

Indústrias Nucleares do Brasil - INB

IMPLEMENTATION OF A NEW MILLING PROCESS AT CAETITÉ-BRAZIL URANIUM SITE

L.A. Gomiero^a, H. Rangel Jr.^a, C.A. Morais^b

^aIndústrias Nucleares do Brasil S/A- INB, Caetité-BA, Brazil.

^bCentro de Desenvolvimento da Tecnologia Nuclear –
CDTN/CNEN, Belo Horizonte-MG, Brazil.

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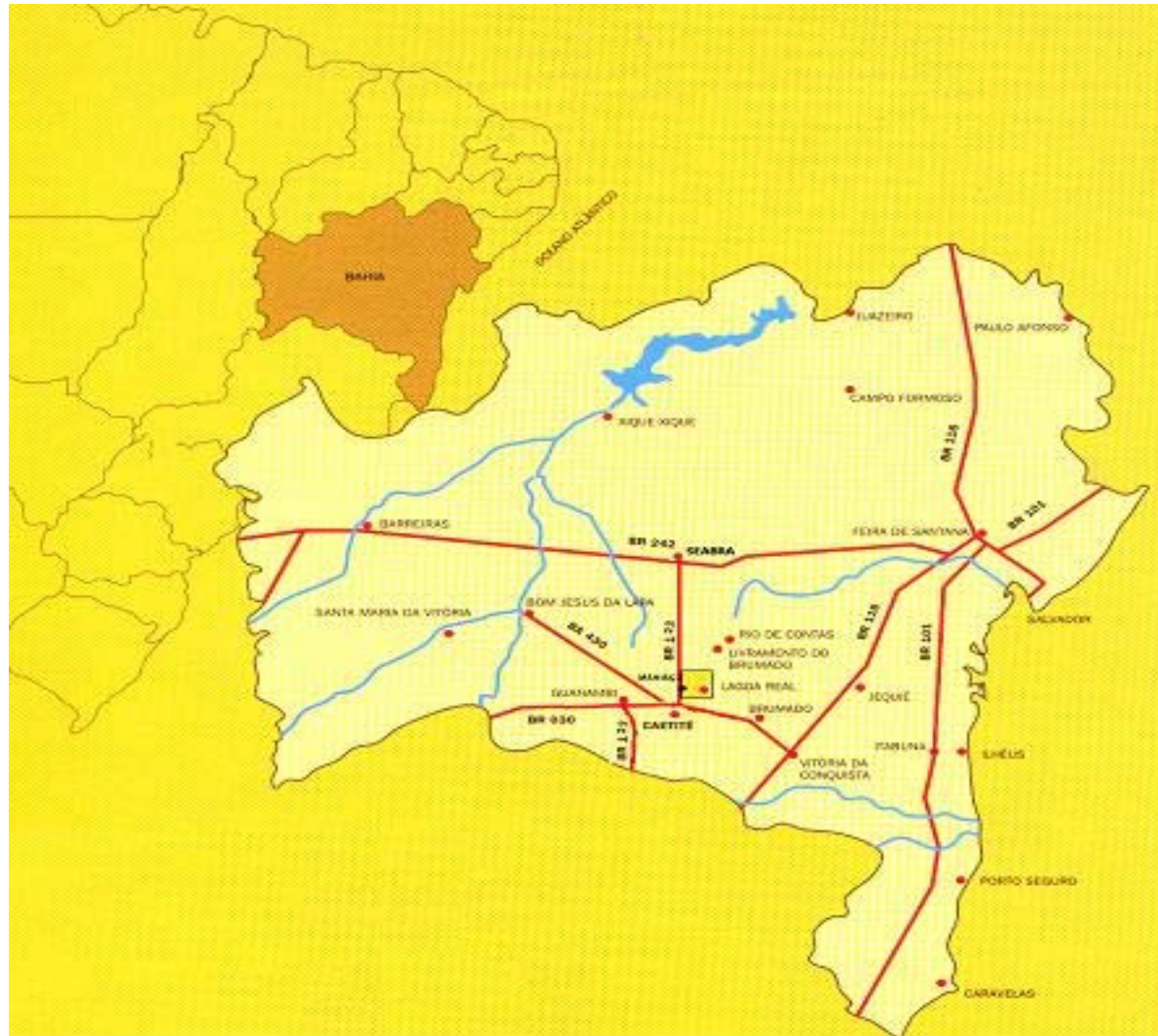
CAETITÉ - BRAZIL FACILITY

Is a mining and milling facility to produce uranium ore concentrate:

- Open pit mining (and underground in a near future).
- Physical & Chemical ore processing plant



CAETITÉ MINE AND MILL FACILITIES LOCATION



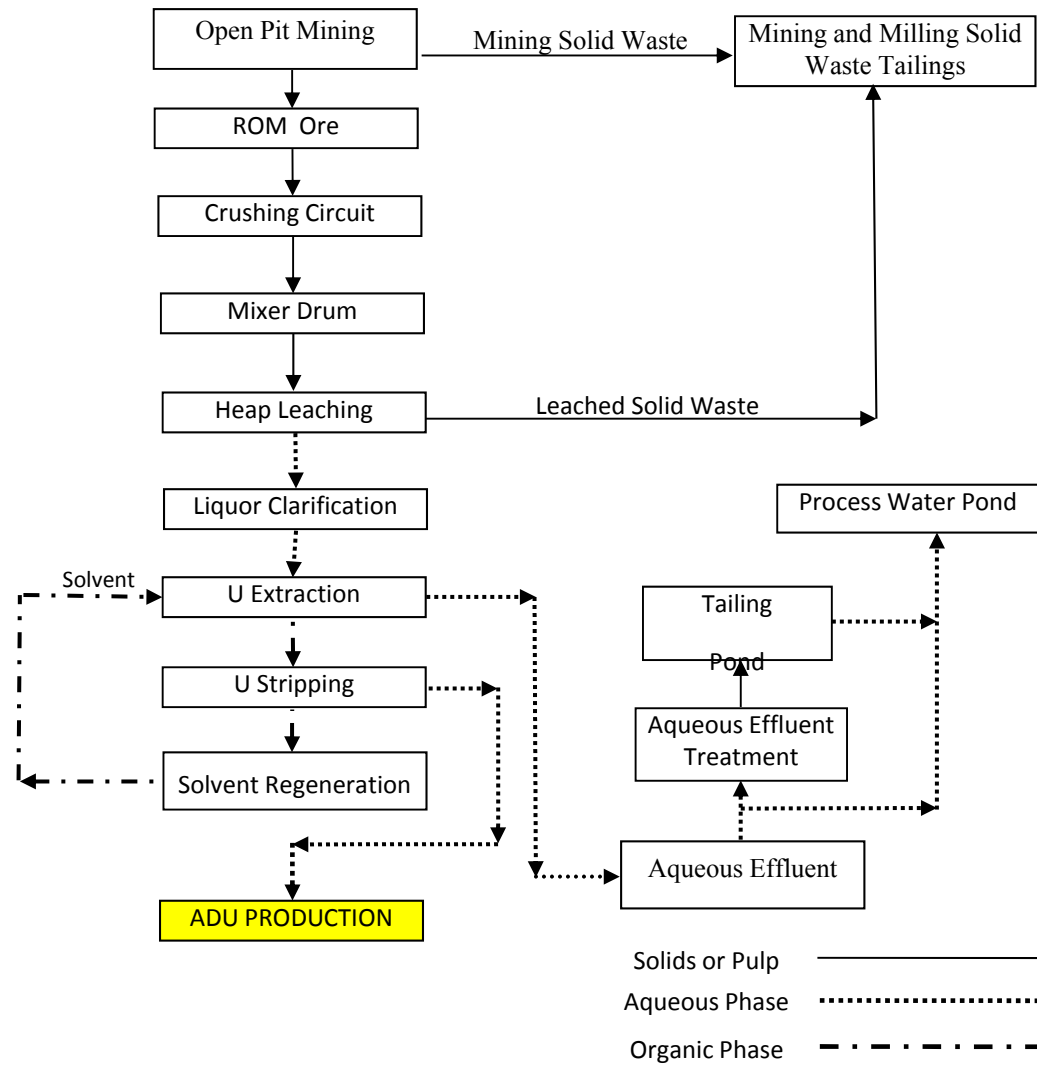
CURRENT CAETITÉ MILL FACILITY



Ore Treatment Capacity (t/y)	200,000
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U Concentrate Production (t/y U₃O₈)	400
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SIMPLIFIED CURRENT GENERAL PROCESS FLOWSHEET



MAIN TARGETS FOR THE MILL EXPANDED PRODUCTION DESIGN

- Increase the UOC production from 400 to 800 t/y as U_3O_8 ;
- Increase the U recovery from 78% to at least 95%;
- Increase the sustainability by avoiding the use of pollutant chemicals;
- Production of a UOC with higher purity.

CHANGES IN THE CURRENT PROCESS

To achieve the established targets the following changes have to be carried out in the current milling process:

- a) Replacement of the heap leaching process by conventional tank agitated leaching ;
- b) Replacement of the sodium chloride stripping solution by high concentrated sulfuric acid solution (~ 4 mol/L) and,
- c) Replacement of ammonia/ammonium hydroxide solution by hydrogen peroxide solution at the uranium precipitation step.

INCREASING PRODUCTION AT CAETITÉ SITE

The current process and the INB's plans for changing the leaching process and increasing the production at INB/Caetité site were the subject of two presentations :

URAM-2009, Vienna, 2009

URANIUM 2010, Saskatoon (Canada), 2010

In both time plans were mentioned to change the heap leach to conventional agitated leaching process taking advantage of the agitated leaching and filtration equipments existing at the old INB facility in Caldas/MG.

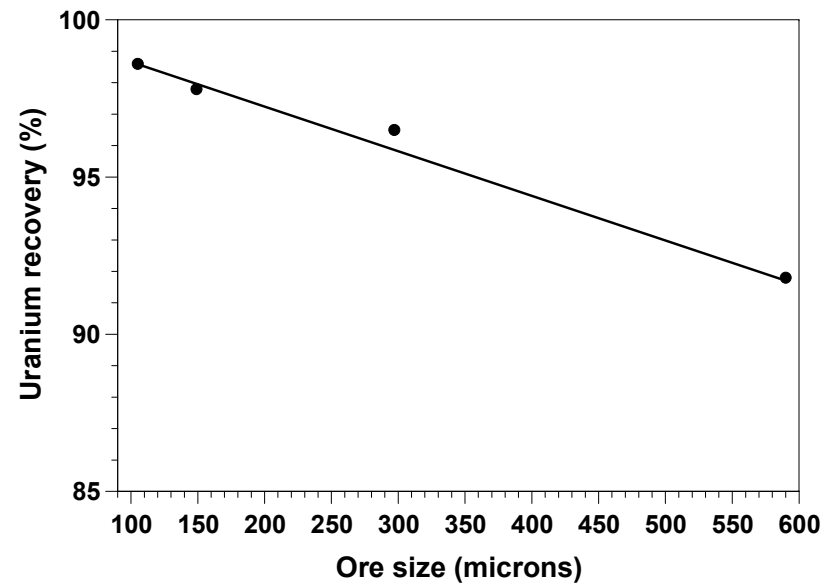
After economical evaluation INB decided to buy new equipments for the enlargement of the Caetité mill facility.

TYPICAL ANALYSIS OF THE CAETITÉ ORE

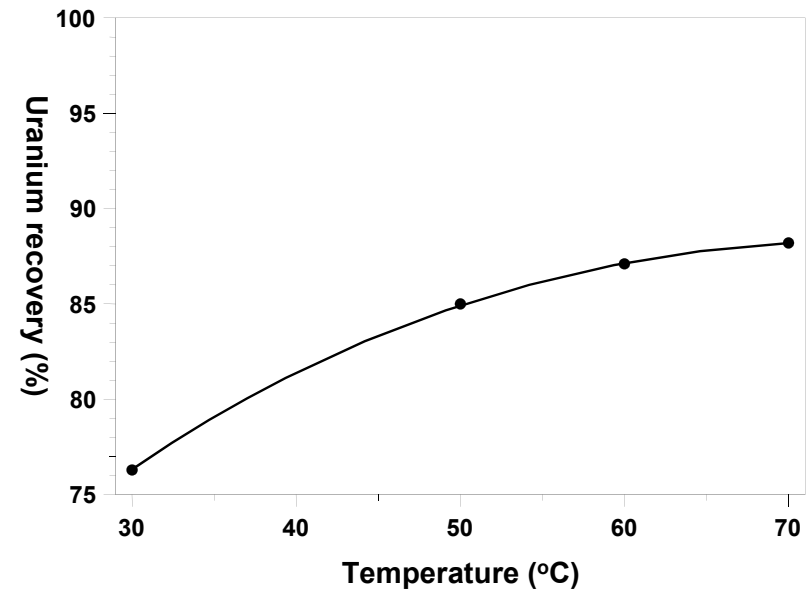
Species	Content (wt%)	Species	Content (wt%)	Species	Content (wt%)
Moisture	< 0.01	V ₂ O ₅	0.15	MnO	0.10
L.I. 500°C (*)	0.12	Al ₂ O ₃	13.6	ZrO ₂	0.12
L.I. 900°C (*)	0.52	Fe ₂ O ₃	7.0	MgO	2.75
U ₃ O ₈	0.283	P ₂ O ₅	0.05	Na ₂ O	7.5
SiO ₂	58.1	CaO	5.38	K ₂ O	0.92
TiO ₂	0.42	SO ₄ ²⁻	0.52	Y ₂ O ₃	< 0.01
(*) L.I. = Loss on Ignition					

INVESTIGATION OF THE BEST LEACHING CONDITIONS

Ore Particle Size:



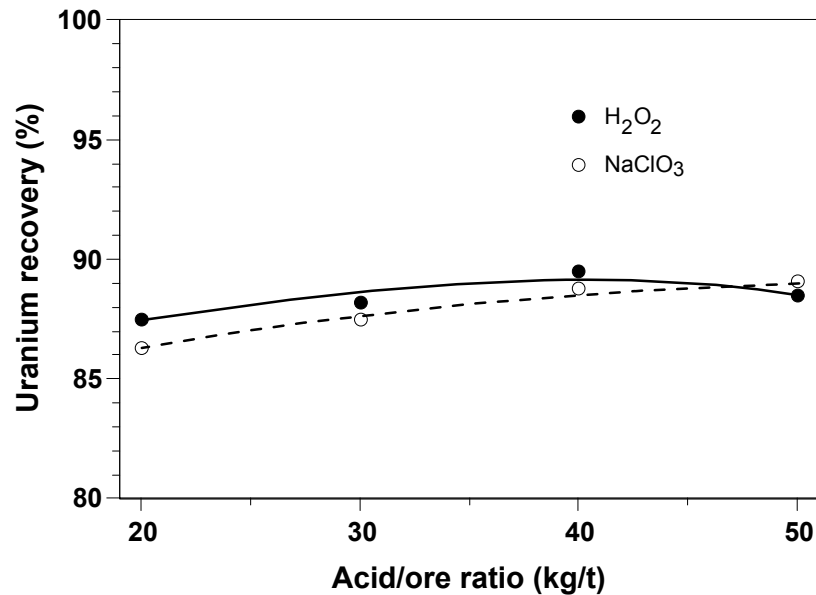
Temperature:



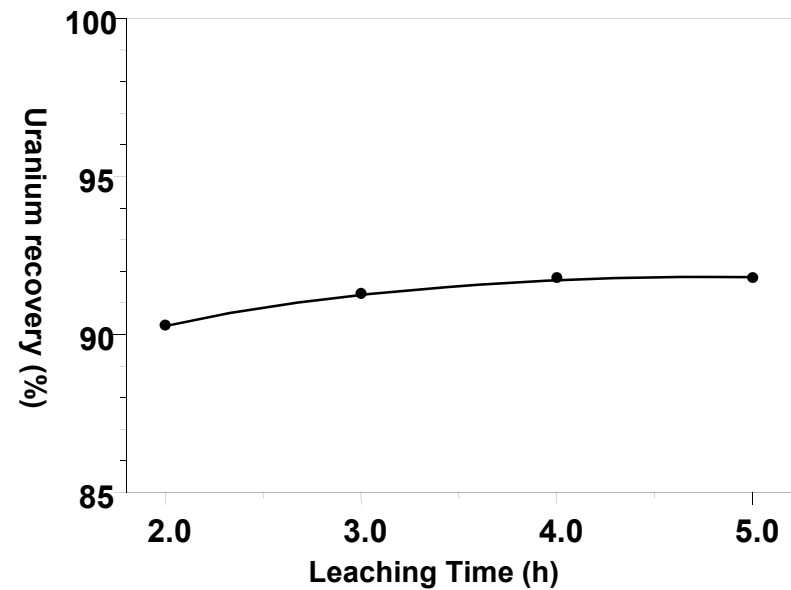
INVESTIGATION OF THE BEST LEACHING CONDITIONS

Acid / Ore ratio:

Will depend on the carbonate content in the ore.



Leaching Time:



INVESTIGATION OF THE BEST LEACHING CONDITIONS

Main conditions for the new plant design:

Ore particle size: ~ 400 microns

Temperature: 70 to 80 °C

Acid / ore ratio: ~ 60 kg H₂SO₄ 98%/t of ore

Oxidant / ore ratio: ~ 0,6 kg NaClO₃ / t of ore

Leaching time: 4 hours

Slurry density: 60 to 65 solids wt%.

Expected U Recovery: > 95%

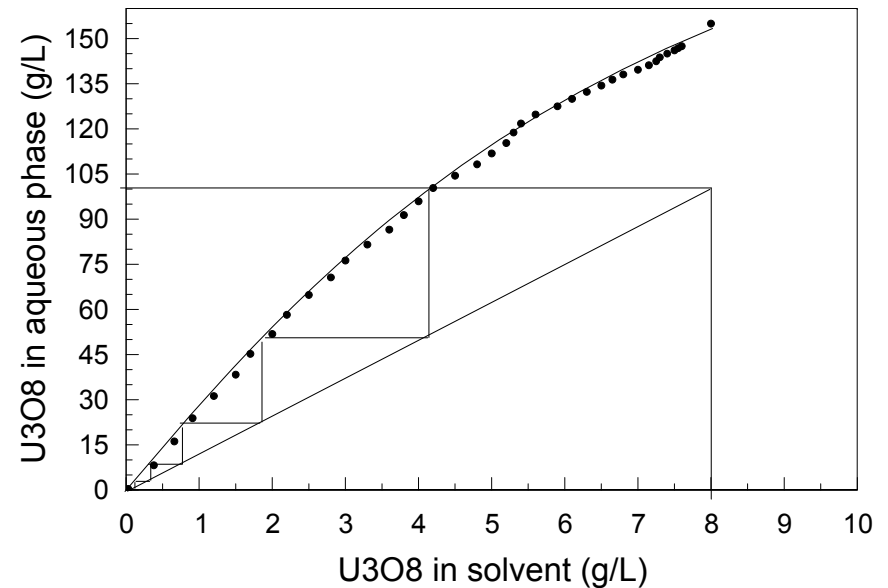
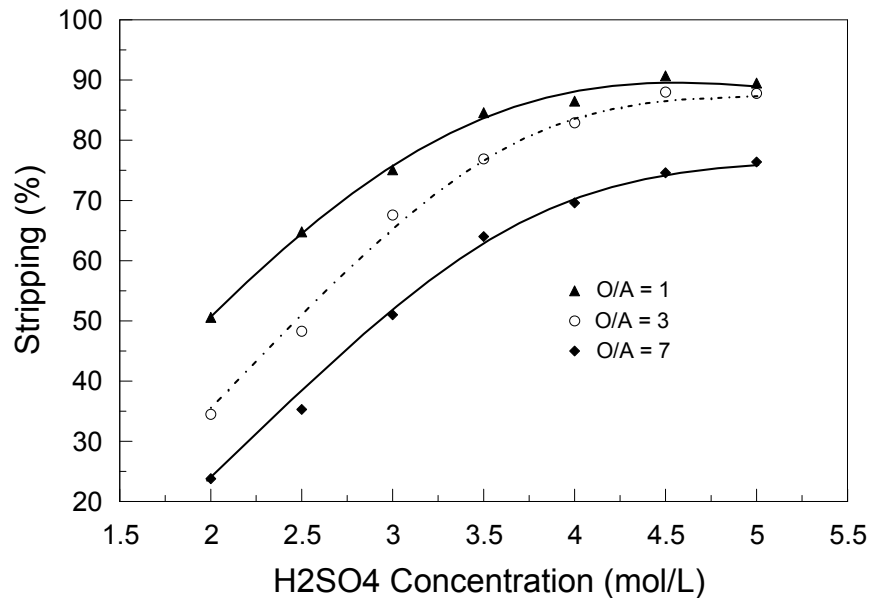
U STRIPPING WITH STRONG SULFURIC ACID SOLUTION

H_2SO_4 conc. = 4.2 mols/L

Number of stages: 6

Aqueous continuous phase
in the mixers

U_3O_8 conc. in the pregnant
strip Solution (PSS): ~100 g/L



U STRIPPING WITH STRONG SULFURIC ACID SOLUTION

NEUTRALIZATION OF THE EXCESS SULFURIC ACID IN THE PSS:

Neutralization agent: limestone

Final pH = ~ 2.5

Reaction time: 4 Hours

SOLID / LIQUID SEPARATION OF THE NEUTRALIZED PULP:

Centrifuge or Vacuum Belt Filter

Gypsum washing

Recycle of the washed gypsum to the ore leaching step

URANIUM PRECIPITATION

URANIUM PRECIPITATION FROM THE FILTRATE:

Precipitation Agent: H_2O_2 50 wt%

Final pH = 3 to 3.5

Reagent for the pH control: MgO / $\text{Mg}(\text{OH})_2$

SOLID / LIQUID SEPARATION:

Centrifuge or Vacuum Belt Filter

Precipitate washing

Precipitate calcination

SIMPLIFIED SCHEDULE OF THE PROJECT

Preparation of the basic and detailed designs:

The choice of the engineering company was completed and the contract will be signed in July 2014.

The estimated time for completion of work is 12 months.

THANKS

gomiero@inb.gov.br



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