



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

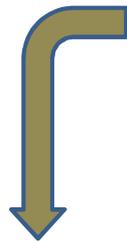
- Omnicem Testing Ltd
- Forkers Ltd
- M&J Drilling Services Ltd
- Fred Sherwood Group
- Omya Fillite Ltd
- Shanks Waste Management Ltd
- Fairport Engineering Ltd
- Drakelow Site Services Ltd
- GRS Roadstone Limited
- Tetron Point LP
- FCC Environment Co UK

Affiliate Members



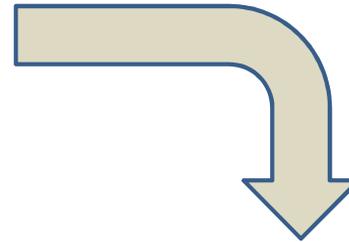
COAL BY-PRODUCTS

Pulverised Coal



Furnace Bottom Ash (FBA)

~ 10%

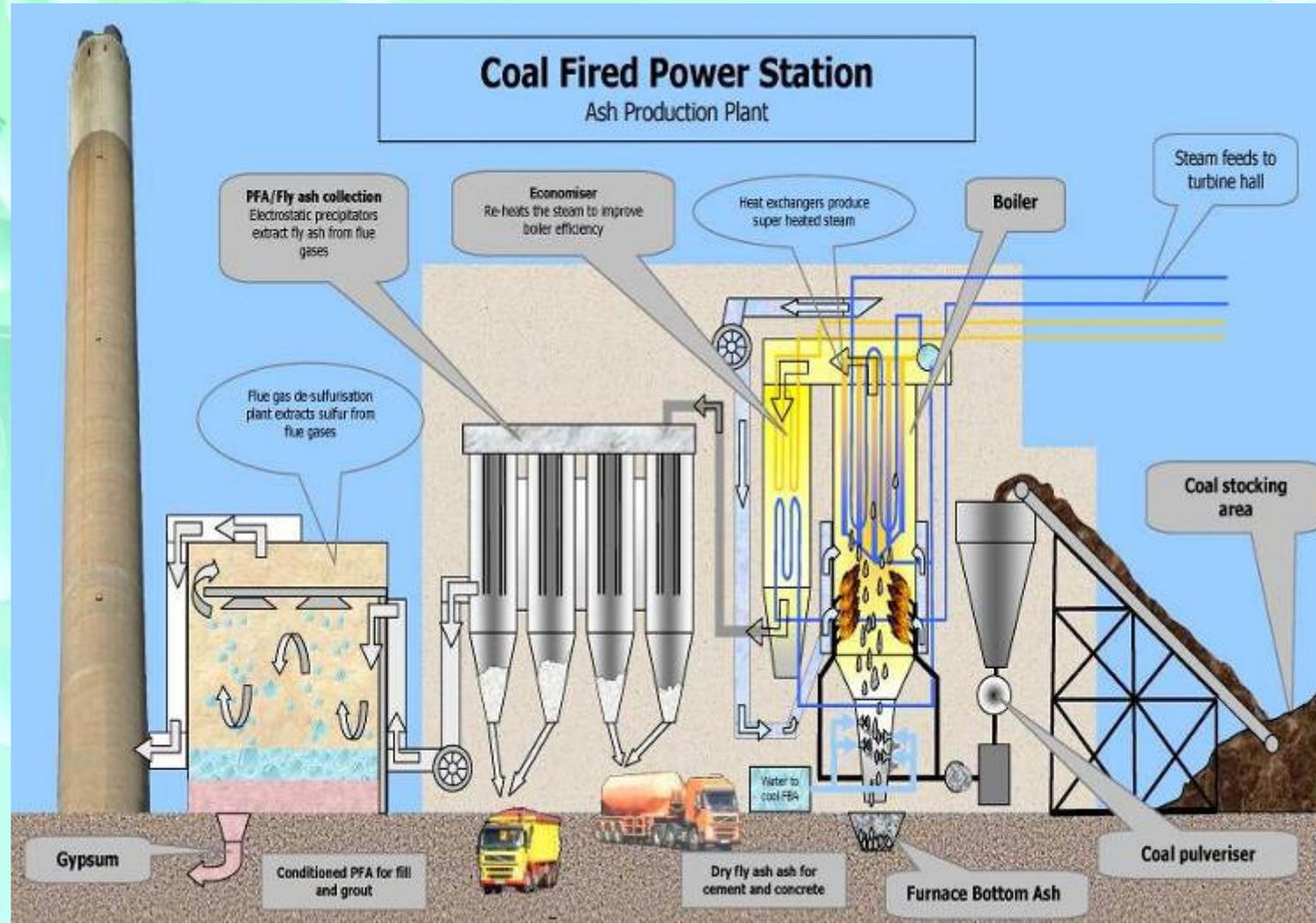


Pulverised Fuel Ash (PFA)

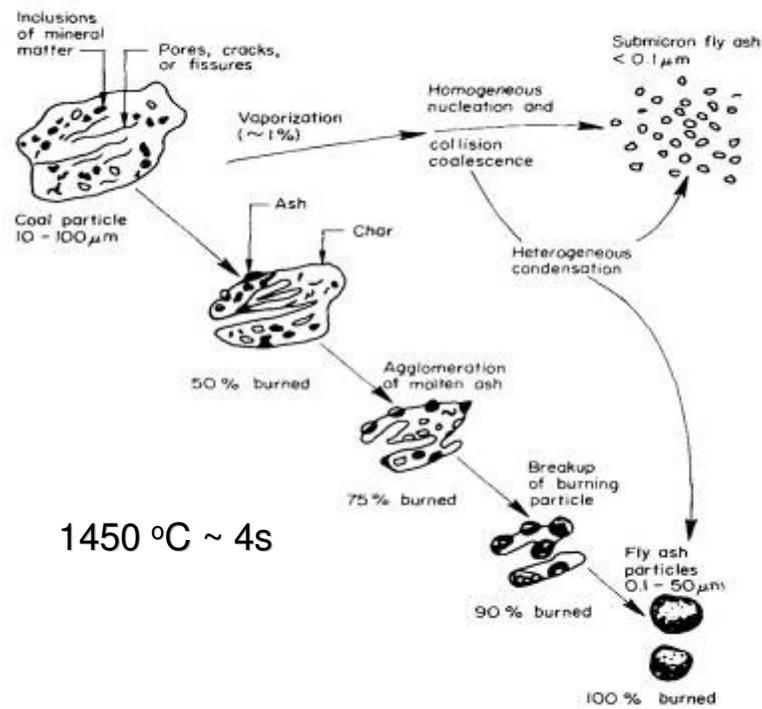
~ 90%



BURNING PULVERISED COAL



FORMATION OF FBA/PFA



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



PROCESSING FBA

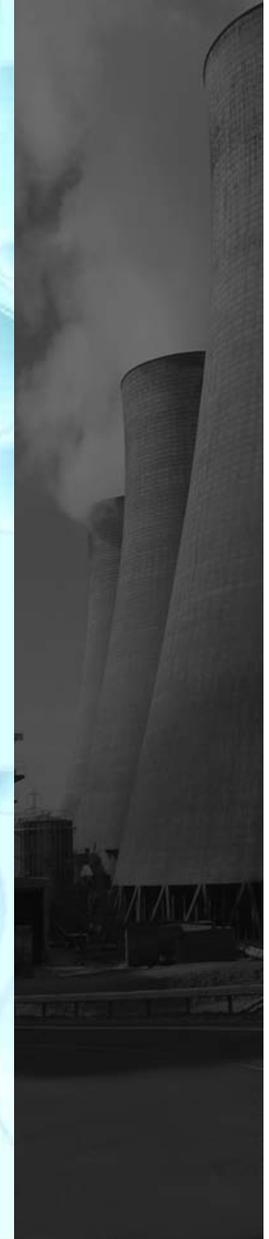
- ⦿ Deposits fall to bottom of furnace
- ⦿ Flushed with water (“wet bottom”) ~ no risk of deleterious reactions.
- ⦿ Discharged to pits
- ⦿ De-watered
- ⦿ Stored and/or collected by truck
- ⦿ Size graded



FBA DISCHARGE - DIDCOT PS



FBA PITS - DRAX PS



SIZE GRADING FBA



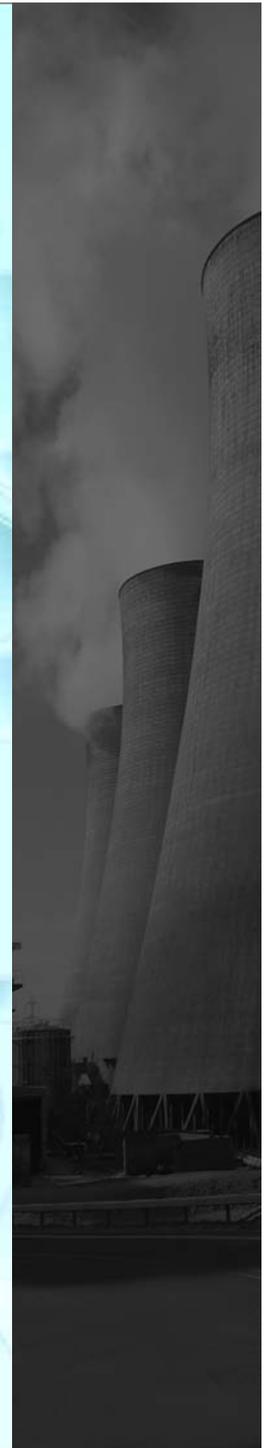
FBA ANALYSIS

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

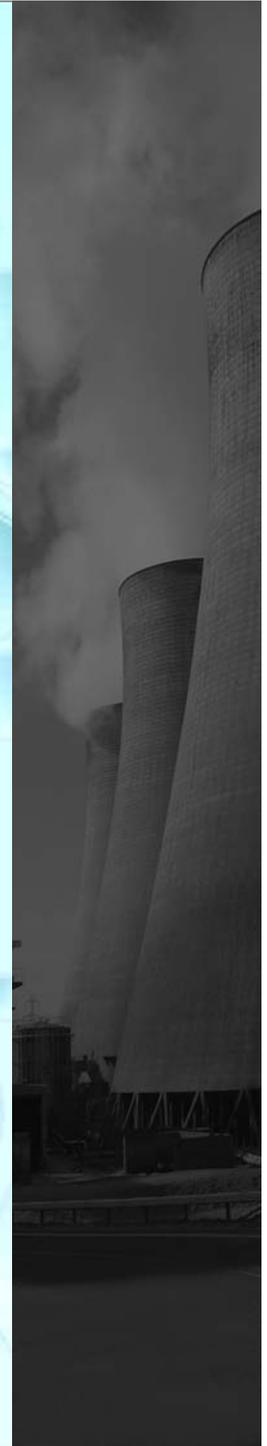
- ◎ Bulk density 800 to 1100 kg/m³
- ◎ Loss on ignition 4 to 10%
- ◎ Moisture content 10 to 15%
- ◎ Particle size ≤ 50 mm



FBA SUB-BASE (1)



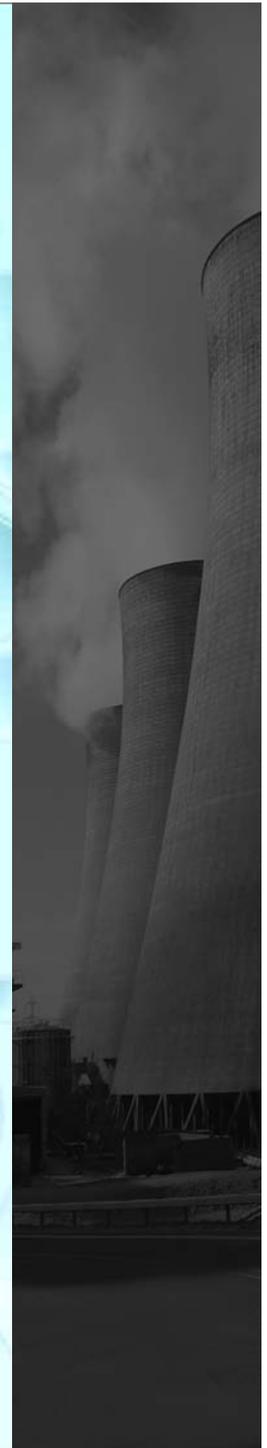
FBA SUB-BASE (2)



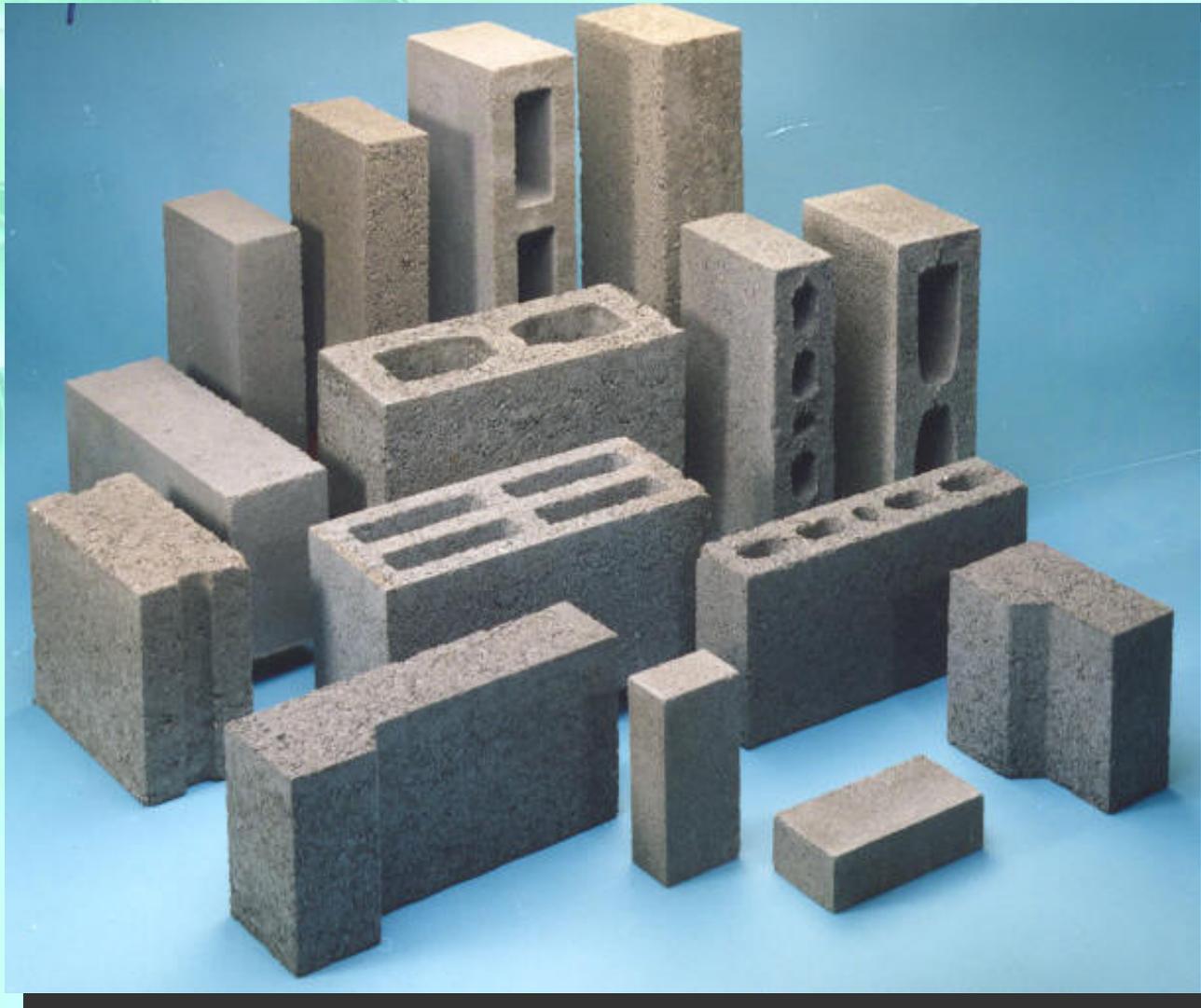
EN 13055-1

- ◎ 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)

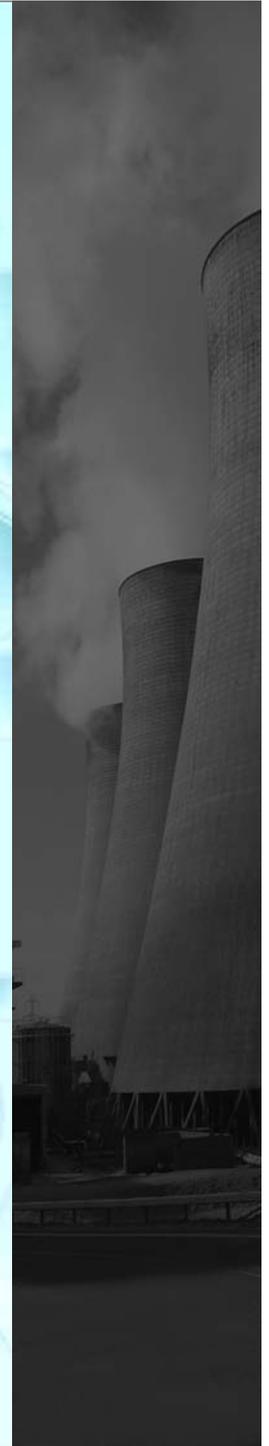


KEY PROCESSES

- ◎ 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

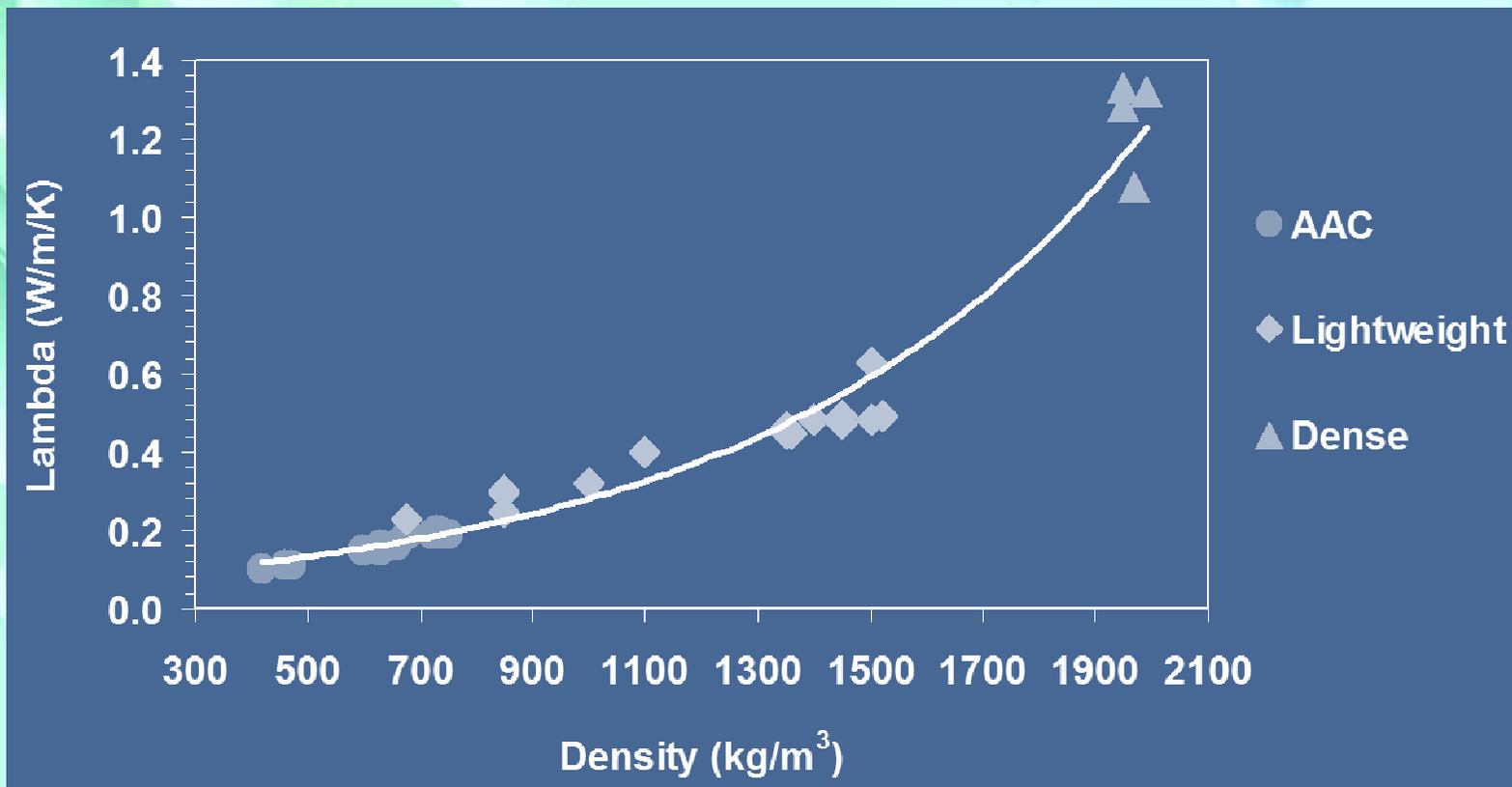


BENEFITS OF FBA IN BLOCKS

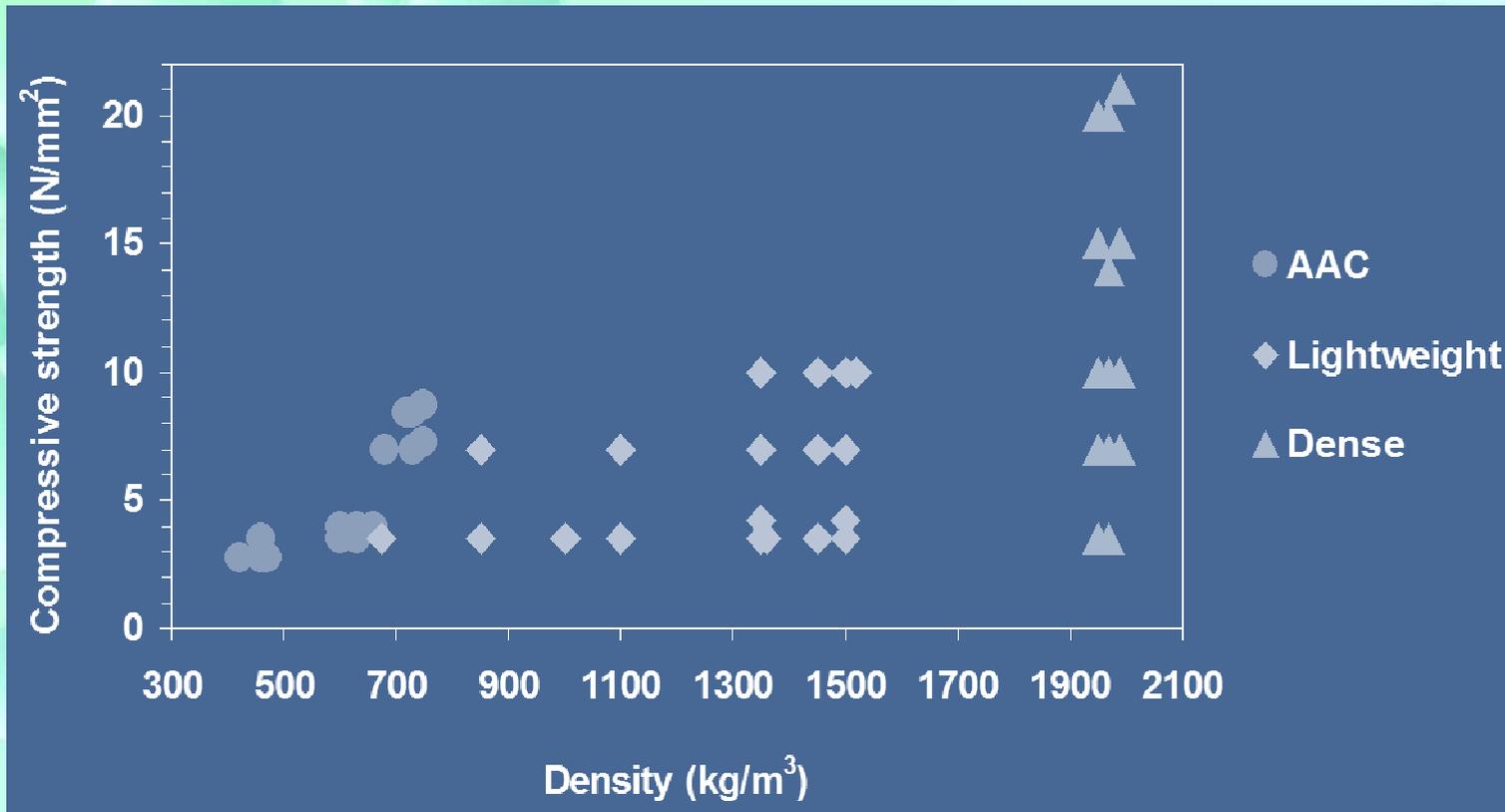
- ◎ Lightweight aggregate = reduces density
- ◎ Lower thermal conductivity
- ◎ Improved manual handling
- ◎ High strength possible
- ◎ Contributes to durability
- ◎ By-product = resource efficient
 - a potential waste
- ◎ Environmentally sound



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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