Uranium and Thorium Production in Brazil - Present and Near Future Status -

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UOC PRODUCTION MANAGER
THORIUM RESERVES IN BRAZIL

This theme will be the subject of the next presentation by the Geologist Getulio Miyasaki, from the Brazilian Nuclear Energy Commission.
THORIUM PRODUCTION IN BRAZIL

Nowadays there are no records about currently thorium compounds production in Brazil.

In the same way, there are no informations about plans for thorium minerals exploitation to produce its compounds in the near future in the Brazilian country.
## BRAZILIAN URANIUM MINERAL RESERVES

<table>
<thead>
<tr>
<th>NAME / LOCATION(</th>
<th>RESERVES CATEGORIES (t U3O8)</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RAR</td>
<td>EAR</td>
</tr>
<tr>
<td></td>
<td>U3O8 &lt;40 US$/lb</td>
<td>U3O8 &lt;40 US$/lb</td>
</tr>
<tr>
<td>CIPC – POÇOS DE CALDAS</td>
<td>500</td>
<td>4.000</td>
</tr>
<tr>
<td>CAETITÉ / LAGOA REAL</td>
<td>94.000</td>
<td>6.770</td>
</tr>
<tr>
<td>SANTA QUITÉRIA / ITATAIA</td>
<td>83.000</td>
<td>59.500</td>
</tr>
<tr>
<td>OTHERS (a)</td>
<td>-</td>
<td>61.600</td>
</tr>
<tr>
<td>TOTAL</td>
<td>177.500</td>
<td>131.870</td>
</tr>
</tbody>
</table>

(a) Related to the following áreas:
- Rio Cristalino (PA);
- Amorinópolis and Rio Preto/Campo Belo (GO);
- Poços de Caldas and Gandarela (MG);
- Figueira (PR) and Espinharas (PB)

A 10,000 M DRILLING WORK IS CURRENTLY ON COURSE AT CAETITÉ / LAGOA REAL REGION IN AN EFFORT TO ENHANCE THE LOCAL RESERVE AND BETTER UNDERSTAND THE GEOLOGY OF THE REGIONAL DEPOSITS
CURRENT URANIUM CONCENTRATE PRODUCTION
CAETITÉ MILL FACILITY

- Initial Production Essays: 2000
- Commissioned in November/2001

<table>
<thead>
<tr>
<th>UNIT OPERATION</th>
<th>NOMINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ore Crushing Capacity (t/y)</td>
<td>200,000</td>
</tr>
<tr>
<td>Ore Treatment Capacity (t/y)</td>
<td>200,000</td>
</tr>
<tr>
<td>U Concentrate Production (t/y U₃O₈)</td>
<td>400</td>
</tr>
</tbody>
</table>
ORE AGGLOMERATOR AND HEAP BUILDING
HEAP BUILDING IN THE LEACHING PAD AND THE CHEMICAL PLANT
CURRENT U PURIFICATION PROCESS

- Solvent extraction with tertiary ammine
- Stripping with NaCl solution
- Precipitation as ADU
- Solid / liquid separation and precipitate washing in a decanter & vacuum belt filter system
- Washed precipitate drying
NEAR FUTURE URANIUM CONCENTRATE PRODUCTION
The expansion of Lagoa Real, Caetité Unit is on course. The nominal capacity will be doubled to 800 t U₃O₈/year and includes the replacement of heap leaching by conventional agitated leaching and also changes in the process root. The overall investment is estimated at 90 x 10⁶ US$ and the operation scheduled for 2015.
### CHANGES IN THE U PURIFICATION & PRECIPITATION

<table>
<thead>
<tr>
<th>CURRENT PROCESS</th>
<th>TO BE CHANGED TO:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solvent extraction with tertiary amine</td>
<td>Same</td>
</tr>
<tr>
<td>Stripping with NaCl</td>
<td>Stripping with sulfuric acid</td>
</tr>
<tr>
<td>Precipitation with ammonia</td>
<td>Precipitation with H\textsubscript{2}O\textsubscript{2}</td>
</tr>
</tbody>
</table>
MILL LIQUID EFFLUENT TREATMENT

The mill liquid effluent is treated with milk of lime up to pH 10. The precipitate slurry is pumped into a HDPE membrane lined pond that has a bottom drainage system. The solid phase is retained in this pond while the liquid one is fed back into the leaching production process.
This area will also be modified to meet the raffinate flow rate increase and to improve its efficiency.
SANTA QUITÉRIA / ITATAIA PROJECT

Proposal:

- Exploration of phosphate and uranium ore to produce:
  - MAP;
  - DCP;
  - $U_3O_8$.

Investment cost: US$ 350 x 10^6

Production Capacity:
- 240,000 t/y of $P_2O_5$
- 1,500 t/y of $U_3O_8$
## SANTA QUITÉRIA / ITATAIA PROJECT

<table>
<thead>
<tr>
<th></th>
<th>Recoverable</th>
<th>Geological</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Ore Reserves:</td>
<td>80 \times 10^6 t</td>
<td>520 \times 10^6 t</td>
</tr>
<tr>
<td>Main Content:</td>
<td>11% in P_2O_5, 0.1% in U_3O_8</td>
<td>1.92% in P_2O_5, 0.02% in U_3O_8</td>
</tr>
<tr>
<td>Phosphate Reserve:</td>
<td>9 \times 10^6 t P_2O_5</td>
<td>10 \times 10^6 t P_2O_5</td>
</tr>
<tr>
<td>Uranium Reserve:</td>
<td>83 \times 10^3 t U_3O_8</td>
<td>90 \times 10^3 t U_3O_8</td>
</tr>
<tr>
<td>Marble Reserve</td>
<td>&gt; 300 \times 10^6 m^3</td>
<td></td>
</tr>
</tbody>
</table>

**SANTA QUITÉRIA / ITATAIA PROJECT**

**Recoverable**

- Total Ore Reserves: 80 \times 10^6 t
- Main Content: 11% in P_2O_5, 0.1% in U_3O_8
- Phosphate Reserve: 9 \times 10^6 t P_2O_5
- Uranium Reserve: 83 \times 10^3 t U_3O_8
- Marble Reserve: > 300 \times 10^6 m^3

**Geological**

- Total Ore Reserves: 520 \times 10^6 t
- Main Content: 1.92% in P_2O_5, 0.02% in U_3O_8
- Phosphate Reserve: 10 \times 10^6 t P_2O_5
- Uranium Reserve: 90 \times 10^3 t U_3O_8

INB
SANTA QUITÉRIA / ITATAIA PROJECT

The Santa Quitéria Project is applying for local / construction licenses, now under the new guidelines imposed by Brazil’s federal environment regulatory authority, IBAMA. Pilot tests have been carried out for phosphate and uranium production. Project design is in progress. The construction is expected to end by 2015 with an initial capacity of 1,100 t $U_3O_8$/year with a ramp up to produce 1,500 t/year.
CONCLUSIONS

Thorium Compounds Production:
- No current production activities.
- No known plans for a near future production.

Uranium Concentrate Production:
- Current Production: 400 t U$_3$O$_8$/year
- Production plans for 2015: 2,300 t U$_3$O$_8$/year
Thank You

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