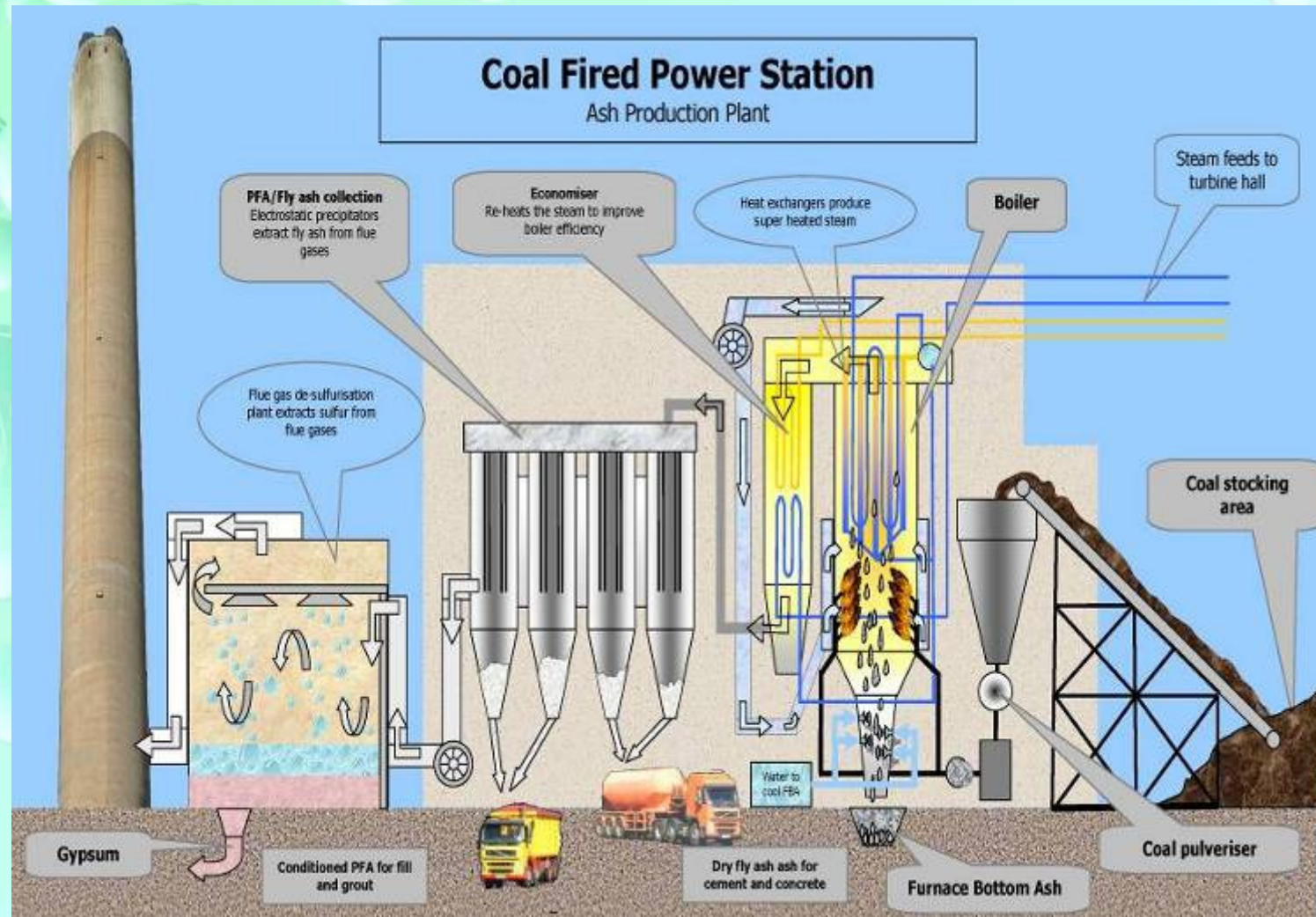


Pulverised Fuel Ash (PFA)

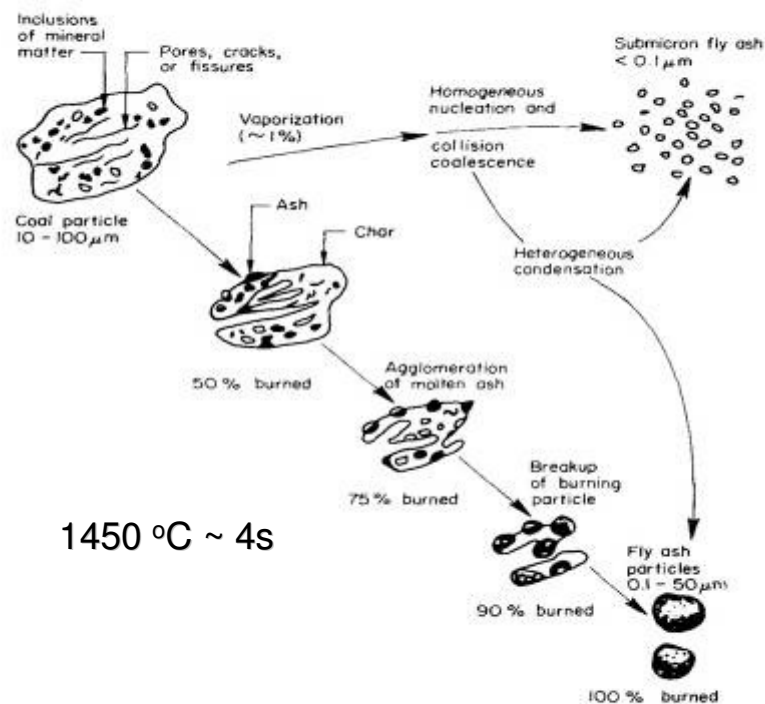
~ 90%



BURNING PULVERISED COAL



FORMATION OF FBA/PFA



1450 °C ~ 4s

Ref. Flagan.R.C. The Combustion Institute 1977



PROCESSING FBA

- ◉ Deposits fall to bottom of furnace
- ◉ Flushed with water (“wet bottom”) ~ no risk of deleterious reactions.
- ◉ Discharged to pits
- ◉ De-watered
- ◉ Stored and/or collected by truck
- ◉ Size graded



FBA DISCHARGE - DIDCOT PS



FBA PITS - DRAX PS



SIZE GRADING FBA



FBA ANALYSIS

Component	FBA (%)	PFA (%)
SiO ₂	49.5	49.6
Al ₂ O ₃	24.2	23.1
Fe ₂ O ₃	15.5	14.0
CaO	6.39	4.37
MgO	2.54	1.95
TiO ₂	0.90	0.87
K ₂ O	1.67	1.87
Na ₂ O	0.53	0.44
SO ₃	0.14	0.58
Mn ₃ O ₄	0.21	0.18
P ₂ O ₅	0.35	0.34
BaO	0.18	0.17



FBA PROPERTIES

- ◎ Bulk density 800 to 1100 kg/m³
- ◎ Loss on ignition 4 to 10%
- ◎ Moisture content 10 to 15%
- ◎ Particle size ≤ 50 mm



FBA SUB-BASE (1)



FBA SUB-BASE (2)



EN 13055-1

- ◎ FBA is a lightweight aggregate (LWA)
 - particle density $\leq 2000 \text{ kg/m}^3$
 - loose bulk density $\leq 1200 \text{ kg/m}^3$
- ◎ “By-product of industrial processes”
 - Intended uses:
 - Concrete
 - Mortar and grout
 - Unbound/hydraulically bound mixtures



EN 771-3 AGGREGATE CONCRETE MASONRY UNITS (BLOCKS)

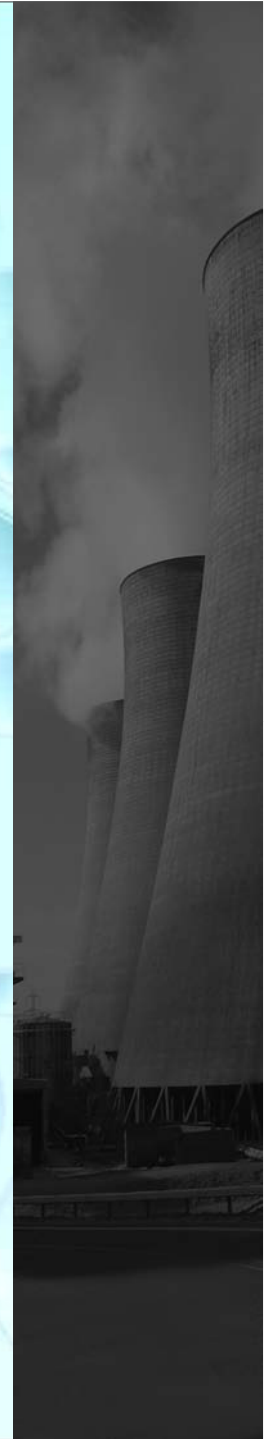


KEY PROCESSES

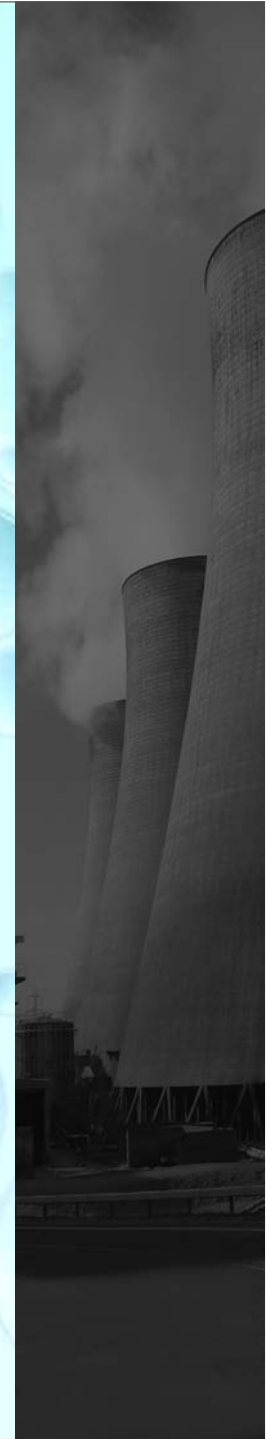
- ◎ Earth-dry mix
 - Aggregate, sand, FBA, cement and PFA ?
 - FBA graded depending on block application
- ◎ Pressed/vibrated into individual mould
- ◎ Demoulded immediately
- ◎ Cured in kilns
 - Elevated temperature & humidity
 - CO₂ may be used



BLOCK MOULDING



BLOCK CURING

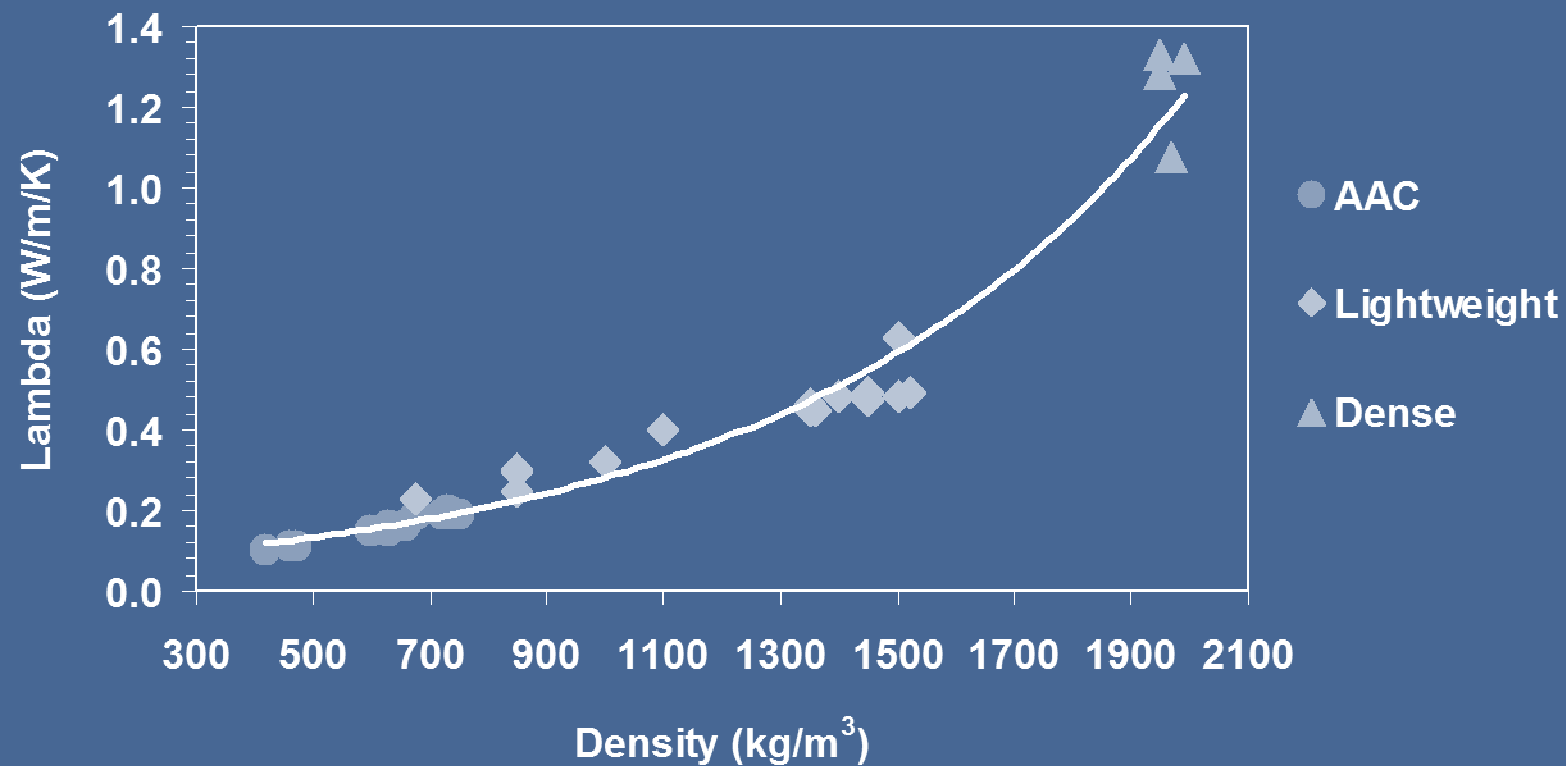


BENEFITS OF FBA IN BLOCKS

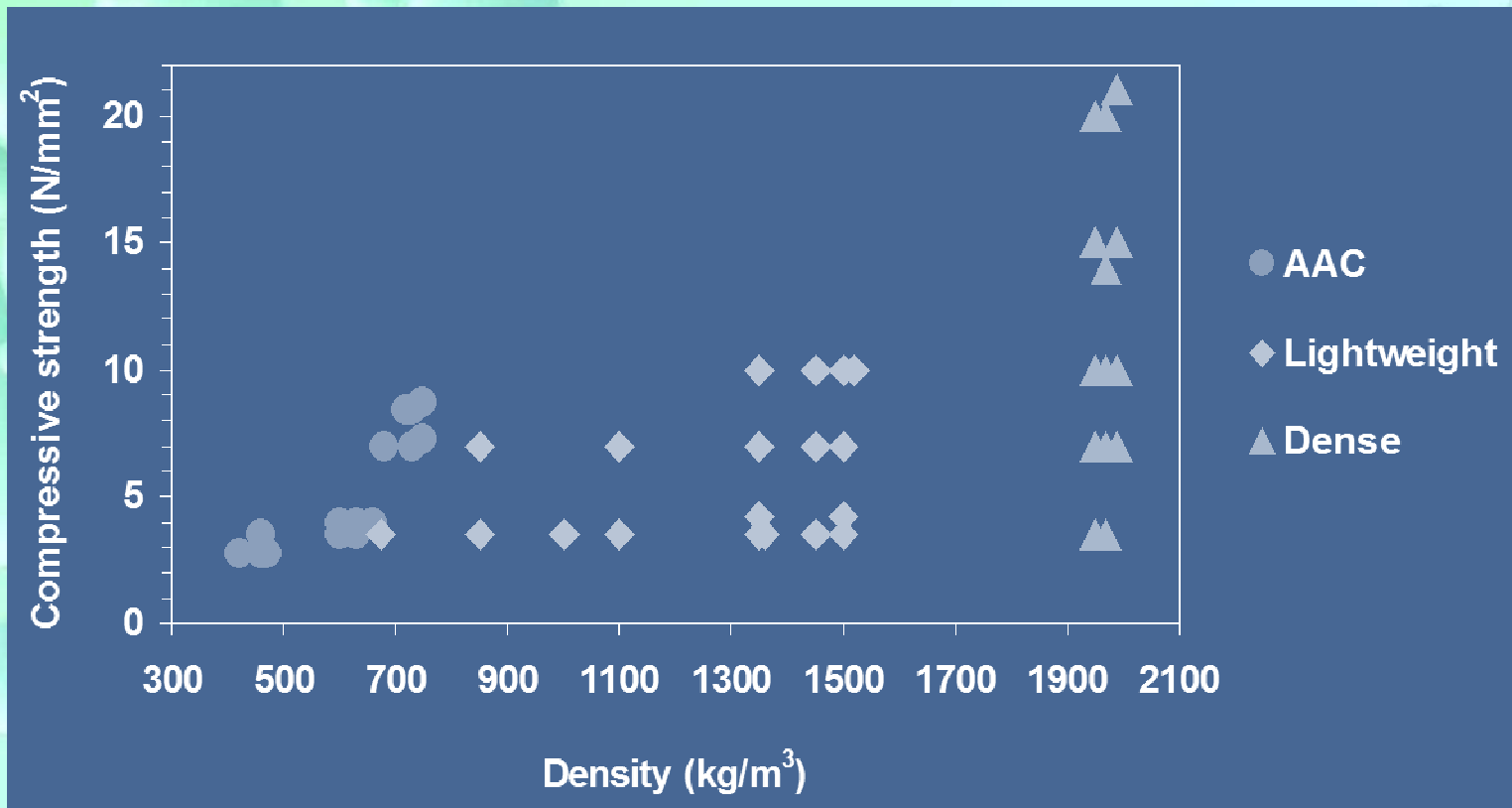
- ◉ Lightweight aggregate = reduces density
- ◉ Lower thermal conductivity
- ◉ Improved manual handling
- ◉ High strength possible
- ◉ Contributes to durability
- ◉ By-product = resource efficient
 - ◉ a potential waste
- ◉ Environmentally sound



THERMAL CONDUCTIVITY



COMPRESSIVE STRENGTH



CONCLUSIONS

- ◉ FBA is a well established lightweight aggregate for construction.
- ◉ Widely used in precast concrete - contributing to performance and durability.
- ◉ Accepted as a raw material in current standards.
- ◉ A by-product aggregate - provides significant environmental benefits.
- ◉ Is REACH compliant.



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