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Case studies and testing of the United Nations**Framework Classification for Fossil Energy****and Mineral Reserves and Resources 2009****Considerations related to the application of the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 to uranium projects and associated resources in Paraguay**

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Summary

This document provides considerations related to the application of the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009), and in particular, the specific Guidelines for Application of UNFC-2009 for uranium and thorium resources to uranium projects carried out by Uranium Energy Corporation (UEC) in Paraguay. The projects considered in this case study are the Yuty Project and the Coronel Oviedo Project. The case study demonstrates that the project maturity model of UNFC-2009 is particularly useful for companies such as UEC which are engaged in mineral exploration and development. UNFC-2009 helps to reflect the accurate project maturity based on the current status of the project and is useful in the company's resource management functions. At a national level, the application of UNFC-2009 contributes to a better understanding of the availability of reliable resources in Paraguay and how these resources can contribute to the mining industry and the supply of nuclear fuel resources for the international market.



I. Introduction

1. This report was prepared with the technical input of Mr. Clyde Yancey and Mr. Victor Fernández both of Uranium Energy Corporation (UEC), Mr. Harikrishnan Tulsidas of the International Atomic Energy Agency (IAEA) and Mr. Luis López of the National Atomic Energy Commission (CNEA) of Argentina.

2. This document provides considerations related to the application of the United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources 2009 (UNFC-2009), and in particular, the specific Guidelines for Application of the UNFC-2009 for uranium and thorium resources [1] to uranium projects carried out by UEC in Paraguay.

II. Uranium projects/resources in Paraguay and the application of UNFC-2009

3. In Paraguay all known uranium occurrences are found in the eastern part of the country, and most of them are situated in the sandstones in the western flank of the Parana Basin. The sandstone host of the uranium deposit is most often of clastic-detrital origin, being located in continental carbonaceous and/or pyrite-bearing fluvial environments or, less commonly, in mixed fluvial-marine environments. The age of most major sandstone uranium deposits ranges from Paleozoic to Mesozoic. Within south-eastern Paraguay there is one uranium deposit close to the town of Yuty, and drilling indicates elongated, uranium-bearing roll fronts. At least one other area with good potential for becoming a new uranium district is presently under investigation to the east and north of the city of Coronel Oviedo (Figure 1). Additional uranium potential in eastern Paraguay is also likely to exist in Upper Permian sandstone near the town of Curuguaty and within Silurian sandstone sequences east of the village of Eusebio Ayala. To date, uranium mining has not been undertaken in Paraguay.

Figure 1

Location of known uranium occurrences in Eastern Paraguay



Table 1
Uranium Resources in Paraguay

Effective dates: 24 August 2011 – Yuty and 15 October 2012 – Coronel Oviedo [2]

Deposit	Type	Million Tonnes Ore	Grade % U ₃ O ₈	Pounds* U ₃ O ₈
Yuty (Uranium Energy Corp) NI 43-101 Resources	Sandstone Hosted	Measured		
		2.054	0.062	2,801,000
		Indicated		
		5.783	0.048	6,113,000
		Inferred		
		2.139	0.047	2,226,000
Coronel Oviedo (Uranium Energy Corp) NI 43-101 Exploration Target	Sandstone Hosted	Exploration Target Range		
		26.3 to 48.9	0.040 to 0.052	23,100,000 to 56,000,000

* 1 tonne uranium (U) = 2,600 pounds U₃O₈

Table 2
Uranium Resources in Paraguay shown in UNFC-2009 - NEA/IAEA classification schemes

Effective dates: 24 August 2011 – Yuty and 15 October 2012 – Coronel Oviedo [2]

Project	UNFC-2009 Class	UNFC-2009 Sub-class	UNFC-2009 Category	Resources (tU)	NEA/IAEA Production Centre Status	NEA/IAEA Classification	Resources (tU)	Total (tU)
Yuty	Potentially Commercial Project	Development Pending	E2 F2.1 G1	1,080	Prospective	RAR <\$130/kgU	3,430	4,290
			E2 F2.1 G2	2,350				
			E2 F2.1 G3	860		IR <\$130/kgU	860	
Coronel Oviedo	Exploration Project		E3.2 F3.1 G4	8,900 to 21,500	---	PR	8,900 to 21,500	8,900 to 21,500

RAR = Reasonably Assured Resources

IR = Inferred Resources

PR = Prognosticated Resources

4. Uranium exploration, development and production are managed under the Vice Ministry of Mining and Energy, which in turn falls under the Ministry of Public Works and Communications (MOPC). To date, neither of the two agencies has published any uranium resource numbers. About 4,290 tonnes of uranium (tU) of Canadian Securities Administrators (CSA) National Instrument 43-101 (NI 43-101) resources have been reported from the Yuty Project by the public mining company Uranium Energy Corporation (UEC) [2]. Yuty is categorized as a Potentially Commercial Project according to UNFC-2009. UEC also reports an NI 43-101 Exploration Target at Coronel Oviedo ranging

from 8,900 to 21,500 tU which can be categorized as Prognosticated Uranium Resources according to the Organization for Economic Co-operation and Development (OECD) Nuclear Energy Agency (NEA)/International Atomic Energy Agency (IAEA) Uranium Classification, commonly known as the “Red Book”. Coronel Oviedo is categorized as an Exploration Project taking into consideration UNFC-2009 criteria. Resources/project classification is summarized in Table 1 (NI 43-101 Resources and NI 43-101 Exploration Target) and Table 2 (UNFC-2009 and NEA/IAEA). The Bridging Document between the Committee for Mineral Reserves International Reporting Standards (CRIRSCO) Template and UNFC-2009 and the Bridging Document between the NEA/IAEA Uranium Classification and UNFC-2009 have been used in this case study [3].

5. No other uranium projects in Paraguay have identified resources.

III. Yuty Project

6. The Yuty Project covers 117,232 hectares and is located approximately 200 kilometres east and south-east of Asunción, the capital of Paraguay. Exploration for uranium in South-eastern Paraguay was started in 1976 by Anschutz, after the Concession Agreement between the Government of Paraguay and Anschutz in December 1975. This agreement allowed Anschutz to explore for “all minerals, excluding oil, gas, and construction materials.” The initial uranium exploration carried out by Anschutz in 1976 covered an exclusive exploration concession of some 162,700 square kilometres, virtually the whole eastern half of Paraguay. This was followed by a programme of diamond drilling and rotary drilling over selected target areas. In total, some 75,000 metres of drilling were completed from 1976 to 1983. An additional 31,000 metres were completed by Cue Resources Ltd between 2007–2011 to define the current Yuty resource [2].

7. The Yuty Project area is situated within the western part of the Paraná Basin in south-eastern Paraguay, which also hosts the Figueira Uranium Deposit in Brazil (Figure 2). The area is underlain by upper Permian-Carboniferous (UPC) continental sedimentary rocks [4]. The continental sedimentary units of the San Miguel Formation (of the UPC) are known to have high potential for uranium exploration in eastern Paraguay. The source of the uranium is thought to be the underlying Coronel Oviedo Formation, which is correlated with the Itataré Formation underlying the Rio Bonito Formation in Brazil.

8. Occasional diabase sills and dikes intrude the sedimentary rocks, such as at the Yuty Project. Outcrops are rare, mostly along road cuts, and mapping is done by drilling. The rocks of the Yuty area are very gently east dipping and un-deformed. Occasional north-west and north-east trending normal faults cut the sedimentary units. Exploration work to date suggests that the uranium mineralization within the San Miguel Formation is strata-bound and possibly syngenetic or diagenetic in origin. Recent interpretation of exploration data suggests that areas of limonite and hematite alteration within the grey-green, fine-grained sandstones of Yuty have characteristics similar to the alteration assemblages present at roll front-type uranium deposits of the Powder River Basin and South Texas Coastal Plains in the United States (Figure 3).

9. The mineral resources of the Yuty Project are contained within a sub-horizontal layer of fine-grained sandstone of the massive sand unit of the San Miguel Formation. The resource estimate was based on the development of a three dimensional geologic and resource model. The geological model was based on a uranium radiometric drillhole value cut-off of 0.02% equivalent U_3O_8 at a minimum thickness of 0.1 metres. This further defined the extent of the mineralized zone. Resource estimation was completed utilizing standard geostatistical methods applied to a three-dimensional block model developed in commercial modelling software.

Figure 2
Occurrence of uranium in the Parana Basin, Paraguay and Brazil

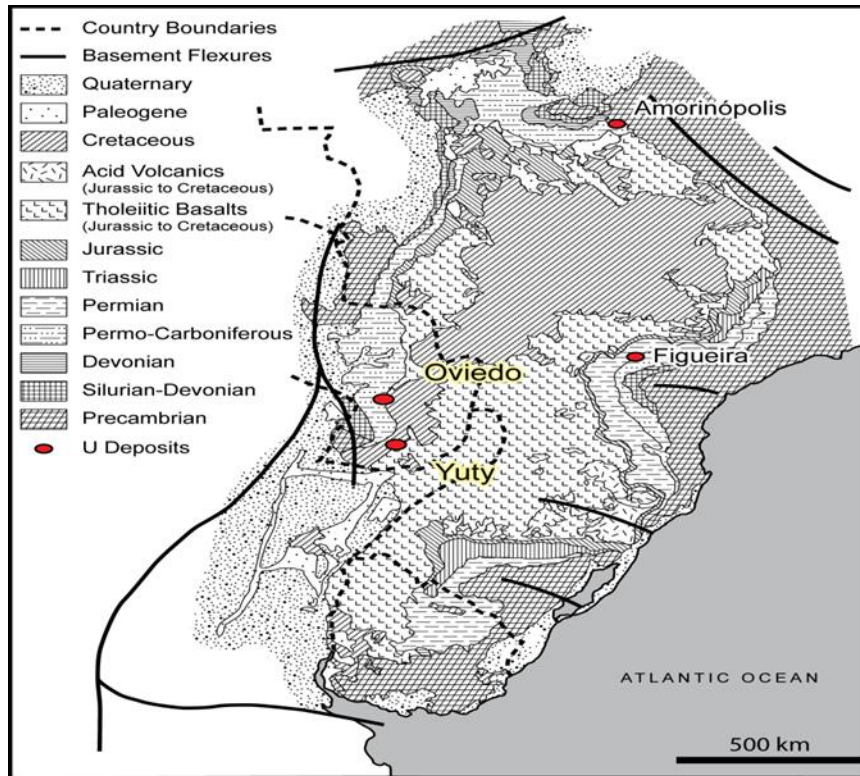


Figure 3
Yuty Project



10. About 4,290 tU grading between 0.047 per cent and 0.062 per cent U_3O_8 of Canadian National Instrument 43-101 (NI 43-101) certified resources have been reported [2]. The quantities are classified as Reasonably Assured Resources (RAR) with cost category <US \$130/kgU (3,430 tU) and Inferred Resources with cost category <US \$130/kgU under the NEA/IAEA scheme (See Appendix 3 in the “Red Book”) [5]. These resources are categorized as G1, G2 and G3 under UNFC-2009 (Table 2).

IV. Coronel Oviedo Project

11. The Coronel Oviedo Project is located in South-eastern Paraguay, approximately 150 kilometres east of Asuncion, the capital of Paraguay and 170 kilometres north of Yuty. The Coronel Oviedo Project consists of a large mineral concession covering a total area of approximately 188,000 hectares. The Coronel Oviedo Project located in central Paraguay was subject to reconnaissance uranium exploration between 1976 and 1983 by Anschutz Corporation of Denver, Colorado, and by Crescent Resources of Vancouver, Canada between 2006 and 2008. During 2012, UEC completed a 10,000 metre drilling programme. A total of 35 holes were drilled, averaging 290 metres in depth. The holes were drilled on east to west lines across known geologic structures believed to be integral in controlling uranium occurrence. The holes were drilled on wide spacing, approximately 1 to 2.4 kilometres apart (Figure 4). A radon extraction survey was completed along the western basin margins, following up on historic airborne radiometric anomalies and outcrop sampling results that indicate a potential for shallow uranium mineralization.

Figure 4

Coronel Oviedo Project



12. The most significant result of recent drilling at Coronel Oviedo was that it identified a redox boundary along some 21 kilometres and demonstrated that significant thicknesses (1.9 to 11.1 metres) of mineralization are present. In addition, based on surface radiometric anomalies and limited drill data the redox boundary may be projected an additional 40 kilometres. Based on this drilling, an NI 43-101 Exploration Target at Coronel Oviedo was calculated ranging from 23.1 to 56 million pounds U_3O_8 (8,900 to 21,500 tU), with 0.04 per cent to 0.052 per cent U_3O_8 grade [2]. These are designated as Prognosticated Resources under the NEA/IAEA scheme, as the quantities are expected to occur in deposits for which the evidence is mainly indirect and which are believed to exist in well-defined geological trends or areas of mineralization within the known deposit, i.e., the Yuty Project. The quantities of uranium in the Coronel Oviedo Project are classified as G4 according to UNFC-2009 (Table 2).

V. Project feasibility considerations

13. To demonstrate the feasibility of these sandstone uranium deposits to in-situ recovery (ISR) technology, aquifer pumping tests are typically performed. Aquifer testing at both Yuty and Coronel Oviedo has been performed. The testing indicates that the uranium bearing unit has aquifer characteristics that would support operational rates for ISR mining and that the aquifer properties determined from the test fall within the range of values determined at other uranium ISR projects located in the United States of America ISR provinces. Limited core data from both project sites indicate that the uranium mineralization is in radiometric equilibrium. Limited agitated leaching studies at Yuty indicate that either alkaline or acid leach liberate the uranium. Based on the studies the Yuty Project has been classified as F2.1, i.e. "Project activities are ongoing to justify development in the foreseeable future". Based on the feasibility studies of the Coronel Oviedo Project, the quantities have been classified as F3.1, in accordance with UNFC-2009 Generic Specification R "Classification of quantities associated with Exploration Projects"¹, which is "where site-specific geological studies and exploration activities have identified the potential for an individual deposit with sufficient confidence to warrant drilling or testing that is designated to confirm the existence of that deposit in such form, quality and quantity that the feasibility of extraction can be evaluated."

VI. Socio-economic considerations

14. When the Ministry of Public Works and Communications grants a mineral concession to an operator, the project initially enters the Exploration Phase for a maximum of six years, during which period a company must advance and demonstrate a viable project. The Exploration Phase is followed by the Exploitation Phase for a maximum of 20 years plus one ten-year extension, during which period the environmental licensing process may begin, a key milestone required before starting production, as well as allowing for reductions in land and various investment costs. The Exploitation Phase is followed by the Production Phase which lasts for an indefinite period. The Yuty Project is in the first year of the Exploitation Phase and the Coronel Oviedo Project is in the fourth year of the Exploration Phase.

15. The Paraguayan Mining Law requires that all applicable environmental laws be met for mining concessions and permits to be granted by the Government. For all uranium projects granted in the territory of the Republic of Paraguay, the projects must be compliant with all applicable regulations and plans, and the licenses approved by the Secretary of Environment (SEAM) which is the national enforcement authority. In order for uranium production to proceed, a detailed plan for assessing environmental baseline conditions and environmental impacts must be submitted, approved, and implemented prior to the initiation of production.

16. During the prospection and exploration phases at both the Yuty and Coronel Oviedo Projects the local population was directly involved in project work to support drilling and field development activities. These jobs have mainly been temporary involving field work and field activity support. The field staff involved in the maintenance of the current facilities is local [2].

¹ UNFC-2009 *incorporating* Specifications for its Application, ECE Energy Series No. 42, ECE/ENERGY/94, Part II, VI Generic Specifications.

17. The economic benefits of the drilling activities carried out near Yuty were well perceived by the surrounding community, which has been positively affected by the development of residential and commercial infrastructure that was constructed largely for the San Antonio community directly adjacent to the Yuty Project. The town of Yuty has also experienced economic benefits from the project development.

18. No significant conflicts over activities related to uranium exploration projects under development by mining companies have been reported through the use of the voluntary processes of public hearings with affected communities [6]. The aim of the public hearing process was to generate a means of direct communication with more than 2,500 people around the country to adequately report on the scope of the aforementioned mining projects.

19. Based on the above considerations, the quantities of uranium in Yuty Project are classified as E2, i.e., “Extraction and sale is expected to become economically viable in the foreseeable future”. The uranium quantities in the Coronel Oviedo Project are classified as E3.2, i.e., “Economic viability of extraction cannot yet be determined due to insufficient information (e.g. during the exploration phase).”

VII. Conclusions

20. Based on careful consideration of the E, F and G criteria, the Yuty Project has been classified as a Potentially Commercial Project with E2, F2.1 and G1, G2 and G3 and 4,290 tU. The applicable Sub-class is designated as Development Pending.

21. The Coronel Oviedo Project is classified as an Exploration Project with E3.2, F3.1 and G4 and 8,900 to 21,500 tU.

22. The application of the Bridging Documents between the CRIRSCO Template and UNFC-2009 and the NEA/IAEA “Red Book” Classification and UNFC-2009 make the transfer of uranium quantities from one system to another accurate and consistent, thus making reporting done under different schemes comparable.

23. The case study demonstrates that the project maturity model of UNFC-2009 is particularly useful for companies such as UEC that are engaged in mineral exploration and development. UNFC-2009 can be helpful to reflect the accurate project maturity based on the current status of the project and will be useful in the company’s resource management functions. At a national level, the application of UNFC-2009 contributes to a better understanding of the availability of reliable resources in Paraguay and how these resources can contribute to the mining industry and the supply of nuclear fuel resources for the international market.

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