OECD MULTILINGUAL SUMMARIES

Uranium 2005 – Resources, Production and Demand

Executive summary

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Uranium 2005 – Resources, Production and Demand, presents the results of the most recent review of world uranium market fundamentals and provides a statistical profile of the world uranium industry as of 1 January 2005. First published in 1965, this, the 21st edition of what has become known as the "Red Book", contains official data provided by 43 countries on uranium exploration, resources, production and reactor-related requirements. Projections of nuclear generating capacity and reactor-related uranium requirements through 2025 are provided as well as a discussion of long-term uranium supply and demand issues.

Exploration

Worldwide exploration expenditures in 2004 totalled over USD 133 million, an increase of almost 40% compared to 2002 expenditures as the market strengthened. Most major producing countries reported significant increases in exploration expenditures, perhaps best exemplified by the United States, where exploration expenditures in 2002 amounted to much less than USD 1 million but by 2004 had jumped to over USD 10 million. Global exploration activities remained concentrated in areas with potential for unconformity-related and ISL-amenable sandstone deposits, primarily in close proximity to known resources. However, the rising price of uranium has also stimulated "grass roots" exploration, as well as exploration activities in regions known to have good potential based on past work. About 50% of the exploration expenditures in 2004 were devoted to domestic activities. Non-domestic exploration expenditures, although reported by only Australia, Canada, France and Switzerland, rose to over USD 70 million in 2004, more than four times the non-domestic exploration expenditures reported in 2002, with only Canada and France reporting data for 2002. Exploration spending is expected to significantly increase again in 2005, with total (domestic and non-domestic) expenditures projected to amount to over USD 195 million.

Resources

Total Identified (formerly Known Conventional) Resources (RAR & Inferred (formerly EAR-I) Resources) in both the <USD 80/kgU (about 3 804 000 tonnes U) and <USD 130/kgU (about 4 743 000 tonnes U) categories increased significantly compared to their 2003 levels, although it is important to note that the bulk of these increases were not the result of new discoveries but were the result of re-evaluations of previously Identified Resources in light of the effects of higher uranium prices on cut-off grades. Identified Resources in the <USD 40/kgU increased by about 13% compared to 2003, mainly due to increases in this category reported by Australia, Brazil and Niger. Total Undiscovered Resources (Prognosticated Resources (formerly EAR-II) & Speculative Resources) in 2005 amounted to about 10 000 000 tonnes U (tU), a slight increase of about 25 000 tU from the total reported in 2003.

Resource totals, on balance, increased between 2003 and 2005, indicating that increased uranium prices have already begun to impact resource totals, principally through re-evaluation of existing resources. However, the recent dramatic increase in exploration expenditures can be expected to lead to further additions to the uranium resource base, just as periods of heightened exploration efforts in the past have done.

Production

Uranium production in 2004 totalled 40 263 tU, an increase of almost 12% from the 36 050 tU produced in 2002, and an even greater increase from the 35 492 tU produced in 2003, a year in which output was reduced at key production facilities by unrelated incidents. A total of 19 countries reported output in 2004, compared to 20 in 2002, as Spain ceased production in 2003. Significant production increases (>30%) were recorded between 2002 and 2004 in Australia, Kazakhstan, and Namibia, while more modest increases (between 5 and 15%) were recorded for Brazil, Niger, the Russian Federation and Uzbekistan. Only two countries recorded reduced production (>10%) between 2002 and 2004: the Czech Republic and South Africa. Reductions in the amount of uranium recovered in mine restoration activities were recorded in France, Germany and Hungary from 2002 to 2004. Underground mining accounted for 39% of global production in 2004; open pit mining, 28%; *in situ* leach mining, 20%; with co-product and by-product recovery from copper and gold operations and other unconventional methods accounting for most of the remaining 13%. Uranium production in 2005 is expected to increase to 41 250 tU, with the largest increases (>10%) anticipated to occur in Kazakhstan and Uzbekistan.

Environmental aspects of uranium production

Although the focus of the Red Book remains uranium resources, production and demand, environmental aspects of the uranium production cycle are again a feature of this volume. A number of National Reports document the long term management of tailings and wastes produced at milling sites, reclamation activities at production centres, monitoring studies of existing operations and waste management areas, as well as information updates on environmental assessment processes. Activities related to the

decommissioning and reclamation of inactive sites and dealing with the associated job losses in countries where uranium mining has been terminated, as well as information on the development of water preservation strategies in mining areas, are also outlined. Additional information on the environmental aspects of uranium production may be found in a joint NEA/IAEA Uranium Group publication titled *Environmental Remediation of Uranium Production Facilities*, Paris, OECD, 2002.

Uranium demand

At the end of 2004, a total of 440 commercial nuclear reactors were operating with a net generating capacity of about 369 GWe requiring about 67 320 tU. By the year 2025, world nuclear capacity is projected to grow to between about 449 GWe net in the low demand case and 533 GWe net in the high demand case. Accordingly, world reactor-related uranium requirements are projected to rise to between about 82 275 tU and 100 760 tU by 2025.

Significant regional variation exists within these broad projections. Nuclear energy capacity and resultant uranium requirements are expected to grow significantly the East Asia region (between 90% to over 115% in the low and high cases, respectively) and in the Central, Eastern and South East Europe region (between 34 and 53%). Nuclear capacity and requirements are expected to increase slightly in North America (between 4 and 27%), but decline in Western Europe (between 16 and 26%) as plans to phase out nuclear energy are implemented. However, there are great uncertainties in these projections as there is ongoing debate on the role that nuclear energy will play in meeting future energy requirements. Key factors that will influence future nuclear energy capacity include projected base load electricity demand, public acceptance of nuclear energy and proposed waste management strategies, as well as the economic competitiveness of nuclear power plants and fuel compared to other energy sources. Concerns about longer-term security of supply of fossil fuels and the extent to which nuclear energy is seen beneficial in meeting greenhouse gas reduction targets could contribute to even greater projected growth in uranium demand over the long-term.

Supply and demand relationship

At the end of 2004, world uranium production (40 263 tU) provided about 60% of world reactor requirements (67 450 tU), with the remainder being met by secondary sources including excess commercial inventories, the expected delivery of LEU derived from HEU warheads, re-enrichment of depleted uranium tails and spent fuel reprocessing.

As currently projected, primary uranium production capabilities including existing, committed, planned and prospective production centres supported by Identified Resources (RAR and Inferred) recoverable at a cost of <USD 80/kgU could satisfy projected world uranium requirements by 2010 if all expansions and mine openings proceed as planned and if production is maintained at full capability at all operations. Although it is unlikely that all projects will produce at full capability in the time expected, the uranium production industry has clearly responded to market developments and production capability is expected to increase significantly in the next few years.

Secondary sources will, however, continue to be necessary to ensure demand is met given challenges associated with achieving full production capability.

However, secondary sources are expected to decline in importance, particularly after 2015, and reactor requirements will have to be increasingly met by the expansion of existing production capability together with the development of additional production centres or the introduction of alternate fuel cycles, both of which are costly, long-term enterprises. A sustained near-term strong demand for uranium will be needed to stimulate the timely development of needed Identified Resources. Because of the long lead-times required to identify new resources and to bring them into production (typically in the order of 10 years or more), there exists the potential for the development of uranium supply shortfalls and continued upward pressure on uranium prices as secondary sources are exhausted. The long lead times required to bring resources into production continues to underscore the importance of making timely decisions to increase production capability well in advance of any supply shortfall. Improved information on the nature and extent of world uranium inventories and other secondary sources would improve the accuracy of the forecasting required to make these timely production decisions.

Conclusions

World electricity use is expected to continue growing over the next several decades to meet the needs of an increasing population and economic growth. Nuclear reactors will continue to play an important role in generating the required electricity, although the magnitude of that role remains uncertain.

Regardless of the magnitude of the role that nuclear energy ultimately plays; the uranium resource base described in this document is adequate to meet projected future requirements. However, a continued strong market and sustained high prices will be necessary for resources to be developed within the timeframe required to meet uranium demand.

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