INT/2/019 - Deploying Technology and Management of Sustainable Uranium Extraction Project

IAEA-UNECE Interregional Training Course on
“Uranium, Coal, Oil and Gas Classification: Towards a Better Understanding of Energetic Basins and Application of UNFC-2009”

Case Study: Application of UNFC-2009 to Uranium Resources and Associated Critical Materials in Argentina

Presented by Luis López (CNEA)

Ulaanbaatar, Mongolia
16 – 19 August 2016
OUTLINE

• NUCLEAR FUEL CYCLE IN ARGENTINA
• URANIUM RESOURCES IN THE OECD-NEA / IAEA SCHEME
• URANIUM RESOURCES IN THE UNFC-2009
• DISCUSSION
• FINAL CONSIDERATIONS
NUCLEAR FUEL CYCLE

Source: IAEA, 2010
URANIUM CONSUMPTION IN A NPP

LIGHT WATER REACTOR (LWR) – 1,000 MWe

• Initial loading: 72 t U (LEU)

LEU 4 % U-235, DU 0.3 % U-235 $\rightarrow$ 650 t U (natural)

• Annual consumption: 24 t U (LEU)

LEU 4 % U-235, DU 0.3 % U-235 $\rightarrow$ 217 t U (natural)

60 years $\rightarrow$ 14,000 t U

Source: WISE Uranium Project, 2013; WNA, 2013
HEAVY WATER REACTOR (HWR) – 1,000 MWe

- Initial loading: 400 – 500 t U (natural)
- Annual consumption: 140 – 160 t U (natural)

60 years → 9,500 t U

Source: WNA, 2013
ARGENTINE NPPs

- **ATUCHA I**
  - 357 Mwe
  - Slightly Enriched U

- **EMBALSE**
  - 648 Mwe
  - Natural U
  - (Refurbishment)

- **ATUCHA II**
  - 692 Mwe
  - Natural U

Source: CNEA, 2015
## U Demand in Argentina

<table>
<thead>
<tr>
<th>NPP</th>
<th>Operation Start</th>
<th>Remaining Operation</th>
<th>Demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atucha I</td>
<td>1974</td>
<td>2016 – 2027</td>
<td>700 t U</td>
</tr>
<tr>
<td>Embalse</td>
<td>1984</td>
<td>2016 – 2033</td>
<td>1,300 t U</td>
</tr>
<tr>
<td>Atucha II</td>
<td>2014</td>
<td>2016 - 2054</td>
<td>3,700 t U</td>
</tr>
<tr>
<td>CAREM</td>
<td>2019?</td>
<td>40 years</td>
<td>600 t U</td>
</tr>
</tbody>
</table>

Total: 6,300 t U

**Current Potential Consumption: 250 t U per year**

Source: CNEA, 2016
## ARGENTINE POWER REACTORS UNDER CONSTRUCTION AND PLANNED

<table>
<thead>
<tr>
<th>Reactor</th>
<th>Location</th>
<th>Model</th>
<th>Net capacity</th>
<th>First power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atucha III</td>
<td>Buenos Aires</td>
<td>PHWR (AR-CANDU-6)</td>
<td>648 MWe</td>
<td>2023?</td>
</tr>
<tr>
<td>5th NPP</td>
<td>?</td>
<td>?</td>
<td>1,100 MWe</td>
<td>?</td>
</tr>
<tr>
<td>CAREM 25</td>
<td>Buenos Aires</td>
<td>CAREM</td>
<td>32 MWe</td>
<td>2019?</td>
</tr>
</tbody>
</table>

Source: WNA, 2014; CNEA, 2015
ARGENTINE NPPs PLANNED

- 4th NPP project is expected to cost $5.8 billion and to take eight years to build at the Atucha Nuclear Power Plant Complex in Buenos Aires province.
- 4th NPP will be a CANDU reactor running on natural uranium fuel, like the 648 MWe Embalse Candu reactor in Cordoba province.
Argentinean NPP of Modular Elements

- The CAREM prototype will be located in the Province of Buenos Aires
- Foundations are already being constructed
- Generation of 32 MWe
- CAREM will feature a distinctive concept, particularly due to its intrinsic safety characteristics and its engineering practical solutions that simplify construction and operation

Source: CNEA, 2015
URANIUM PRODUCTION IN ARGENTINA
(1952 – 1997)

Total: 2,600 t U

Source: CNEA, 2011
Price 08/2016 = USD 26/lb U3O8 = USD 68/kg U

Source: UxC, 2016
NUCLEAR FUEL CYCLE IN ARGENTINA

YELLOWCAKE IMPORTS
KAZA, CANADA, CZECH REP

D2O FACILITY
ENSI S.E.

UO2 CONVERSION
DIOXITEK S.A.

FUEL FABRICATION
CONUAR S.A.

Source: CNEA, 2016
URANIUM IDENTIFIED RESOURCES IN ARGENTINA

• In 2014, the National Atomic Energy Commission of Argentina (CNEA) reported about 20,000 t of uranium (tU) as identified resources (reasonably assured resources + inferred resources) for the production cost category <US $130/kgU.

• In addition, about 11,000 tU of Canadian National Instrument 43-101 certified resources have been reported in recent years by public and private mining companies.

• The total uranium resources of Argentina are thus approximately 31,000 tU in the aforementioned identified resources category.
<table>
<thead>
<tr>
<th>Deposit</th>
<th>Type</th>
<th>RAR t U ≤ USD 130/kgU</th>
<th>IR t U ≤ USD 130/kgU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sierra Pintada</td>
<td>Volcanic-related</td>
<td>3,900</td>
<td>6,110</td>
</tr>
<tr>
<td>Cerro Solo</td>
<td>Sandstone hosted</td>
<td>4,420</td>
<td>4,810</td>
</tr>
<tr>
<td>Don Otto</td>
<td>Sandstone hosted</td>
<td>130</td>
<td>300</td>
</tr>
<tr>
<td>Laguna Colorada</td>
<td>Volcanic-related</td>
<td>100</td>
<td>60</td>
</tr>
<tr>
<td>Laguna Salada</td>
<td>Surficial</td>
<td>2,420</td>
<td>1,460</td>
</tr>
<tr>
<td>Meseta Central</td>
<td>Sandstone hosted</td>
<td>-</td>
<td>7,350</td>
</tr>
<tr>
<td>Sub Total</td>
<td></td>
<td>10,970 t U</td>
<td>20,090 t U</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td><strong>31,060 t U</strong></td>
</tr>
</tbody>
</table>

**URANIUM IDENTIFIED RESOURCES IN ARGENTINA**

URANIUM IDENTIFIED RESOURCES IN ARGENTINA

- Volcanic: 33%
- Surficial: 12%
- Sandstone: 55%

Total: 31,060 t U

OECD NUCLEAR ENERGY AGENCY (NEA)/ INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA) RESOURCE REPORTING SCHEME

<table>
<thead>
<tr>
<th>Recoverable at costs</th>
<th>Identified Resources</th>
<th>Undiscovered Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>USD 40/KqU</td>
<td>Reasonably Assured Resources</td>
<td>Inferred Resources</td>
</tr>
<tr>
<td>USD 40-80/KqU</td>
<td>Reasonably Assured Resources</td>
<td>Inferred Resources</td>
</tr>
<tr>
<td>USD 80-130/KqU</td>
<td>Reasonably Assured Resources</td>
<td>Inferred Resources</td>
</tr>
<tr>
<td>USD 130-260/KqU</td>
<td>Reasonably Assured Resources</td>
<td>Inferred Resources</td>
</tr>
</tbody>
</table>

Increasing confidence in estimates
Increasing economic attractiveness
Production centre: is a production unit consisting of one or more ore processing plants, as well as one or more associated mines and uranium resources that are tributary to these facilities.
For the purpose of describing production centres, they have been divided into four classes, as follows:

- **Existing production centres** are those that currently exist in operational condition (includes plants that are closed but could be readily brought back into operation)

- **Committed production centres** are those under construction or firmly committed for construction

- **Planned production centres** are those for which feasibility studies are either completed or under way, but construction commitments have not yet been made (includes plants that are closed and would require substantial expenditures to bring back into operation)

- **Prospective production centres** are those that could be supported by tributary Reasonably Assured Resources and Inferred Resources, but for which construction plans have not yet been made
URANIUM RESOURCES IN ARGENTINA

Increasing economic attractiveness

Increasing confidence in estimates

Bridging Document

NEA/IAEA

UNFC-2009
For the uranium resources of different projects of CNEA and mining companies, the criteria of UNFC-2009 concerning social and economic viability (E), technical feasibility (F) and geological knowledge (G) were defined at the sub-category level and grouped into major classes considered in this classification system.
CERRO SOLO U DEPOSIT
(9,230 tU)

San Jorge Basin
(Cretaceous)

Type: Sandstone
Subtype: Basal channel (U, Mo, Re)

Sedimentary Rocks

Igneous and Metamorphic Rocks

Source: Benítez et al, 1993; Bianchi & Páez, 2005
CERRO SOLO U DEPOSIT

• The increase in exploration efforts has led to a significant increase in uranium resources and their level of knowledge and the tonnage and grade estimated is expected to ensure sustained uranium production in the future

• Currently, a programme to complete the feasibility study of the Cerro Solo deposit is being carried out. As background, in 1997 the CNEA retained NAC International to complete a pre-feasibility study of the Cerro Solo uranium deposit, including geological model revision and ore reserves estimate, mining and milling methods and their costs, cash flow and risk analysis

Source: CNEA, 2015
Regarding by-products, it can be mentioned that though economic recovery of molybdenum (870 t Mo) has not been defined, the potential economic benefits of income from this process justify further research and evaluation in both the extent of molybdenum reserves and its recovery.

In addition, anomalous assays of rhenium (up to 50 ppm Re) were detected, and its potential should be the subject of further research.
Chubut Provincial Law No. 5001/2003 prohibits open pit mining.
Projects need to wait for the Chubut provincial territory zoning provisions of Law 5001/2003, as well as the introduction of a mining regulatory framework for this jurisdiction. The proximity of Cerro Solo to the Navidad project could play a positive role regarding that issue.
CERRO SOLO U DEPOSIT
Social Viability

SURVEYING BASELINES (2009 – Present)

HYDROGEOLOGY
National University of La Plata

PALEONTOLOGY
Museum “Egidio Feruglio”

AIR QUALITY
CNEA

EDAPHOLOGY
Argentine Research Council

ECOLOGY
National University of Patagonia

GAMMA - RAY SPECTROMETRY
CNEA

ARCHEOLOGY
Call for proposals in progress

SOCIO-ECONOMIC
National University of Patagonia

Source: CNEA, 2009 - 2013
CERRO SOLO U DEPOSIT
SOCIAL ECONOMIC BASELINE

According the legal framework given by the “Environmental Code of the Chubut province” (Annex VII – Decree 185/09 – Law Nº 5439), the following issues are considered:

• To carry out a diagnosis of the current social economic conditions at the Cerro Solo U deposit and influence area, prior to the implementation of mining activities

• To identify social economic indicators feasible to be monitored

• To describe social, economic and cultural aspects of the population of the nearest towns
Involvement with local community:

- Presentation of information to the public in general, covering both uranium mining aspects and a variety of nuclear topics
- Promote the labor recruitment of local people, offering technical training for employees
ECONOMIC CONSIDERATIONS OF CNEA’S PROJECTS

• To define the economic feasibility of CNEA’s projects, uranium prices in the international market are taken as a reference, not as a determining factor, considering that the raw material has a bearing of five to seven per cent in the total cost of nuclear energy in the country

• Argentina so far has not pursued the objective to obtain dividends from the sale of uranium in international markets

• For domestic use, uranium is imported which has implications for security of supply
• The Cerro Solo project appears to be the most promising project, and with realistic assumptions of possible market conditions and obtaining social licence, there are prospects for extraction in the near future
CERRO SOLO U DEPOSIT (9,230 t U)
UNFC-2009

CLASS: POTENTIALLY COMMERCIAL PROJECTS

SUBCLASS: DEVELOPMENT PENDING

E = 2        F = 2.1        G = 1, 2, 3
SIERRA PINTADA U DEPOSIT
(10,010 tU)

San Rafael Basin
(Lower Permian)

Type: Volcanic-related
Subtype: Volcano-sedimentary

Source: Salvarredi, 1999; Navarra, 2001-2006
URANIUM PRODUCTION (1968 – 1997)

Total Production: 1,600 t U @ 0.09 – 0.29 % U
System: open pit + heap leaching + dilute sulphuric acid solution + ion exchange resins
RECENT / CURRENT ACTIVITIES AT THE SAN RAFAEL URANIUM MINING – MILLING COMPLEX

- LEACHING PILOT TESTS
- GEOLOGICAL MODELING / MINING DESIGN
- ENVIRONMENTAL REMEDIATION
- ENVIRONMENTAL MONITORING
LEACHING PILOT TESTS – “STALLE” CONSTRUCTION
LEACHING PILOT TESTS – ORE MINERAL LOADING
## Comparative Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Heap Leaching</th>
<th>Stalle</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GEO</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Altura paquete de mineral (m)</td>
<td>3,0 a 4,0</td>
<td>2,5</td>
</tr>
<tr>
<td>Superficie ocupada m²/t- año de mineral tratado</td>
<td>0,2</td>
<td>0,11</td>
</tr>
<tr>
<td><strong>OPE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ciclo Lixiviación de Mineral</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Completo de Tratamiento (meses)</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>CION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recuperación (%)</td>
<td>80</td>
<td>90</td>
</tr>
<tr>
<td>Consumo de ácido (kg/t. de mineral)</td>
<td>90 - 100</td>
<td>80 - 85</td>
</tr>
<tr>
<td><strong>ME</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sistema de riego</td>
<td>Riego a manto con drenaje libre</td>
<td>Inundación y drenaje controlado</td>
</tr>
<tr>
<td><strong>TO</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contacto Sólido-líquido</td>
<td>Contacto heterogéneo con la masa de mineral (canalizaciones preferenciales)</td>
<td>Mejor contacto con toda la masa de mineral</td>
</tr>
<tr>
<td><strong>DO</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Granulometría</td>
<td>Con granulometría más pequeña, se genera deslizamiento de taludes</td>
<td>Permite operar con granulometría menor</td>
</tr>
<tr>
<td><strong>LO</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxidación minerales de U</td>
<td>Contacto con O₂ intergranular.</td>
<td>Oxidantes o contacto con O₂ alternante (en experimentación)</td>
</tr>
<tr>
<td><strong>GIA</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
GEOLOGICAL MODELING / MINING DESIGN
DATA MINING
ENVIRONMENTAL REMEDIATION

ENVIRONMENTAL LIABILITIES OF FORMER U PRODUCTION

BARREN MATERIAL

MINE WATER

LOW-GRADE MINERAL

TAILINGS

PRECIPITATES

SOLID WASTE
ENVIRONMENTAL REMEDIATION
CONSTRUCTION OF EFLUENT TREATMENT POND

- Security drainage systems
- Double waterproofing HDPE geo-membrane in order to control leaks
ENVIRONMENTAL REMEDIATION
WATERPROOFING OF CISTERNS
ENVIRONMENTAL MONITORING

- AIR
- SOIL
- GROUND WATER
- STREAM WATER
Sampling points: 17
Frequency: 6 months
ENVIRONMENTAL MONITORING
WATER QUALITY
MENDOZA PROVINCE LEGAL FRAMEWORK

• It was the last province that had an uranium deposit in operation in the country when the closing of production took place for economic reasons in 1997

• Nowadays, the operation of uranium mining and processing will require major changes to the legislation, such as permitting of the use of sulphuric acid, which is currently forbidden by Law 7722/2007
Uranio: 30 razones para oponerse

“30 reasons to oppose uranium ...

... $10^{-6}$ g of plutonium enters the body and cause cancer ...

uranium mining is lethal ...”
SOCIAL ISSUES

Yellow Uranium
Dark Future
SIERRA PINTADA U DEPOSIT (10,010 t U)
UNFC-2009

CLASS: POTENTIALLY COMMERCIAL PROJECTS

SUBCLASS: DEVELOPMENT ON HOLD

E = 2       F = 2.2       G = 1, 2, 3
DON OTTO U DEPOSIT
(430 tU)

Salta Basin
(Cretaceous - Tertiary)

Type: Sandstone
Subtype: Tabular (U,V)

Source: Gorustovich, 2010; López et al 2010 - 2013
DON OTTO U DEPOSIT

System: heap leaching + dilute sulphuric acid solution + ion exchange resins

Total Production: 202 t U at 0.1 % (1961-1982)
DON OTTO U DEPOSIT

YACIMIENTO DON OTTO
DPTO. SAN CARLOS - SALTA
CORTE VERTICAL DE LABOREOS
ESTIMACION DE RESERVAS
Al 31-08-81 t.c.f. 0.05% U O2

RAR
PR
IR
Mined Out

Current Identified Resources > 400 t U
A comprehensive study:

• Enlargement of the mining property and resource augmentation
• Updating EIA reports
• Block leaching research and development studies
• Feasibility of underground extraction
• Use of mobile ionic exchange plant
• Vanadium recovery?
• Uranium recovery from the former heaps and remediation of the site

DON OTTO U DEPOSIT
CONSIDERATIONS ON DON OTTO U PROJECT

• When mapping to the E, F and G axes, this is classified as a "non-commercial project" where development is not clarified
• However, it should be highlighted that this deposit was previously in operation and current exploration/evaluation studies yielded very encouraging results, which could make it possible in the future to move the project to a higher UNFC-2009 class
DON OTTO U DEPOSIT (430 t U)
UNFC-2009
CLASS: NON-COMMERCIAL PROJECTS
SUBCLASS: DEVELOPMENT UNCLARIFIED

E = 3.2        F = 2.2        G = 1, 2, 3
LAG. COLORADA U DEPOSIT
(160 tU)

San Jorge Basin
(Cretaceous)

Type: Volcanic-related
Subtype: Volcano-sedimentary

Source: Fuente & Gayone, 1999
The limited resources of Laguna Colorada make it difficult to envisage extraction at present, unless the characteristics of the ore will allow treatment in a plant that might potentially be located in the future in the area of Cerro Solo.
LAGUNA COLORADA U DEPOSIT (160 t U)

UNFC-2009

CLASS: NON-COMMERCIAL PROJECTS

SUBCLASS: DEVELOPMENT NOT VIABLE

E = 3.3        F = 2.3        G = 1, 2, 3
LAGUNA SALADA U DEPOSIT
(3,880 tU; 21,330 tV)

Type: Surficial
Subtype: Fluvial valley (U,V)

Modern Cover

Source: U3O8 Corp., 2013
LAGUNA SALADA U DEPOSIT

Mineralised area: 28 Km2

Source: U3O8 Corp., 2013
LAGUNA SALADA U DEPOSIT

- Carnotite, the principal uranium-vanadium mineral at Laguna Salada, occurs as a powdery filling between the sand grains and as a partial rim on pebbles in the gravel
- U-V-bearing layer is 0.93 meter wide in average

Source: U3O8 Corp., 2013
LAGUNA SALADA U DEPOSIT

Uranium Identified Resources: 3,880 t U @ 55 – 72 ppm U
Vanadium Identified Resources: 21,330 t V @ 308 – 330 ppm V
LAGUNA SALADA U DEPOSIT

• Preliminary Economic Assessment (PEA) based on previous NI 43-101 report of Laguna Salada deposit takes into consideration U – V comprehensive extraction

• Initial metallurgical results show uranium and vanadium grades increase between 3 and 11x by simple screening and rapid uranium-vanadium extraction using alkaline leaching at a temperature of 20 °C

Source: U3O8 Corp., 2013
## The Uranium (V) Business Model Canvas for U3O8 Corp.
### Laguna Salada Project

<table>
<thead>
<tr>
<th>Key Partners</th>
<th>Key Activities</th>
<th>Value Propositions</th>
<th>Customer Relationships</th>
<th>Customer Segments</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-country nuclear fuel fabricator</td>
<td>Double uranium resource to 20Mlbs</td>
<td>Environmentally friendly, low-cost, comprehensive uranium – vanadium extraction, to provide revenue, employment and social benefits with a strategic nuclear raw material supply</td>
<td>Personal contact</td>
<td>Domestic: Uranium sales to in-country nuclear UO2 fabricator (Dioxitek)</td>
</tr>
<tr>
<td>Foreign nuclear fuel manufacturers</td>
<td>Build on PEA to complete bankable feasibility study in two years</td>
<td></td>
<td>Contact through regulatory entities (local &amp; international)</td>
<td>International: Export component of production not needed in-country</td>
</tr>
<tr>
<td>Option agreement with province’s resource company – potential to increase the size of the deposit</td>
<td>Offtake agreement</td>
<td></td>
<td>Website, social media, conferences to develop clean energy relationships</td>
<td>Clean Energy: Vanadium sales to steel or battery / renewable energy segment</td>
</tr>
<tr>
<td>Vanadium Redox Battery (VRB) producers, steel manufacturers</td>
<td>Study use of wind energy</td>
<td></td>
<td></td>
<td>Society</td>
</tr>
<tr>
<td></td>
<td>Continue to build local community relationships</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Key Resources</th>
<th>Value Propositions</th>
<th>Customer Relationships</th>
<th>Customer Segments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective exploration team &amp; expertise, Mineral processing knowledge</td>
<td>Environmentally friendly, low-cost, comprehensive uranium – vanadium extraction, to provide revenue, employment and social benefits with a strategic nuclear raw material supply</td>
<td>Personal contact</td>
<td>Domestic: Uranium sales to in-country nuclear UO2 fabricator (Dioxitek)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact through regulatory entities (local &amp; international)</td>
<td>International: Export component of production not needed in-country</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Website, social media, conferences to develop clean energy relationships</td>
<td>Clean Energy: Vanadium sales to steel or battery / renewable energy segment</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Society</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost Structure</th>
<th>Revenue Streams</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEA estimated cash-cost of production of US$21.62/lb average</td>
<td>86% from uranium, 14% from vanadium by-product</td>
</tr>
<tr>
<td>CAPEX: $136M including 20% contingency. Australian and Brazilian currency weakness against US$ reduces CAPEX to $117M. Argentine Peso weakness should reduce capex and opex further</td>
<td>After tax NPV (7.5% discount rate) = US$42MM over 10-year mine life</td>
</tr>
<tr>
<td>Doubling processing plant throughput on the back of doubling the resource would increase CAPEX: $162M including 20% contingency</td>
<td>Double the resource &amp; plant throughput would increase the after-tax NPV to US$131MM</td>
</tr>
</tbody>
</table>
LAGUNA SALADA U DEPOSIT (3,880 t U; 21,330 tV)
UNFC-2009

CLASS: NON-COMMERCIAL PROJECTS

SUBCLASS: DEVELOPMENT UNCLARIFIED

E = 3.2       F = 2.2       G = 2, 3

• The PEA includes around 40 per cent inferred resources
• To the extent that follow up exploration activities can increase resources and their geological knowledge, the project could move to a UNFC-2009 Class of “potentially commercial projects”
Type: Sandstone
Subtype: Basal channel / Roll Front?
MESETA CENTRAL PROJECT

• NI 43-101 Uranium Resources of the project are entirely classified as Inferred, and have been estimated to total 7,350 tU grading 265 ppm eU
• As reported by UrAmerica Ltd., about 75% of the uranium resources evaluated are placed in confined aquifers layers
• Therefore, further geological and hydrological studies will be addressed to determine the amenability to in situ leaching mining
• The results of these studies could play a relevant role regarding the socio-economic viability of this project

Source: UrAmerica, 2013 - 2014
MESETA CENTRAL PROJECT (7,350 tU)
UNFC-2009

CLASS: NON-COMMERCIAL PROJECTS

SUBCLASS: DEVELOPMENT UNCLARIFIED

E = 3.2    F = 2.2    G = 3

Source: UrAmerica, 2013 - 2014
## U Resources in Argentina (Red Book / UNFC-2009)

### 31,060 t U

<table>
<thead>
<tr>
<th>Project</th>
<th>UNFC Class</th>
<th>UNFC Sub-class</th>
<th>UNFC Categories</th>
<th>Resources (tU)</th>
<th>NEA/IAEA Production Centre Status</th>
<th>NEA/IAEA Classification</th>
<th>Resources (tU)</th>
<th>Total (tU)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cerro Solo</strong></td>
<td>Potentially Commercial Projects</td>
<td>Development Pending</td>
<td>E2 F2.1 G1</td>
<td>2,420</td>
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</table>
• Mineral resources belong to the Provincial States as established by the National Constitution in 1994

• Uranium and thorium are declared as nuclear minerals

• U and Th can be explored and exploited by the CNEA and third parties under a legal license by a Competent Provincial Authority

• The National State shall have the first option to purchase nuclear minerals produced in the country

• U and Th exportation can be authorized by the National State while internal supply and final destination are guaranteed
The identified uranium resources in Argentina are mostly located in the provinces of Chubut and Mendoza.

These are areas where no metallic mineral mining projects are in operation.

In addition, legislation is in place that markedly restricts uranium production and which needs to be taken into account when studying the social viability of the projects.
## U RESOURCES IN ARGENTINA (RED BOOK / UNFC-2009)

**31,060 t U**

<table>
<thead>
<tr>
<th>Project</th>
<th>UNFC Class</th>
<th>UNFC Sub-class</th>
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<th>Resources (tU)</th>
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</table>
FINAL CONSIDERATIONS

• The application of UNFC-2009 as a complement to the NEA/IAEA Classification contributes to both a better understanding of the availability of reliable resources in Argentina and how these resources can contribute to the national nuclear energy programme.
INT/2/019 - Deploying Technology and Management of Sustainable Uranium Extraction Project

IAEA-UNECE Interregional Training Course on “Uranium, Coal, Oil and Gas Classification: Towards a Better Understanding of Energetic Basins and Application of UNFC-2009”

Case Study: Application of UNFC-2009 to Uranium Resources and Associated Critical Materials in Argentina

Presented by Luis López (CNEA)

Ulaanbaatar, Mongolia
16 – 19 August 2016

THANK YOU VERY MUCH!