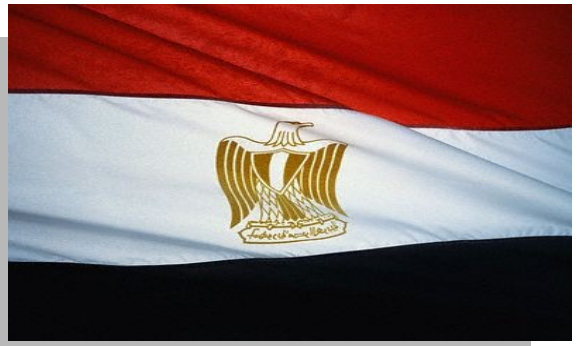


Uranium from phosphates – Current status of Egyptian UxP project

Dr. Mohamed H. Taha

Regional Training Course on "United Nations Framework Classification – 2009 for evaluation of uranium and thorium resources and to leverage transparent and effective communications"

Venue: Luxor, Egypt

18 - 22 October, 2015

OUTLINES

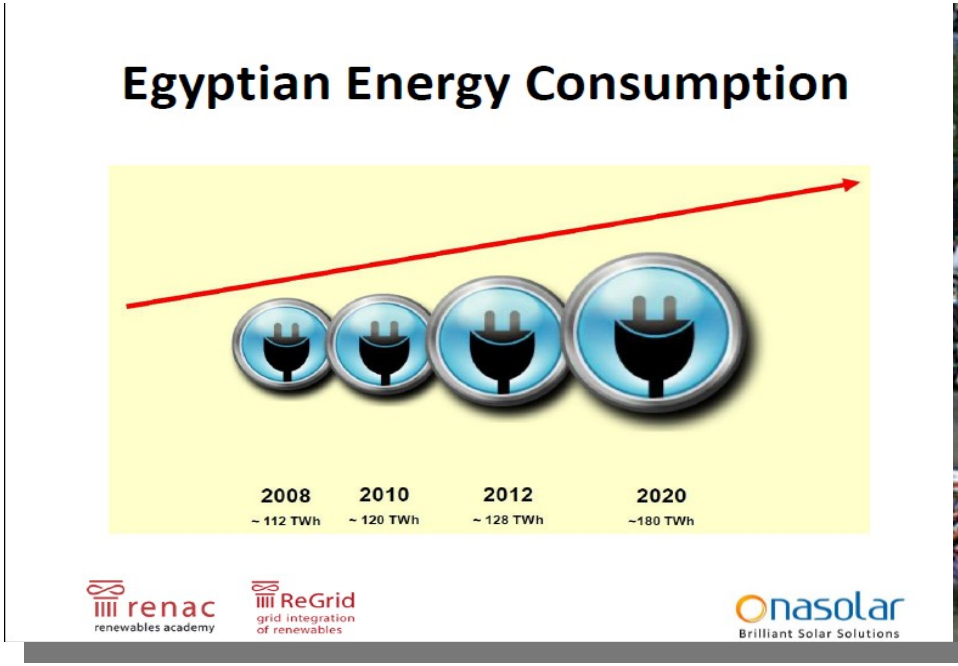
I. Introduction (why phosphate?????).

II. Uranium Resources in Egyptian Phosphate Rocks.

III. NMA-IAEA National Project (EGY 2011/ 01).

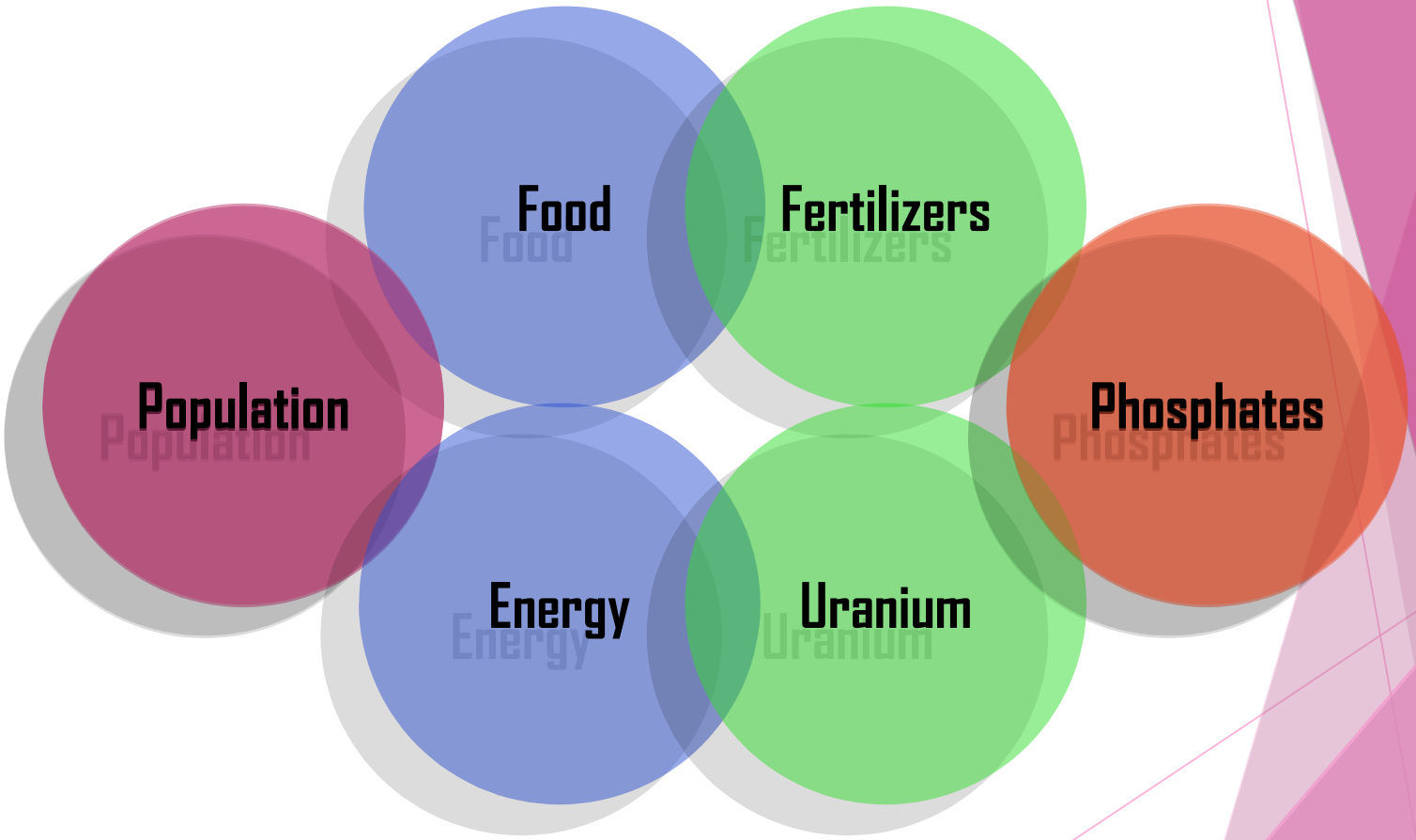
I. Introduction (why phosphate??)

Sustainable Development, 21 Century



- Main Challenges for sustainable development in the 21 century are food security and energy security.
- These Challenges are in favors of U recovery from phosphoric acid.

Phosphate Importance

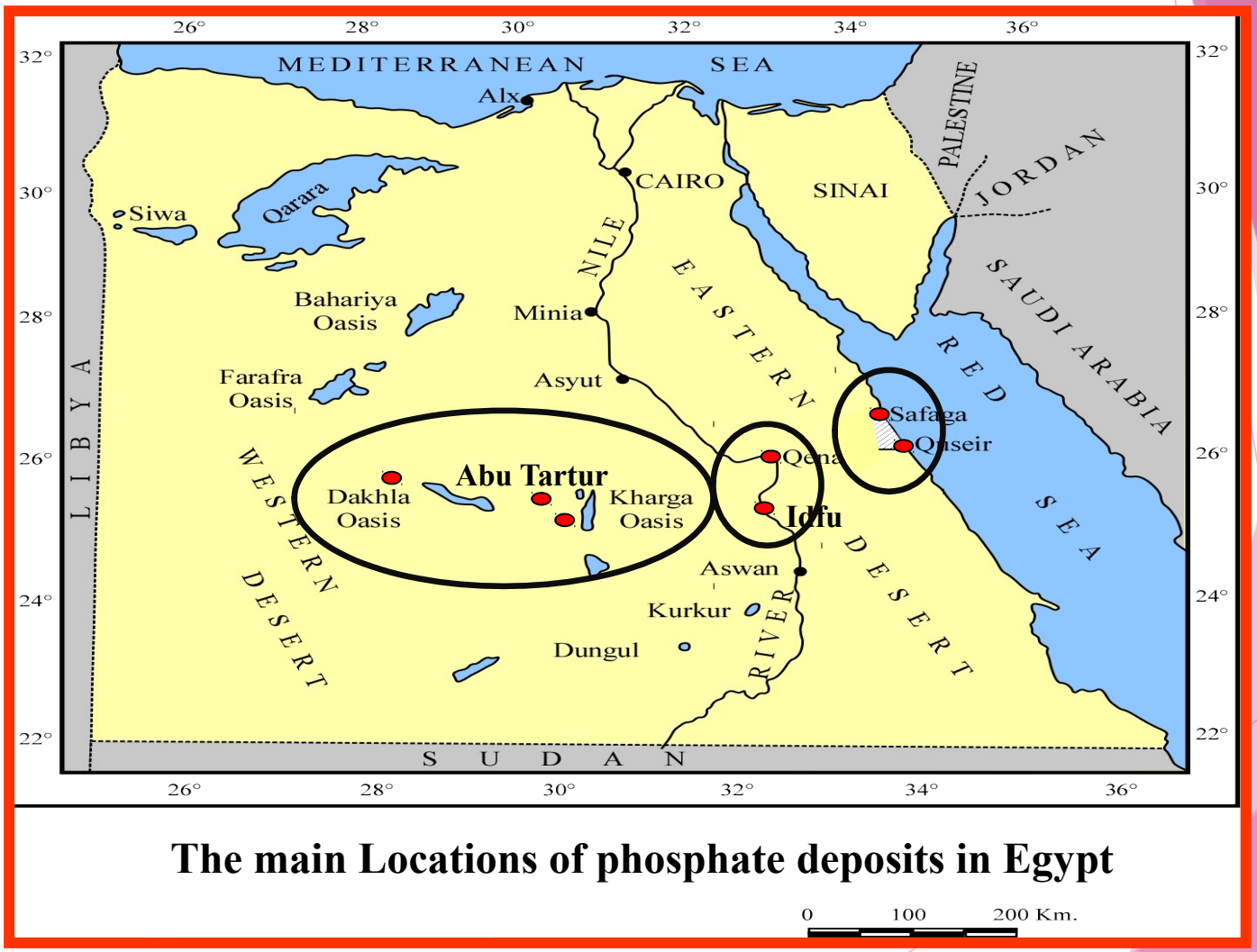


II. Uranium Resources in Egyptian Phosphate Rocks

Major phosphate producing countries in 2014, Mt

	Mine production		Reserves[4]
	2013	2014[e]	
United States	31,200	27,100	1,100,000
Algeria	1,500	1,500	2,200,000
Australia	2,600	2,600	1,030,000
Brazil	6,000	6,750	270,000
Canada	400	--	76,000
China[5]	108,000	100,000	3,700,000
Egypt	6,500	6,000	715,000
India	1,270	2,100	35,000
Iraq	250	250	430,000
Israel	3,500	3,600	130,000
Jordan	5,400	6,000	1,300,000
Kazakhstan	1,600	1,600	260,000
Mexico	1,760	1,700	30,000
Morocco and Western Sahara	26,400	30,000	50,000,000
Peru	2,580	2,600	820,000
Russia	10,000	10,000	1,300,000
Saudi Arabia	3,000	3,000	211,000
Senegal	800	700	50,000
South Africa	2,300	2,200	1,500,000
Syria	500	1,000	1,800,000
Togo	1,110	1,200	30,000
Tunisia	3,500	5,000	100,000
Vietnam	2,370	2,400	30,000
Other countries	2,580	2,600	300,000
World total (rounded)	225,000	220,000	67,000,000

The Main Exploited Phosphate Ore in Egypt



The main Locations of phosphate deposits in Egypt

0 100 200 Km.

Average Chemical Composition of Egyptian Phosphates

Constituent, %	Nile Valley	Red Sea	New Valley
P_2O_5	24.8	19.3	27.3
CaO	43.5	43.9	40.1
MgO	1.5	5.3	1.2
Fe_2O_3	2.2	1.2	2.9
Al_2O_3	1.8	2.2	1.7
SiO_2	12.1	3.7	6.1
C_{total}	2.1	4.6	1.9
S_{total}	1.3	0.5	3.5
Na_2O	1.6	1.7	0.7
F	1.1	1.2	3
Moisture	2.0	2.1	2.2
U, ppm	100	150	30

In Egypt, the proved phosphate reserves are estimated at about 100 million tons while the geological reserves are calculated as about 2000 million tons. The average assay of uranium in the Egyptian phosphate ores is about 90 ppm, consequently, the phosphate assured reserves are estimated to contain about 9,000 tons uranium at least.

Phosphoric Acid Production

- *In Egypt;* Phosphoric acid is produced mainly at Abu-Zaable Fertilizer Company and El-Nassar Company.
- The total phosphoric acid production capacity is about 200,000 ton/ year.
- Average uranium content in produced phosphoric acid is ≈ 60 ppm.

Uranium Extraction Unit

- *In 1996,* **Nuclear Materials Authority** has established a semi-pilot plant for experimental uranium extraction from di-hydrated phosphoric acid using D_2EHPA & TOPO system.

Phosphoric Acid Pretreatment Stage

First Cycle

Second Cycle

Uranium Extraction Unit

Uranium Extraction

Pre-Treatment Tanks

Safe Room

Uranium Stripping

- The phosphoric acid industry is now undergoing a gradual shift towards using the Hemihydrate Process and Hemi-Dihydrate Process for economic reasons. The main Advantages of this process are the direct production of strong phosphoric acid ≈ 45 % P_2O_5.

III. NMA-IAEA National Project EGY 2011/ 01

- Basic Information:

Country	Egypt
Institution	Nuclear Materials Authority
Counterpart Name	Prof. Dr. Nagdy Mohamed Farag
Project Number & Title:	EGY 2011/01 & Separation and estimation of valuable rare metal during uranium ore processing in the Eastern Desert
Effective Starting Date:	1/1/2014
Expected End Date:	31/12/2015
Total Project Budget:	IAEA TCF: 160,000.0 €

•Project Objectives:

Main Project Objectives:

- Contribution to the Egyptian energy plan by supplying uranium for the Egyptian Peaceful Nuclear program.
- Development the Egyptian phosphate industry.

•Project Objectives:

Detailed Project Objectives & Dependencies:

- Classification of Egyptian phosphate resources based on UNFC2009 system.
- Pretreatment of high strength phosphoric acid.
- Design new Mixer-settler unit for high strength phosphoric acid.
- Achievement the infrastructure for the revamped unit.
- Organic solvent making up.
- Evaluating the experimental data for UxP pre-feasibility study.
- Utilization of PG to increase the economy of phosphate industry.
- Recovery of REEs from PG to add value for phosphate industry.

- Expert Mission:

(1)Julian Hilton& Tapan Haldar during 7-11 September 2014


NMA
National Work Shop
For
Development The Egyptian
Phosphatic Industries
IAEA

•Expert Mission:

Recommendations:

- NMA should adopt an Integrated Program Management approach to gather all current projects with potential to contribute to the national uranium fuel need into a single Integrated Program.

Work Breakdown Structure:

- Experiments in the Laboratory:
- Design, Engineering & construction of the 'Bench Scale Facility':

- Expert Mission:

(2) Hassan El-Shall

during 26-30 July 2015

•Expert Mission:

Recommendations:

- Continue the financial support of this project to replace missing equipment and provide sensors and automatic control.
- Provide support for the efforts to conduct feasibility studies for commercial size plants to:

A. recover uranium and REE from concentrated phosphoric acid.

B. various uses of phosphogypsum.

•Equipments

1)Complete set of Mixer-Settlers unit. (delivered)

2)Spring return metering pump. (delivered)

3)Quality control lab equipments. (delivered)

- Fellowships & Scientific visit:

1)Fellowships were already submitted to IAEA; *(2 Japan, 3 Brazil, 2 France, 1 Poland,…..).*

2)Scientific still looking for a hosting place.

•Achieved Objectives :

1)Clearly defined value proposition; Project team, partners and techo-economic feasibility study in place.

2)Studying pretreatment of high strength phosphoric acid.

3)Design a new Mixer-settler unit for high strength phosphoric acid.

4)Investigating uranium extraction from high strength phosphoric acid (lab scale).

5)Classification of Egyptian phosphate resources based on UNFC-2009 system.

6)Design, Engineering & construction of the.

•Partially Achieved Objectives :

1)Evaluating the experimental data to help in the UxP pre-feasibility study.

2)Feasibility study for PG application in bricks & fertilizers.

3)Feasibility study for low grade phosphate utilization.

•Not Achieved Objectives :

1)Scale up the existing unit to commercial scale.

2)Recovery of REEs from PG.

3)Pre-feasibility study for food grade phosphoric acid production process

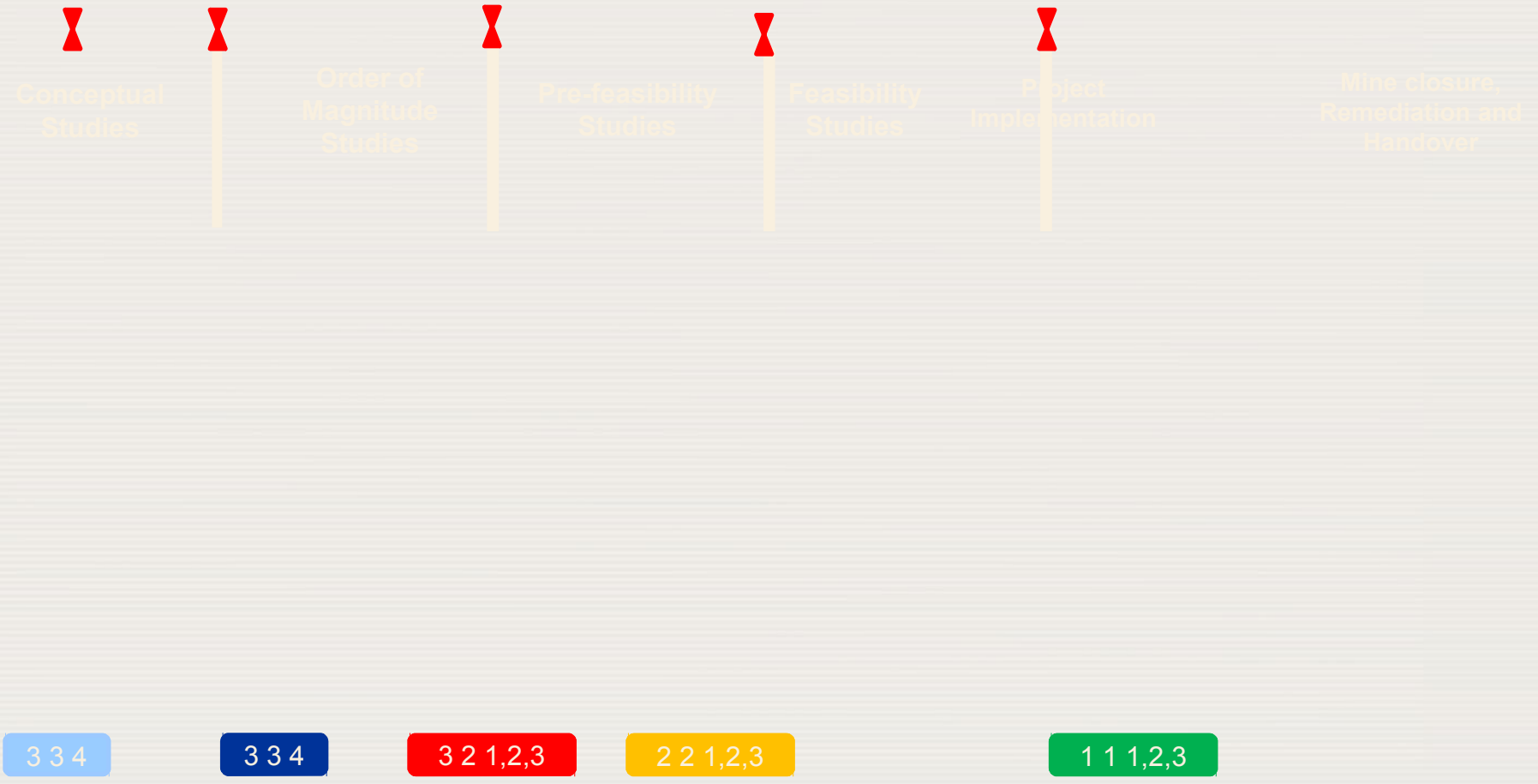
The obstacles:

1)Needing an expert mission for helping us to scale up the existing unit to commercial scale.

2)Needing suitable places to host the required fellowships and scientific visits.

3)Needing to more time and more fund to achieve the other objectives.

Comprehensive extraction lifecycle



Accurate and transparent management of essential materials throughout the lifecycle

IAEA


AP Photo