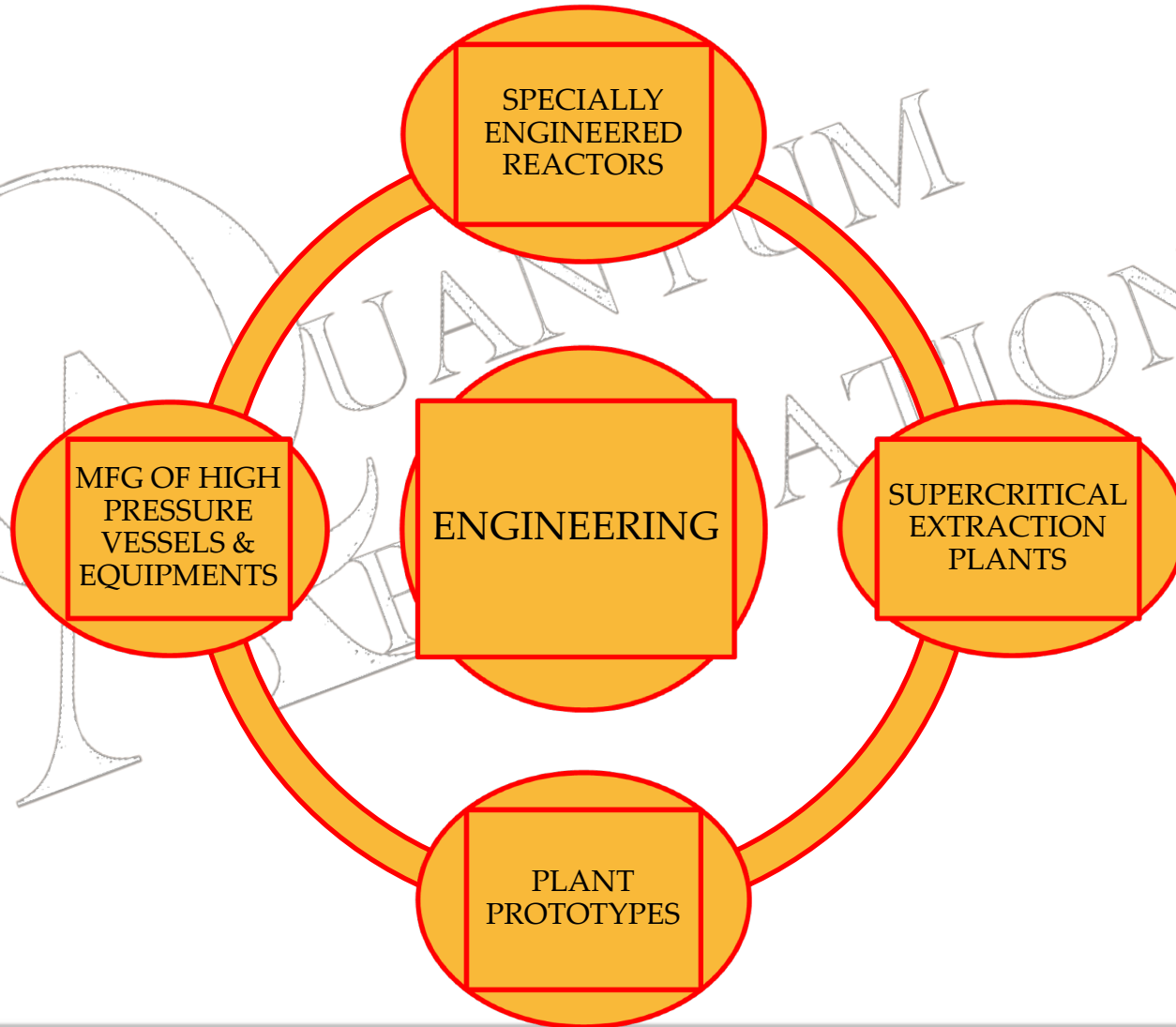




RED MUD

Quantum Applications



About Us

STRATEGIC NUCLEAR MATERIALS
SEPARATION & DECONTAMINATION
PROCESS DEVELOPMENT,
METHODOLOGY & SCIENTIFIC
DATABASE. NOVEL RESEARCH &
DEVELOPMENT USING SUPERCRITICAL
WATER OXIDATION FOR SYNTHESIS

SEPARATION OF PHYTOCHEMICALS TO
MAINTAIN EXTREMELY HIGH AMOUNT
OF PURITY AND EXTRACTION
EFFECIENCIES

PHYSICO-CHEMIC
EXTRACTION
PROCESSES

EXTRACTION OF PERFUMARY BASES
FROM NATURAL RESOURCES

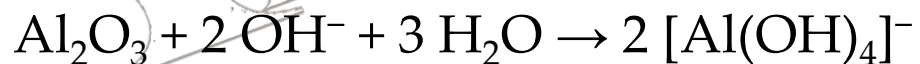
DEVELOPMENT OF METHOD TO
DISPERSE NATURAL TEXTILE DYES ON
FIBRE SUBSTRATES WITHOUT WATER
OR OTHER SOLVANTS, EFFLUENTS AT
SIGNIFICANTLY LOW POWER
REQUIREMENTS

Bauxite Mining

- Bauxite is a naturally occurring form of aluminum ore.
- It consists of 45-60% aluminum oxide, 12-30% water, and various other impurities.
- Bauxite is typically mined in open-pits and either processed into alumina near the mining operation, or shipped to smelting markets around the world for processing.
- There is a huge amount of industrial byproducts/wastes emitted out of bauxite mining.

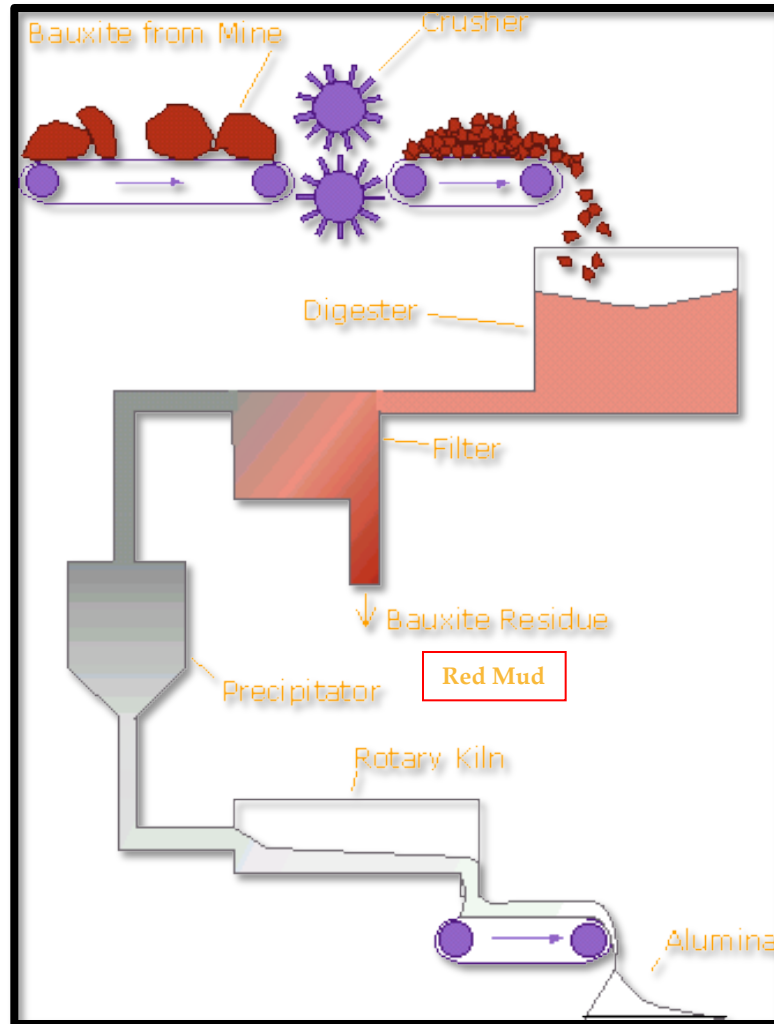
Bayer Process

- Bauxite, the most important ore of aluminum, contains only 30-54% alumina, Al_2O_3 , the rest being a mixture of silica, various iron oxides, and titanium dioxide. The alumina must be purified before it can be refined to aluminum metal.
- In the Bayer process, bauxite is digested by washing with a hot solution of sodium hydroxide, NaOH , at 175°C . This converts the alumina to aluminum hydroxide, $\text{Al}(\text{OH})_3$, which dissolves in the hydroxide solution according to the chemical equation:



- The other components of bauxite do not dissolve. The solution is clarified by filtering off the solid impurities. The mixture of solid impurities is called red mud, and presents a disposal problem.

Bayer Process



Red Mud

- Red Mud is composed by a mixture of solid and metallic impurities.
- The red color is caused by the oxidized iron present in the mud, it can make up to 60% of the mass of the red mud.
- Red mud cannot be easily disposed. In most countries where red mud is produced, it is pumped into red mud ponds. These "ponds" are simply areas full of red mud.
- Red mud presents a problem because of its toxicity and also it takes up large areas of land unnecessarily. This is because red mud cannot be built on, even when dry.



Constituents of Red Mud

Constituents	Red Mud
Fe_2O_3	46-50%
Al_2O_3	19-20%
TiO_2	17-22%
SiO_2	5-12%
Na_2O	4-8%
CaO	6-11%
MgO	-
K_2O	-
Loss on ignition	8-12%
pH	8-8.7

A Study on the Geochemistry of Red Mud from Damanjodi (NALCO) Bauxite Processing, Bauxite of Eastern Ghats of India, The Indian Mining & Engineering Journal, 2009

Other Components

- Aluminum – 20%
- Silica – 10%
- Vanadium (traces up to 710 ppm)
- Sodium Oxide – 6%
- All the above mentioned components can be separated and can be enhanced in terms of their quality.
- We can sell or create uses for the above.

HOW MUCH RED MUD ARE WE TALKING ABOUT?

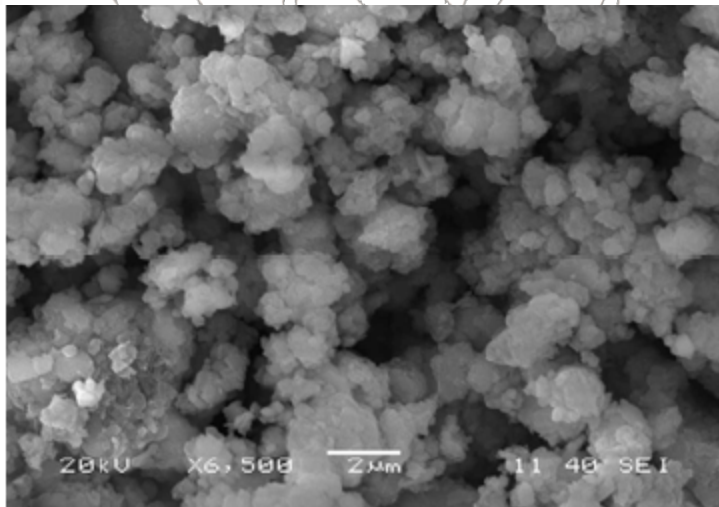
- Nalco has 500 acre pond and has 50 Million tonnes of Red Mud.
- Almost 50 % contains Fe_2O_3 .
- Every hour 200 tonnes is produced therefore in one year 17,52,000 tonnes is produced.
- We have designed a process where 60% can be recovered out of this 50 %. Therefore 25 tones per hour can be recovered.

Titanium

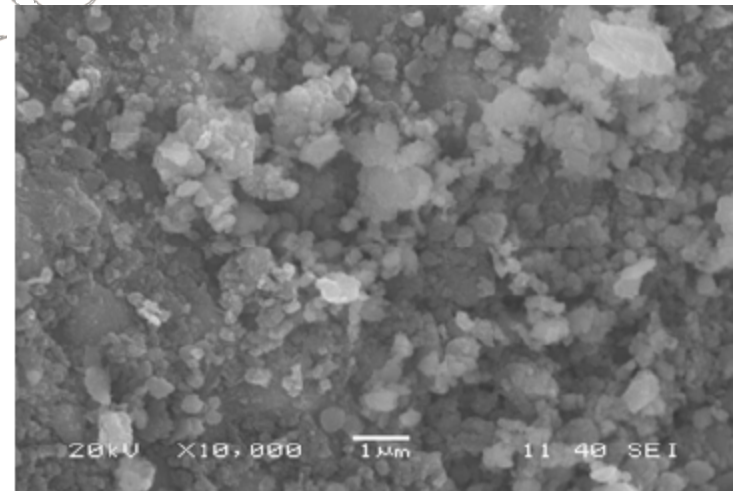
- Nalco has 500 acre pond and has 50 Million tonnes of Red Mud.
- Almost 20% is Titanium.
- We can recover about 15% Titanium by experimenting the size analysis method.

RED MUD ANALYSIS

- Red mud shows compositional features of the materials.
- Rounded shape of red mud particles is responsible for extremely high friction angles, most of minerals are cubic or prismatic shapes.
- The cementing/aggregating agent is hydroxysodalite. It is only very slightly soluble in water, but becomes more soluble in alkaline conditions.
- The dissociation of hydroxysodalite is responsible for decrease of rounded shape and aggregation of red mud



Red Mud



Neutralized Red Mud

CURRENT RED MUD APPLICATIONS

- The metallurgical ones - iron and steel production.
- Production of building materials constructional brick, light weight aggregates, bricks roofing and flooring tiles, cements.
- Catalysis, ceramics pottery, sanitary ware, special tiles and glasses, glazes, ferrites.
- Miscellaneous direct uses in waste treatment, as a filler, as a fertilizer.

RED MUD CONSTITUENT OF VARIOUS PLANTS

Company	constituents, wt %				
	Fe ₂ O ₃	Al ₂ O ₃	TiO ₂	SiO ₂	Na ₂ O
Al. Corpn.	20.26	19.60	28.00	6.74	8.09
MALCO	45.17	27.00	5.12	5.70	3.64
HINDALCO	35.046	23.00	17.20	5.00	4.85
BALCO	33.80	15.58	22.50	6.84	5.20
NALCO*	52.39	14.73	3.30	8.44	4.00
Hungary	38.45	15.20	4.60	10.15	8.12
Jamaica	50.9	14.20	6.87	3.40	3.18
Surinam	24.81	19.00	12.15	11.90	9.29
ALCOA Mobile	30.40	16.20	10.11	11.14	2.00
Arkansas	55.6	12.15	4.5	1.5-5.0	Traces
Sherwon	50.54	11.13	Traces	2.56	9.00
FRG Baudart	38.75	20.00	5.5	13.00	8.16

PRESENT AND FUTURE GENERATION OF RED MUD IN INDIA

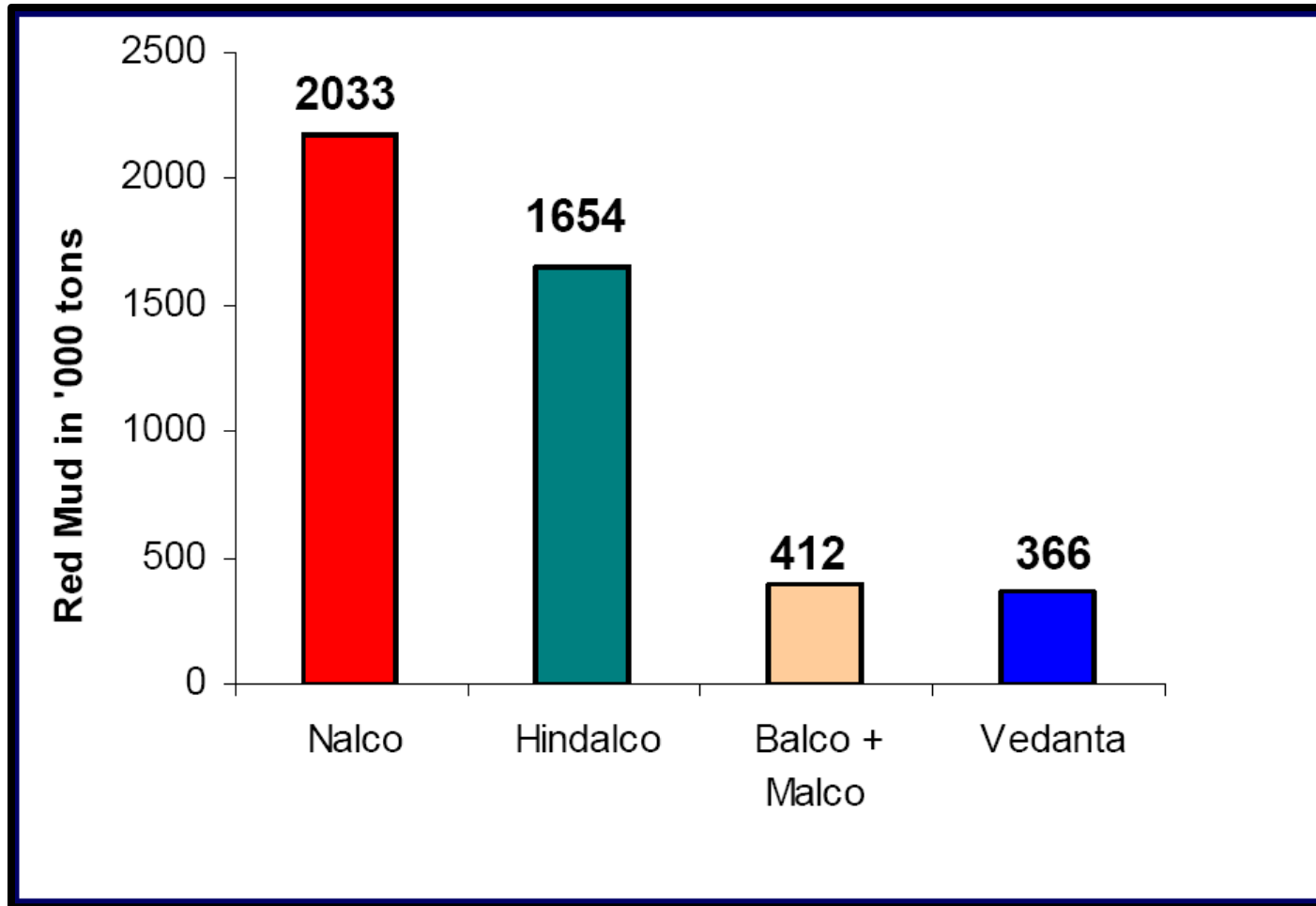
RED MUD GENERATION IN INDIA – Present & Projections			
Company	(i)Present generation (Lakhs Ton/Annum)	Company	(ii) Addl.Gen. by 2010 (Lakhs Ton/Annum)
NALCO	20.47	NALCO	6.50
HINDALCO	16.07	HINDALCO	4.55
BALCO	2.97	VEDANTA	18.20
MALCO	0.95	UTKAL	19.50
TOTAL	40.46	RAYKAL	18.20
		ADITYA	18.20
		JSW	18.20
		TOTAL	96.85
Grand Total - (i) + (ii)			137.31

Nalco

Red Mud Ponds of NALCO Damanjodi



Nalco

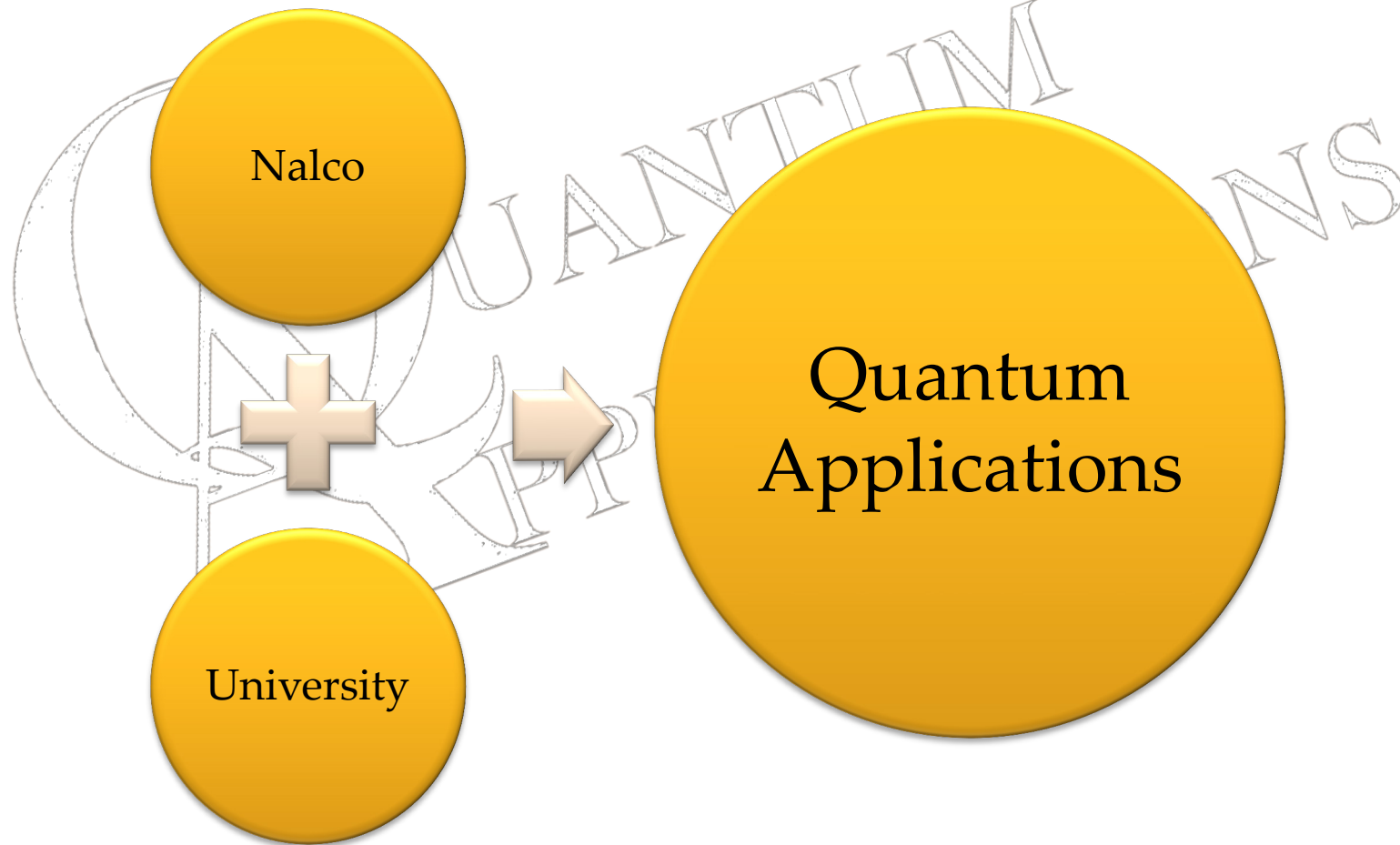


Total Red Mud Generation for 2008-09

MITIGATION OF RED MUD POLLUTION – A TECHNO-COMMERCIAL PERSPECTIVE

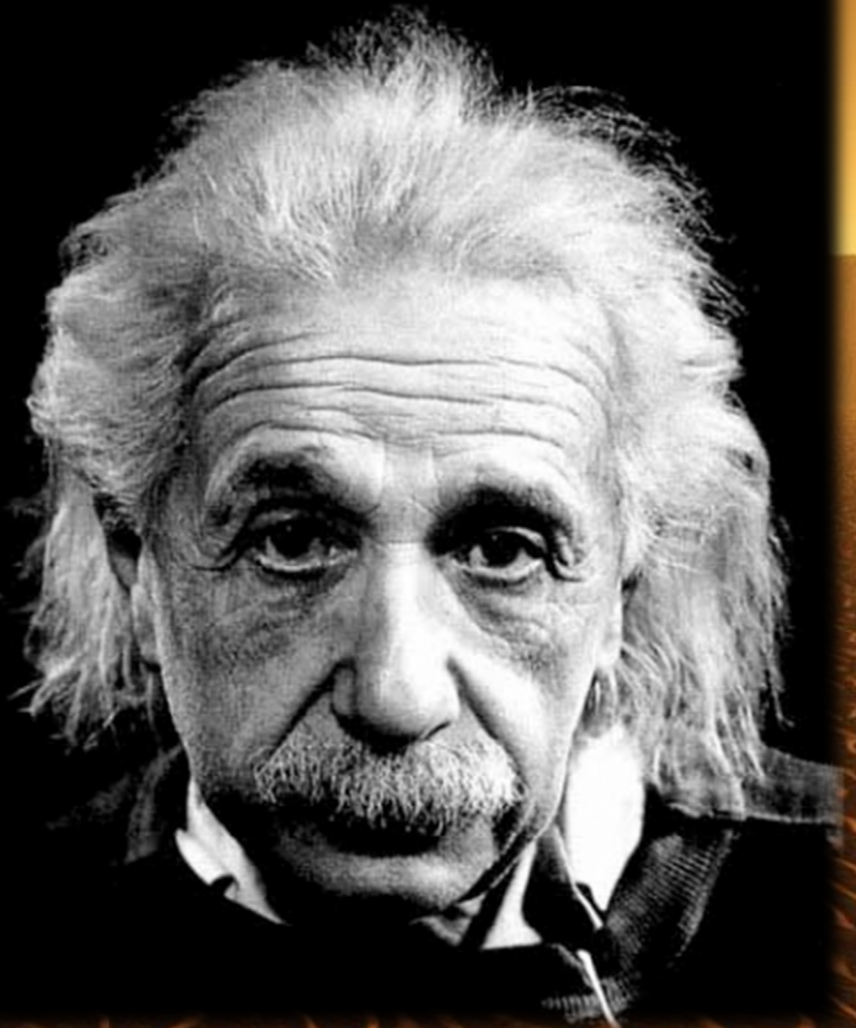
- To mitigate the environmental impact of Red Mud, a combined approach of research and development, process and industrialization is required.
- The roles defined are
 - Nalco – Red Mud and environment compliance.
 - University – Research & Development, Proof of concept.
 - Quantum Applications – Industrial Partners to university and Nalco for converting proof of concept to pilot scale and subsequent commercialization

A COMBINED FORCE TO MITIGATE THE ISSUE OF RED MUD



“Everything should be made
as simple as possible,
but not simpler.”

Albert Einstein



Thank You For Listening

Any Questions?

