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# The U.S. Uranium Industry: Regulatory and Policy Impediments

Thomas E. Drennen, Jessica Glicken

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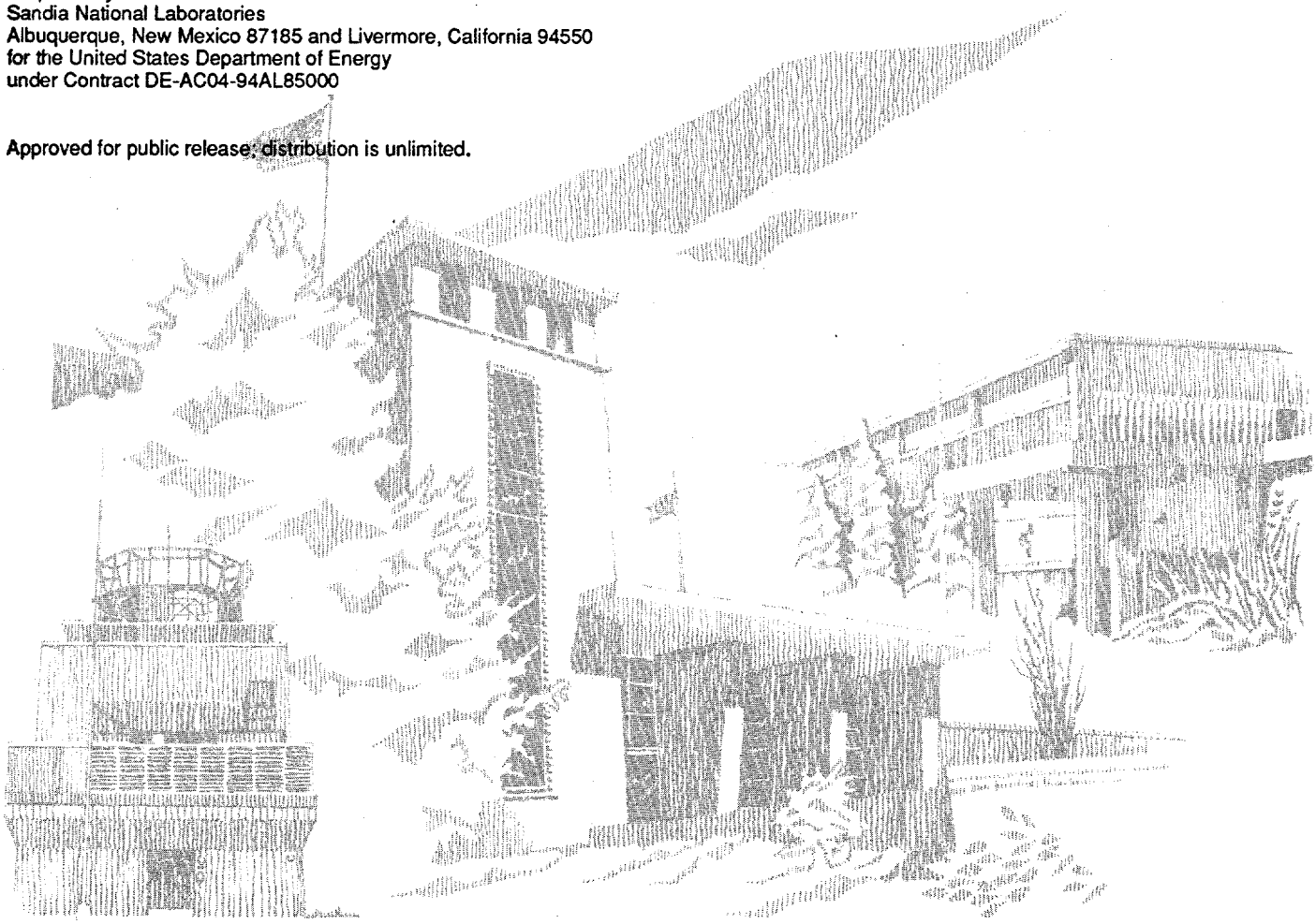

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# The U.S. Uranium Industry: Regulatory and Policy Impediments

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## Abstract

The Energy Policy Act of 1992 required the U.S. Department of Energy to develop recommendations and implement government programs to assist the domestic uranium industry in increasing export opportunities. In 1993, as part of that effort, the Office of Nuclear Energy identified several key factors that could (or have) significantly impact(ed) export opportunities for domestic uranium. This report addresses one of these factors: regulatory and policy impediments to the flow of uranium products between the U.S. and other countries. It speaks primarily to the uranium market for civil nuclear power. Changes in the world political and economic order have changed U.S. national security requirements, and the U.S. uranium industry has found itself without the protected market it once enjoyed. An unlevel playing field for U.S. uranium producers has resulted from a combination of geology, history, and a general U.S. political philosophy of nonintervention that precludes the type of industrial policy practiced in other uranium-exporting countries. The U.S. has also been hampered in its efforts to support the domestic uranium-producing industry by its own commitment to free and open global markets and by international agreements such as GATT and NAFTA. Several U.S. policies, including the imposition of NRC fees and licensing costs and Harbor Maintenance fees, directly harm the competitiveness of the domestic uranium industry. Finally, requirements under U.S. law, such as those in the 1979 Nuclear Nonproliferation Act, place very strict limits on the use of U.S.-origin uranium, limitations not imposed by other uranium-producing countries. Export promotion and coordination are two areas in which the U.S. can help the domestic uranium industry without violating existing trade agreements or other legal or policy constraints.

## Acknowledgments

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## Disclaimer

This report was prepared using unclassified source information available as of January 1995.

## Contents

## Figures



## Tables

# Executive Summary

The U.S. Department of Energy (DOE) has ruled the domestic uranium industry "nonviable" annually from 1984 to 1992.[1] In 1993, production was just 3.3 million lbs $U_3O_8$,[2] compared to 43.7 million lbs in 1980.

In the past three decades, the world uranium market has evolved from one dominated by national security interests to a much more open market with few overt barriers to U.S. producers. The primary reason for the domestic industry's noncompetitive position is the low quality of its domestic resources compared to the rich reserves of other countries such as Australia and Canada. However, this difference in ore quality only partially explains the low market share. Other factors include strong support by other uranium-producing nations of their uranium industries, a U.S. utility regulatory system that rewards utilities for purchasing the lowest-cost uranium regardless of origin, and a regulatory atmosphere in the U.S. that increases the cost of U.S. uranium.

This report outlines the regulatory and policy impediments that have resulted in an uneven playing field for U.S. domestic uranium producers and discusses the specific actions that the U.S. government can take to assist this industry in increasing its exports without violating existing trade agreements or other legal or policy constraints. This report speaks primarily to the market for uranium as defined by civil nuclear power needs and does not directly address military requirements.

## Uranium Demand and Supply

Installed nuclear capacity drives uranium demand. At present, worldwide uranium demand exceeds production levels by a wide margin. Inventory supplies, both civilian and military, continue to fill the difference. While civilian inventories are not expected to play a major role after the mid-1990s, military inventories are large and could remain a significant source in the foreseeable future. There is considerable uncertainty surrounding the possible disposition of the highly enriched uranium (HEU) from the dismantlement of nuclear weapons in Russia, the Ukraine, and the U.S. This uncertainty has manifested itself through lowered production, deferred long-term contracts, and depressed worldwide prices.

The U.S. has signed a purchase agreement with Russia for HEU blended down to low enriched uranium (LEU) for use in civilian reactors. Under the agreement, Russia will sell to the U.S. (through the United States Enrichment Corporation (USEC)) the equivalent of 8 million lbs $U_3O_8$ annually for the first 5 years and 24 million lbs annually for the next 15 years, for a total of 400 million lbs $U_3O_8$ equivalent. At the 24-million-lb level, this is

[1]Section 170B of the Atomic Energy Act of 1954 (AEA), as amended by the Nuclear Regulatory Commission Authorization Act of 1983, required the Secretary of Energy to annually evaluate the viability of the domestic uranium industry for the years 1983 to 1992. The Energy Information Administration (EIA) developed four criteria for evaluating viability, including resource capability, supply response capability, financial capability, and import commitment dependency (EIA 1993b).

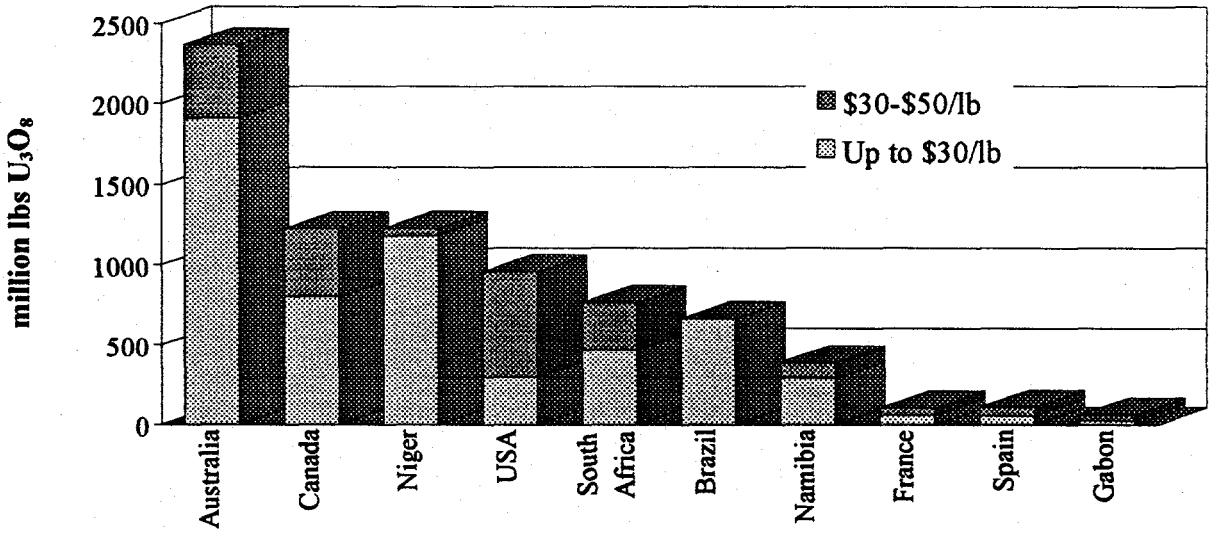
[2]$U_3O_8$ is uranium concentrate, commonly referred to as "yellowcake." One million lbs $U_3O_8$ is equal to 0.384647 thousand metric ton U. The symbol "U" denotes contained uranium.

comparable to the annual production in Canada. That country led the world in $U_3O_8$ production in 1993. If this material is not used as overfeed[3] at the USEC enrichment plants, or stockpiled for later use, this large addition to supply could have a significant effect on world prices.

In terms of new production, available resources of uranium still in the ground and recoverable at less than $30/lb are sufficient to cover aggregate demand requirements through 2010. This implies that while some new production may be necessary as inventories decline under free-market conditions, uranium prices are unlikely to increase rapidly. With current uranium prices hovering around $10/lb of $U_3O_8$, a large proportion of U.S., a large proportion of U.S. reserves are not economically recoverable, as shown in Figure ES-1.

## Foreign Competitors

U.S. companies often find themselves at a competitive disadvantage when seeking to capture foreign markets. This is particularly true of U.S. uranium producers who, in addition to price challenges, must deal with competitors that are government-owned or who operate in government-influenced economies. In France, for example, Compagnie Générale des Matières Nucléaires (Cogema), a French national company and the world's leading uranium producer, operates in an environment where government and industry work so closely together that federal indicative planning guides national economic activity.[4] In Russia, the final price often has no relationship to production costs. U.S. producers also often feel handicapped when




Source: OECD, 1994.

**Figure ES-1. Distribution of Uranium Resources**

[3]Overfeeding means using more uranium feed than normal during the enrichment process. While more uranium is used, this process saves large quantities of electricity. This overfeeding can be viewed as the substitution of uranium for electricity in the input process.

[4]Indicative planning refers to those economies where government "suggestions" guide industrial decisions.

cultivating Japanese customers, who are used to an environment of strong coordinated government support for specific industrial sectors and expect the development of career-long personal relationships with their government and industry partners.

The national policies of key competitors of the U.S. are the focus of Section III of this study. In particular, the policies of Australia, Canada, and France, the three largest competitors to the U.S. in the uranium market, are discussed in depth. Although Niger and the former Soviet Union Republics (FSU Republics) are also uranium producers, they are not considered in this section. While Niger is the Western world's number two producer, outside operators (Cogema of France, Overseas Uranium Resources Development Co. (OURD) of Japan, and Empresa Nacional del Uranio S.A. (ENUSA) of Spain) largely control Niger's production. As such, it is not seen as a direct competitor to the U.S. The uranium production from the FSU Republics is covered under antidumping agreements in this Executive Summary and in Section IV of this study.

### *Australia*

Australia possesses vast reserves of low-cost uranium. However, the Australian government actively restricts the potential of Australian uranium producers through a "three mine" policy, which limits operation to three mines. Only two mines remain in operation today; together they supplied 5.9 million lbs $U_3O_8$ in 1993, making Australia the third leading uranium-producing nation, behind Canada and Niger. This three mine policy was initiated in 1983 following the election of the Australian Labor Party, as part of a broader policy that bans both further processing of nuclear fuels and the use of nuclear power to generate electricity. Given Australia's large uranium reserves, however, and the industry's potential to create jobs and increase exports, there is considerable internal opposition to the three mine policy. During recent elections, the opposition party campaigned against the policy. There is also considerable opposition within the Labor Party to this policy, which could be relaxed at the upcoming September 1994 Labor Party conference. If the government decides to relax the three mine policy, Australia could capture a much larger share of the world uranium market than it currently has. Australian mining companies make a strong case for relaxation of the policy. One such company, Energy Resources of Australia, Ltd., has noted that a failure to relax the policy will simply increase the Saskatchewan (Canadian) domination of the world uranium market and cast doubt on Australia's willingness to be a reliable supplier.

### *Canada*

Canadian mines produced 23.9 million lbs $U_3O_8$ in 1993, making Canada the leading uranium-producing nation. It is predicted that Canadian uranium production will continue to supply a large percentage of the world's uranium demand for the foreseeable future, primarily because of the high grade of its uranium deposits. Export policies have been greatly relaxed in recent years, reflecting a trend towards a more open market philosophy. At the same time, there is a tightening of environmental restrictions, as evidenced by the recent decision to delay further development at the Midwest uranium production site pending further environmental analysis. This could hinder future capacity of Canadian mines.

In general, the Canadian government has played a very supportive role in the development of its uranium mining industry. The government stockpiled uranium in the 1970s to protect the industry from the negative effects of U.S. policies. The Canadian government required utilities to secure long-term uranium supply contracts that needed the approval of the government. For example, Ontario Hydro, a provincial government-run utility, signed long-term contracts with Ontario uranium producers, thereby ensuring that uranium mining would continue in Ontario. Government involvement even extended to involvement in global price fixing in the 1970s (U.S. House of Representatives 1977, Gray 1992, Spar 1994).

Several companies have benefited from this government involvement, including Cameco, the second leading uranium producer in the world. However, Canadian government involvement in the industry has been reduced considerably over the years as Canada has relaxed various policies in order to maintain its obligations under the free trade agreements and the General Agreement on Tariffs and Trade (GATT). One could argue that it has been willing to do this because of the overall success of its uranium industry in capturing a large share of the global market, making further governmental involvement unnecessary.

### *France*

In general, the French view strong industrial policy as a means of protection against foreign economic domination, as a mechanism to "catch up" to other international players through the focused application of government resources, and as a means to garner international prestige through excellence in various fields. In the energy arena, the French recognized nuclear power as a resource that would give them energy independence and provide for a future export market. The French political structure has allowed France to proceed with this long-term energy program and to succeed with its nuclear power program where others, with the exception of the Japanese, have failed. This success has required strong state control and the creation of a global, integrated network to obtain the uranium to supply the program. As a result of these efforts, in 1993, the 89.2% government-owned Cogema became the world's leading uranium producer although domestic uranium production in France that year totaled just 4.5 million lbs $U_3O_8$.

The national utility, Electricité de France (EdF), builds and operates all of the country's nuclear power plants. EdF is a subsidiary of the Commissariat a l'Energie Atomique (CEA), the government agency charged with overall responsibility for both civilian and military nuclear programs. Cogema, also a subsidiary of CEA, supplies 90% of EdF's uranium needs. It also converts, enriches, fabricates, and eventually reprocesses the fuel. Cogema has invested globally, in Australia, Gabon, Niger, Canada, and the U.S., making sure that it controls adequate reserves to meet the uranium requirements of EdF.

All of this has occurred, according to Georges Vendryès of the CEA, with only minimal oversight by the French Parliament. He notes the following: "For forty years, the big decisions . . . have been made by a very limited group of people occupying key posts in the government or high administration of EdF, of the CEA, and of a few industrial companies concerned with the program. The approach remains unchanged, in spite of changes of minister, thanks to the permanence of the people who generally occupy the same post for some

dozen years."[5] This is in contrast to the U.S., where public participation at almost all levels of the policy-making process results in few secrets, or at least allows intragovernmental checks and balances.

## The Impact of Trade Agreements on the Domestic Uranium Industry

Overall, the impact of trade agreements, including GATT, the U.S-Canada Free Trade Agreement (CFTA), and the North American Free Trade Agreement (NAFTA) has been to remove overt barriers to uranium trade. Today, any overt governmental policies to protect a country's domestic uranium industry bring either GATT or free trade agreement challenges. This has made it difficult for the U.S. government to enact meaningful legislation to revitalize the domestic uranium industry. On the other hand, these agreements have meant that other countries, such as Canada, have had to modify their policies with respect to their uranium industries. Unfortunately for the U.S. uranium industry, other countries are still able to produce uranium at lower costs.

## Additional Factors Affecting Trade

Additional factors affecting the U.S. uranium industry include requirements added to the Atomic Energy Act of 1954 (AEA) by the Nuclear Nonproliferation Act of 1978 (NNPA), enforcement of antidumping statutes, and various user fees.

### *The Nuclear Nonproliferation Act (NNPA)*

The NNPA added the requirement to the AEA that the U.S. maintain prior approval rights over the transfer or reprocessing of materials of U.S.-origin, or materials that are produced using facilities of U.S.-origin. At the present time, this requirement is stalling negotiations with the European Atomic Energy Community (EURATOM) countries on the new U.S.-EURATOM Cooperation Agreement. Without this agreement, U.S. uranium producers would be effectively shut out of the EURATOM market. Clearly, satisfactory resolution of the U.S.-EURATOM talks is very desirable. Further, any disruption in the U.S.-EURATOM Cooperation Agreement would have negative effects on the U.S. uranium industry, as third-party countries could not receive or retransfer fuels of U.S.-origin from or through EURATOM countries, making the security of U.S. supply options questionable.

### *Antidumping Agreements*

The antidumping suspension agreements with four of the FSU Republics are illustrative of U.S. government efforts to actively protect the interests of the uranium industry. They also demonstrate how difficult it is to please all sides, including our international trading partners and our former Cold War adversaries. The U.S. Department of Commerce (DOC) has had to walk a thin line in negotiating these agreements. On one side are the U.S. producers that want to keep material from the FSU Republics out of this country in order to increase uranium prices. These producers want a strong agreement with measures to ensure compliance. On the other side are utilities, which want to buy the cheapest uranium, and the FSU Republics,

[5]Quoted in Davis (1988).

which need foreign currency. In the middle are other uranium-producing countries that benefit from restrictions on material from the FSU Republics because such restrictions increase price (although not high enough to benefit U.S. producers), but that also oppose the terms of the amendments because they allow some dumping to continue to the benefit of U.S. domestic producers.

The amendments to the Russian Suspension Agreement should be viewed positively in terms of U.S. domestic uranium revitalization because they allow for increased U.S. production. To what extent domestic producers actively negotiate sales under these agreements will depend on the willingness of utilities to accept such contracts; the perception of regulatory involvement on the part of DOC; and, most importantly, whether producers can negotiate low enough prices from Russian producers to assure long-term profitability. The amendments have drawn protests from other uranium-producing countries that are charging that they violate both GATT and the free trade agreements (CFTA and NAFTA). The DOC is concluding negotiations with Kazakhstan, Kyrgyzstan, and Uzbekistan as well. Two other republics, Ukraine and Tajikistan, have terminated their suspension agreements.

### *User Fees*

The Omnibus Budget Reconciliation Act of 1990 requires the U.S. Nuclear Regulatory Commission (NRC) to recover 100% of its budget authority through annual licensing and inspection fees. The NRC fee structure places heavy financial burdens on the U.S. domestic uranium industry. First, annual fees on uranium recovery facilities increase the bottom-line cost of domestic uranium. Further, most uranium exports require specific export licenses costing thousands of dollars, whereas most imports are covered under general licenses that require no fees. While Congress is considering partial relief, there appears to be little enthusiasm for it at this time.

The Customs User Fee (CUF) is an example of a fee levied on uranium imports but not exports. At present, the fee is set at 0.17% of the appraised value of the goods, with a maximum ceiling of $400. The ceiling was added in 1990. In accordance with NAFTA, imports of uranium from Canada are exempt from the fee. Because of the $400 ceiling, the CUF does not have a major impact on uranium import decisions.

A Harbor Maintenance Tax (HMT) is collected on both imports and exports of uranium. The HMT reduces the chances for domestic uranium producers to win export contracts because it directly increases costs. However, because it also applies to imports of uranium from other countries, the HMT provides an incentive for U.S. consumers to use U.S. uranium.

## Key Priorities for Governmental Action

One important area where the U.S. can help the domestic uranium industry is export promotion and coordination. The U.S. has traditionally avoided this type of role, believing that the most effective operation of the market occurs when it is completely free of government or other outside intervention. However, there are some indications that this policy is

changing. The Clinton Administration issued the report, *Toward a National Export Strategy* (Trade Promotion Coordinating Committee 1993), which calls for the government to be more proactive in its support of U.S. industry in foreign markets. This could benefit the U.S. uranium industry as it seeks overseas opportunities and competes with other countries, such as France, that actively support their industries. Likewise, the successful renegotiation of the U.S.-EURATOM Cooperation Agreement is important to ensure continued nuclear trade with European countries. Finally, the government could reduce the impact of user fees on the industry, particularly the annual NRC license fees.

## Acronyms and Abbreviations

**AEA** – Atomic Energy Act
**AEC** – Atomic Energy Commission
**AECB** – Atomic Energy Control Board
**ASCM** – Agreement on Subsidies and Countervailing Measures
**BWR** – boiling water reactor
**CEA** – Commissariat a l'Energie Atomique
**CFM** – Compagnie Française de Mokta
**CFTA** – U.S.-Canada Free Trade Agreement
**Cogema** – Compagnie Générale des Matières Nuclèaires
**DSB** – Dispute Settlement Body
**CUF** – Customs User Fee
**DOC** – United States Department of Commerce
**DOE** – United States Department of Energy
**DOS** – United States Department of State
**EAR-I** – Estimated Additional Resources - Category I
**EdF** –Electricité de France
**EIA** – U.S. Energy Information Administration
**EMR** – Canadian Ministry of Energy, Mines, and Resources
**ENUSA** – Empresa Nacional del Uranio S.A.
**EPAct** – Energy Policy Act of 1992
**ERA** – Energy Resources of Australia, Ltd.
**EURATOM** – European Atomic Energy Community
**FBFC** – Franco Belge de Fabrication de Combustibles
**FSU Republics** – Former Soviet Union Republics
**GATT** – General Agreement on Tariffs and Trade
**GWe** – gigawatts-electric
**HMT** – Harbor Maintenance Tax
**HEU** – highly enriched uranium
**IAEA** – International Atomic Energy Agency
**ISL** – in situ leaching
**JFPP** – Joint Federal Provincial Panel
**KEPCO** – Korea Electric Power Corporation
**LRC** – lower reference case
**LEU** – low enriched uranium
**MITI** – Japanese Ministry of International Trade and Industry
**MT** – metric tons
**MWDt/MTu** – megawatt days thermal per metric ton of uranium
**MWe** – megawatts-electric
**NAFTA** – North American Free Trade Agreement
**NEA** – Nuclear Energy Association
**NEI** – Nuclear Energy Institute
**NNPA** – Nuclear Nonproliferation Act of 1978

**NPT** - Nuclear Nonproliferation Treaty
**NRC** - U.S. Nuclear Regulatory Commission
**NUEXCO** - Nuclear Exchange Corporation
**OECD** - Organization for Economic Cooperation and Development
**OURD** - Overseas Uranium Resources Development Corporation
**PWR** - pressurized water reactor
**RAR** - Reasonably Assured Resources
**R&D** - Research and Development
**SAE** - Société Auxiliaire d'Energie
**SWU** - Separative Work Units
**TCMF** - Total Compagnie Minière France
**UCAN** - Uranium Canada Limited
**UG** - German Urangesellschaft
**URC** - upper reference case
**USEC** - United States Enrichment Corporation
**WMC** - Western Mining Corporation

# Introduction

Several countries once protected their uranium industries from foreign influence under the guise of national security. In the U.S., national policies were enacted to ensure a long-term stable supply. Beginning with the enactment of the Atomic Energy Act of 1946, the U.S. government controlled the production, ownership, and use of all fissionable material. All uranium produced in the U.S. was purchased by the U.S. Atomic Energy Commission (AEC) until 1964, when the 1946 Atomic Energy Act was amended to allow utilities to purchase and own uranium for use in commercial nuclear power plants. In the years from 1969 until 1984, the U.S. first banned and then limited the enrichment of foreign-origin uranium. Canada protected its fledgling industry by stockpiling uranium and requiring long-term contracts for its utilities. France developed a national program to secure uranium supplies around the world, which included the creation of Cogema, a complete nuclear fuel cycle company that now dominates the international uranium market.

With time, the international uranium market has become much more open, largely as a result of trade agreements. Today, any overt governmental policies to protect a country's domestic uranium industry can bring challenges under the General Agreement on Tariffs and Trade (GATT), the U.S.-Canada Free Trade Agreement (CFTA), and the North American Free Trade Agreement (NAFTA). For the U.S., this has meant difficulties enacting meaningful legislation to revitalize the U.S. domestic industry. On the other hand, these same agreements have required other countries, such as Canada, to modify their policies with respect to their uranium industries. Unfortunately for the U.S. uranium industry, other countries are able to produce uranium at lower costs.

Actions that a government can take to revitalize its domestic uranium industry include export promotion and coordination. The U.S. has traditionally avoided this role, believing that the most effective operation of the market occurs when completely free of government or other outside intervention. However, there are some indications that this policy is changing. The Clinton Administration issued the report, *Toward a National Export Strategy* (Trade Promotion Coordinating Committee 1993), which calls for the government to be more proactive in its support of U.S. industry in foreign markets. This involvement could prove beneficial to the U.S. uranium industry as it seeks overseas opportunities and competes with other countries, such as France, that actively support their uranium industries.

## Purpose of Report

Section 1014(b) of the Energy Policy Act of 1992 (EPAct) assigned responsibility to the Secretary of Energy to develop recommendations and implement government programs to promote the export of domestic uranium. The April 1993 "Response to §1014(b) of the EPAct: Recommendations to Promote the Export of Domestic Uranium," prepared by the Office of Nuclear Energy, U.S. Department of Energy (DOE), identified four key issues that "could (or have) result(ed) in a significant impact on the export of domestic uranium." These four key issues were:

- Lack of sufficient government facilitation of uranium export activities,
- Regulatory and policy impediments to the flow of uranium products between the U.S. and other countries,
- Excess supply, and
- Dismantlement of foreign nuclear weapons.

This report addresses the second issue, "Regulatory and policy impediments to the flow of uranium between the U.S. and other countries." The objective of this study is:

> *"To provide an assessment of the 'levelness' of the international playing field in this area and a discussion of possible leverage points for the United States to promote the export of U.S. uranium."*

Specifically, three areas are examined:

1) Policies of foreign governments that impact their imports of uranium, including border measures and any policies that affect the international competitive position of their uranium industries
2) U.S. laws and policies that impact U.S. uranium export, such as licensing requirements, nonproliferation policy, and fair trade practices
3) Any international agreements, including GATT and the free trade agreements, which limit U.S. options for providing assistance to the domestic uranium industry

## Organization of Report

Section I of this report discusses the U.S. government policy regarding support of U.S. industry. This discussion is general in nature and sets the stage for the rest of the report.

Section II begins with a general overview of the world uranium market, including supply and demand considerations, and the geographic and cost distribution of available resources.

Section III compares the uranium industries of three key countries, Australia, Canada, and France, and the impact of governmental policies on their respective uranium industries.

Section IV begins with a discussion of the impact of international agreements on the domestic uranium industry, including GATT, the free trade agreements, and the suspension agreements with the former Soviet Republics (FSU Republics). Specific domestic policies that directly or indirectly impact the domestic uranium industry are then discussed.

Section V provides a commentary and recommends actions that the U.S. government can take to assist the uranium industry in increasing its exports without violating existing trade agreements or other legal or policy constraints.

## Section I. U.S. Government Policy and International Trade

The end of the Cold War and the disintegration of the former Soviet Union led to the collapse of a decades-old bipolar world geopolitical structure based on military power. Over the last four to five years we have seen the emergence of a new world order based to a large degree on economic power (see, e.g., Sandholtz et al. 1992, Allison and Treverton 1992). The U.S. has been struggling to adjust to these new world dynamics and is exploring the viability of new tools, including legislation, agreements, and policies, to encourage the development of U.S. technology and strengthen U.S. industry internationally. Many of these, including export requirements (both those that restrict the import of foreign goods into a country and those that help facilitate the movement of domestic goods out), are a form of industrial policy. We follow Okimoto in his definition of industrial policy as "the government's use of its authority and resources to administer policies that address the needs of specific sectors and industries (and, if necessary, individual companies) . . ." (Okimoto 1989). In general, industrial policy is to be contrasted with macroeconomic policy, which includes those public policies that address the economy as a whole, not just the needs of specific industrial parts. For historical and cultural reasons, different countries put different emphases on industrial and macroeconomic policies.

> European governments, the (European) Community, and major European companies are increasingly investing the resources required to overcome existing weaknesses and play to technological strengths. . . . Meanwhile, the U.S. assumes that market development (i.e., market activity) will ensure its future position in technology and industry (Borrus and Zysman 1992).

The U.S. has historically eschewed engaging explicitly in the creation and/or the implementation of industrial policy, choosing instead to focus on macroeconomic policy with the intent of creating a climate that is equally conducive to the success of *all* industrial sectors. When the U.S. has engaged in industrial policy-making, it has done it for the stated purpose of job retention or creation or for the purpose of meeting national security objectives.

Other countries have adopted explicit courses of industrial policy. Japan is the most well-known (and the most infamous in the U.S.), with its coordinated work through the Ministry of International Trade and Industry (MITI). Japan sees industrial policy—the selection and coordinated promotion of specific industrial sectors—as key to its efforts to 'catch up' to the U.S. and to become a world player in the global economic game, so generating the economic security that the country's lack of natural resources might otherwise preclude. European countries such as France and Germany have viewed industrial policy as a means to protect against foreign economic domination in specific areas, to develop and maintain a competitive position relative to other international players through the focused application of government resources, and to garner international prestige through excellence in some particular field.

Industrial policies can be loosely divided into two types: technology push and market pull. The former include such mechanisms as the stimulation of technology through federal research and development (R&D) subsidies, R&D tax incentives, and government-subsidized

financial instruments such as loans. Market pull mechanisms include infant or home industry protection, government procurement programs, and the stimulation of international markets through export promotion. Although this study focuses on export promotion, the integrated nature of these mechanisms and the comprehensive nature of industrial policy will prompt reference to other market pull and technology push policies.

The concept of explicit government promotion of specific export sectors has been a very difficult concept for the U.S. to swallow. There is a general belief in the U.S. that the economy will optimally allocate resources to the individual players according to their relative strengths if left to operate according to the "invisible hand of the marketplace" as expounded by Adam Smith, the father of capitalist economics (Smith 1974).[6] Capitalism as an economic principle thus directly translates into laissez-faire politics.

With few exceptions, U.S. domestic, political, and economic policy has tended to follow the rhetoric of capitalist economics. In general, macroeconomic policy has been designed to manipulate the environment within which the market operates rather than the market itself and tends to be consumer-focused rather than producer-focused.[7] A consumer-focused policy is designed to ensure that consumers have appropriate access to the marketplace rather than to strengthen producers' capabilities. (This is not to be confused with a "market pull" perspective that focuses on generating consumer demand.) Much of the U.S. legislation[8] specifically directed at the industrial production environment is designed to protect the rights of individuals (such as safety and health regulations or equal employment laws) or the rights of corporations to participate in a market in which the constraints are the same for all competitors, rather than to strengthen the ability of the producers to produce. Regulatory,

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[6]It has been claimed that, since firms and other organizations have taken the place of the individual players that formed the basis of the market in Adam Smith's time and that were the "rational decision makers" that led to this optimal resource allocation, the invisible hand no longer has such a strong influence. However, it is interesting to note that a fundamental principle of U.S. corporate law is that a corporation, *by definition*, is treated as, and is considered to behave as, an individual. Therefore, although a corporation's decision-making process is the conflation of the many internal and often competing interests of the organization and so its decisions may not exhibit the same utility-maximizing characteristics as would the decision of a "rational man," legally (and hence politically and economically) we treat individual and corporate decisions as results of the same kinds of processes.

[7]An interesting anomaly has developed in market economies as a result of this approach. Known as the *tragedy of the commons* it assumes that the community of rational decision makers (the utility-maximizing individuals) will individually make decisions that will collectively destroy commonly held assets or neglect to invest in social infrastructure that will contribute to the common wealth rather than to individual gain. Some interesting studies have shown that this is, indeed, a function of market economies rather than of the existence of assets held in common (Ostrom 1990). In the U.S., one area that has been seen as appropriate for government intervention in order to avoid this "tragedy of the commons" is government support of basic science. This support has been defended in terms of a "widespread but weakly held sentiment that the pursuit of knowledge is a cultural activity intrinsically worthy of public support" (Brown 1992) or an activity that "plays an abstract but ennobling role in human culture" (ibid.). This support has also given rise to arguments that basic research is a necessary precursor to the development of applied technologies that can sustain our economic growth. Advocates of all these positions have argued the appropriateness of public support of science (loosely defined as the pursuit of knowledge for its own sake), but have denounced the support of technologies that are (by definition) presented in terms of market attractiveness as industrial policy and hence not appropriate to support with public funds.

[8]Legislation is seen here as a specific expression of a policy direction.

antitrust, and antidumping legislation are well-known examples of this type of legislation. In fact, U.S. antitrust policies have had a significant impact on the international uranium market. It was under the federal antitrust laws that Westinghouse charged the international uranium-producing community in the 1970s with illegal collusion and price fixing (see Spar 1994). In recent years, uranium producers and mines have used U.S. antidumping protection to curb the flow of material from the former Soviet Union.

There is one group of exceptions to the U.S. commitment to the precepts of a strict capitalist market economy. In cases where the U.S. government has considered it necessary to the nation's security and well-being to maintain a specific industry in the U.S. despite its economic nonviability, it has intervened in the market to support that industry. This was true for the uranium industry, which enjoyed strong home market protection until the 1970s, stimulated by strong demand from the U.S. government for uranium for weapons and quickly followed by a rapidly growing domestic base of civil nuclear power plants. During this period, therefore, the U.S. uranium industry was primarily concerned with satisfying an existing domestic demand rather than stimulating new demand either at home or abroad. In contrast, the uranium industry in most other countries has been forced from early on to seek out consumers for its products (i.e., to stimulate market pull rather than to focus on technology push) and to exploit foreign markets. Uranium companies from countries other than the U.S. thus have developed both a set of strategies for stimulating demand abroad and (equally important) an attitude that recognizes this as necessary for their economic viability.

Although industrial policy that favors one sector or group of players over another has not been explicitly promoted in the U.S., there have been recent indications that this position is changing in the international economic arena. Historically, the U.S. has viewed the global economic system as a marketplace in which individuals/companies are allowed to compete freely and that will thus lead to the most equitable distribution of resources. The unstated but implicit corollary is that, if allowed to compete on merit, U.S. corporations will win a reasonable share of such resources. However, such an approach requires that all other players allow the market to operate freely and refrain from the imposition of "unfair" trade practices. Hence was born the concept of the "level playing field," with the recognition that it might, in fact, not be level and the growing realization that other countries are not willing to withdraw their support of particular industries in order to level the field.

The recognition of the unlevelness of the playing field led to the institution of similar support measures on the part of the U.S. for selected industries. Recognizing, for example, that the calls to Japan to open its domestic markets to U.S.-manufactured goods were not being heeded (infant industry and home market protection are a strong element of Japan's industrial policy portfolio), the U.S. requested voluntary export restrictions on the part of Japanese auto manufacturers, thus instituting *de facto* home market protection for the U.S. auto industry. Similar protections for the U.S. semiconductor industry were considered, and antitrust legislation was modified to allow the creation of Sematech, an industry-wide semiconductor

R&D consortium.[9] And in 1993, the Clinton administration issued a report to Congress entitled *Toward a National Export Strategy* that strongly suggests that the U.S. government be more proactive in its support of U.S. industry in the foreign marketplace. The report stated that the government will directly enhance the capability of U.S. companies to compete in those markets: "Government must play an important and more focused role in helping the private sector sell more goods and services overseas" (Trade Promotion Coordinating Committee 1993).

That the government proposed to act as an advocate for U.S. industry was a reversal of a *de facto* policy that had been in place for many years (see Clinton and Gore 1993). Concerned that it would appear that the government was supporting one particular company over another in a given market opportunity (and hence making the playing field unlevel for the other U.S. companies involved) or supporting one industrial sector at the expense of another, the federal government had been very cautious in its participation in international sales negotiations on behalf of U.S. industries. In a recent confidential interview, an industrial representative noted that the U.S. government had indicated that it would be very supportive of a general "buy American" campaign but that it had to refrain from endorsing a specific U.S. competitor or industrial sector.

In summary, the U.S. government has historically disengaged itself from supporting or protecting specific U.S. industry trading abroad. Its efforts have been more general—to keep the marketplace open to all competitors. Exceptions to this policy have been aimed at satisfying very specific purposes (for example, national security). Although the U.S. uranium industry was strongly supported by the U.S. government at one time in order to satisfy national security requirements, changes in the world political and economic order have changed such requirements and so the U.S. uranium industry has found itself without the protected market it once enjoyed. Furthermore, in part because of this history, it also finds itself less prepared to compete effectively in the international arena than foreign competitors that have been involved for some time in assiduously seeking strong foreign or domestic markets.

We now turn to a general overview of the world uranium market, exploring in more depth the supply and demand considerations briefly alluded to earlier in this chapter. A description of the geographic distribution of available resources and a overview of relative recovery costs will complete the background necessary for the discussion of specific policies of the three target countries.

[9]It is interesting to note that much of the rhetoric surrounding the justification of Sematech focused on the generic or pre-competitive focus of the proposed research activities. *(See previous note on the acceptability of U.S. government involvement in science versus technology.)*

## Section II. The World Uranium Market

This section provides a general overview of the world uranium market, discussing issues regarding demand and supply, existing resources, and the sources of uncertainty in the market.

### Worldwide Demand

Uranium demand is driven by the generation of nuclear power. In 1993, there were a total of 424 nuclear plants operating worldwide, with installed capacity of 330 gigawatts-electric (GWe). In the U.S., 109 reactors had an installed capacity of 98.5 GWe. Table 1 lists the annual reactor uranium requirements by country. Total world uranium demand in 1993 was 151.9 million lbs $U_3O_8$; U.S. reactors required 44.9 million lbs $U_3O_8$, 29.6% of total world demand. Japan and France followed the U.S. with 13.9% and 13.5%, respectively, of total world demand. Nuclear reactors in countries in the Organization for Economic Cooperation and Development (OECD)[10] required 81.4% of the world total.

OECD is one of several groups that regularly forecast future nuclear capacity and uranium requirements. OECD projections for uranium requirements from 1993 to 2010 are included in Table 1. The OECD projects a 37% increase in nuclear capacity worldwide by 2010 (445 GWe) and an increased demand for uranium of 26% (OECD 1994). These projections for overall growth in world nuclear capacity rely on responses received to questionnaires sent to member countries of the Nuclear Energy Association (NEA) and the International Atomic Energy Agency (IAEA). They reflect the best-guess estimate of installed nuclear capacity in 2000 and 2010 for each country that responded. They do not include a low and high case, as do most other projections. Where a response to the questionnaire was not received by the OECD, the OECD secretariat provided the estimate.

The OECD projects a 26% increase in worldwide uranium demand by 2010, and a 16% increase overall for the OECD countries themselves. Several countries are expected to achieve sizable increases in installed nuclear capacity over 1993 levels by the year 2010. These include Argentina (100%), Brazil (1373%), China (320%), the Czech Republic (79%), India (132%), Japan (85%), Kazakhstan (449%), Mexico (109%), Pakistan (144%), Russia (61%), South Korea (77%), Taiwan (39%), and the Ukraine (55%). Certain OECD countries, including the U.K. and Sweden, however, expect a decline in annual requirements. Over this time period, U.S. demand is seen as relatively stable, declining by only 2% by 2010.

The OECD estimate for a 37% increase in nuclear capacity by 2010 exceeds most other forecasts and therefore represents a scenario of the greatest demand in the period between 1993 and 2010. The U.S. Energy Information Administration's (EIA's) upper reference case projects a 29.6% increase over 1992 levels; the lower reference case projects a mere 6.6%

[10]OECD countries include Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.

## Table 1. Annual Reactor Requirements (1000 lbs $U_3O_8$)

| | 1993 | % of World Total | 2000 | 2010 | % Change Since 1993 |
|---|---|---|---|---|---|
| Argentina | 390 | 0.3 | 780 | 780 | 100 |
| Armenia | 0 | 0.0 | 465 | 1,209 | NA |
| Belgium | 2,470 | 1.6 | 2,470 | 2,470 | 0 |
| Brazil | 286 | 0.2 | 1,404 | 4,212 | 1373 |
| Bulgaria | 2,194 | 1.4 | 1,687 | 1,178 | -46 |
| Canada | 4,940 | 3.3 | 4,940 | 5,200 | 5 |
| China | 512 | 0.3 | 902 | 2,150 | 320 |
| Cuba | 0 | 0.0 | 255 | 255 | NA |
| Czech Republic | 1,014 | 0.7 | 1,820 | 1,820 | 79 |
| Finland | 1,196 | 0.8 | 1,118 | 1,105 | -8 |
| France | 20,540 | 13.5 | 20,800 | 22,360 | 9 |
| Germany | 8,320 | 5.5 | 8,060 | 8,060 | -3 |
| Hungary | 1,128 | 0.7 | 1,092 | 1,092 | -3 |
| India | 538 | 0.4 | 881 | 1,251 | 132 |
| Japan | 21,060 | 13.9 | 26,000 | 39,000 | 85 |
| Korea, DPR | 0 | 0.0 | 107 | 380 | NA |
| Korea, Rep. of | 5,574 | 3.7 | 7,493 | 9,880 | 77 |
| Kazakhstan | 182 | 0.1 | 182 | 998 | 449 |
| Lithuania | 1,342 | 0.9 | 1,342 | 1,342 | 0 |
| Mexico | 572 | 0.4 | 572 | 1,196 | 109 |
| Netherlands | 221 | 0.1 | 247 | 234 | 6 |
| Pakistan | 42 | 0.0 | 101 | 101 | 144 |
| Romania | 0 | 0.0 | 426 | 855 | NA |
| Russia | 10,946 | 7.2 | 11,284 | 17,615 | 61 |
| Slovak Republic | 936 | 0.6 | 1,768 | 884 | -6 |
| Slovenia | 265 | 0.2 | 265 | 265 | 0 |
| South Africa | 520 | 0.3 | 520 | 520 | 0 |
| Spain | 3,471 | 2.3 | 3,336 | 3,336 | -4 |
| Sweden | 4,160 | 2.7 | 4,160 | 2,860 | -31 |
| Switzerland | 1,383 | 0.9 | 1,383 | 1,201 | -13 |
| Taiwan | 2,106 | 1.4 | 2,106 | 2,925 | 39 |
| Ukraine | 5,356 | 3.5 | 6,568 | 8,304 | 55 |
| United Kingdom | 5,291 | 3.5 | 5,057 | 2,998 | -43 |
| United States | 44,980 | 29.6 | 45,500 | 43,940 | -2 |
| Other | 0 | 0.0 | 0 | 4,774 | NA |
| OECD Total | 123,607 | 81.4 | 130,564 | 143,528 | 16 |
| **Total** | **151,936** | **100.0** | **165,092** | **196,750** | **26** |

Source: OECD 1994

increase over the same period (EIA 1993a). Corresponding uranium growth rates are 22% and 7%.[11] EIA notes that there is much uncertainty in these estimates. Countries that have the least uncertainty in their future nuclear growth include France, Japan, South Korea, and Taiwan, because they have made significant commitments to nuclear-power-generated energy.

It is indeed possible that even the relatively slow growth projected by the EIA's lower reference case (6.6% increase in installed capacity) is overly optimistic. For the U.S., the EIA assumes that the operating licenses for 50% of all existing units are renewed for 20 years. They do not account for possible premature plant shutdowns although these have been occurring in the recent past.[12] However, these assumptions make little difference in the aggregate uranium requirements prior to 2010.

Table 2 presents a comparison from several major studies of projections for nuclear growth for the period 1995–2005. Estimates of installed capacity for the year 2005 range from 356 GWe (projection by EIA, lower reference case) to 453 GWe (projection by NUEXCO). The NUEXCO case assumes significant growth in foreign programs. Also interesting to note is that EIA's 1993 estimates are lower than those made in 1992, reflecting the closure of three plants in the U.S. and a less optimistic outlook for growth of nuclear power in Western Europe and the Far East than in the previous year.

It is also instructive to consider past estimates. The OECD estimated installed nuclear capacity for 1990 of between 424 and 487 GWe, significantly higher than the 1993 installed capacity of 330 GWe (OECD 1982). This table shows that, with the exception of NUEXCO's estimates, the OECD estimates are at the upper end of all of these studies. Based on these uncertainties, we conclude that the OECD projections should represent an absolute upper range of uranium requirements for the period 1993–2010.

Annual uranium requirements under the OECD scenario increase from 151.9 million lbs in 1993 to 196.8 million lbs in 2010 (see Table 1). Aggregate uranium demand through 2010 totals 3.08 billion lbs $U_3O_8$. At 1993 levels of demand, aggregate uranium demand through 2010 would total 2.6 billion lbs. Actual aggregate uranium demand for 1993–2010 should therefore fall in the range of 2.6 to 3.1 billion lbs $U_3O_8$.

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[11]This assumes that capacity factors increase from an average of 71% to 75% by 2010. This also assumes that enrichment tail assays (the amount of uranium contained in the waste stream) remain at 0.3% through 2000 and then decrease by 0.01% annually to a level of 0.25%. EIA calculations assume that worldwide spot prices will increase through 2005; under this assumption, decreasing the tails assay would make economic sense. The reference cases further assume that design burnup increases from 33,000 megawatt days thermal per metric ton of uranium (MWDt/MTu) in 1993 to 43,000 MWDt/MTu in 2007 and beyond for Boiling Water Reactors (BWRs); 42,000 MWDt/MTu in 1993 to 55,000 MWDt/MTu in 2005 and beyond for Pressurized Water Reactors (PWRs).

[12]In 1992, Yankee Rowe, owned by Yankee Atomic Electric Company, and San Onofre 1, owned by Southern California Edison and San Diego Gas and Electric, were shut down. In January 1993, it was announced that the Trojan nuclear plant, operated by Portland General Electric Company, would not be restarted. While these were included in EIA's projections, many industry analysts expect other plants will also shut down in the near future (Washington International Energy Group 1994), especially those with high operating and maintenance costs.

**Table 2. Forecasts of Installed Nuclear Capacity**

| Forecasting Organization | Predicted Capacity (GWe) | | |
|---|---|---|---|
| | 1995 | 2000 | 2005 |
| OECD 1994 | 349 | 378 | 410 |
| EIA | | | |
| LRC (1992) | 333 | 352 | 359 |
| LRC (1993) | 331 | 349 | 356 |
| URC (1992) | 345 | 366 | 409 |
| URC (1993) | 341 | 362 | 387 |
| NUEXCO (1992) | 344 | 385 | 453 |
| Energy Resources International (1993) | 343 | 367 | 389 |
| Uranium Institute (1992) | 344 | 366 | 384 |

Notes: LRC refers to "lower reference case"; URC refers to "upper reference case."

Sources: EIA 1993a, OECD 1994.

## Supply

Uranium demand in 1993 totaled 151.9 million lbs $U_3O_8$ (see Table 1). This was met through new production and inventory draw-downs, both from private and governmental sources. Table 3 shows world uranium production from 1989 to 1993. Total world production totaled just 86.3 million lbs $U_3O_8$ in 1993, down 7.7% from 1992, and down 42.2% from 1989 levels. Canada was the leading producer in 1993, supplying 27.7% of world production. Among Western producers, Canada was followed by Niger (8.6%) and Australia (6.8%). Eastern producers produced 33.8% of the world's production.[13]

World uranium production remains significantly below world demand, due to excess supply on the world market and uncertainty about the disposition of excess military inventories that may become available for civilian purposes. The OECD estimates remaining world civilian stockpiles of uranium to be 624 million lbs $U_3O_8$ equivalent or enough to meet needs for 4.1 years at the current rate of demand (OECD 1994). The EIA reported a U.S.

[13]Eastern producers include: Bulgaria, China, Czech Republic, E. Germany, Hungary, Kazakhstan, Russia, Ukraine, and Uzbekistan.

**Table 3. World Uranium Production: 1989–1993 (million lbs $U_3O_8$)**

| | 1989 | 1990 | 1991 | 1992 | 1993 | % Change Since 1989 |
|---|---|---|---|---|---|---|
| Australia | 9.5 | 9.2 | 9.8 | 6.1 | 5.9 | -37.9% |
| Canada | 29.5 | 22.8 | 21.3 | 24.2 | 23.9 | -19.0% |
| France | 8.4 | 7.4 | 6.8 | 5.5 | 4.5 | -46.4% |
| Gabon | 2.3 | 1.8 | 1.6 | 1.4 | 1.4 | -39.1% |
| Namibia | 8 | 8.3 | 6.4 | 4.3 | 4.3 | -46.3% |
| Niger | 8 | 7.4 | 7.7 | 7.7 | 7.5 | -6.3% |
| South Africa | 7.7 | 6.4 | 4.4 | 4.4 | 4.5 | -41.6% |
| US | 13.6 | 8.9 | 8 | 5.6 | 3.3 | -75.7% |
| Eastern Producers* | 59.8 | 50.4 | 40.1 | 32.5 | 29.2 | -51.2% |
| Other** | 2.4 | 1.9 | 1.6 | 1.8 | 1.8 | -25.0% |
| **Total** | **149.2** | **124.5** | **107.7** | **93.5** | **86.3** | **-42.2%** |

*Includes Bulgaria, China, Czech Republic, E. Germany, Hungary, Kazakhstan, Russia, Ukraine, and Uzbekistan.
**Includes Argentina, Belgium, Brazil, India, Mongolia, Pakistan, Portugal, Slovenia, and Spain.

Source: Adapted from NUEXCO 1994.

commercial inventory of 117.2 million lbs $U_3O_8$ at the end of 1992 (EIA 1993a). The Nuclear Assurance Corporation (NAC) predicts that inventory levels will reach a "desired level" in the mid 1990s (NAC 1993), referring to an inventory level that utility managers are comfortable with in terms of assuring flexibility in uranium provision while minimizing storage costs. Most U.S. utilities are comfortable with a 1-year forward inventory; Asian utilities typically carry a 2- to 3-year inventory.

In addition to civilian stockpiles, there are very large inventories of government-owned supplies. Continued uncertainty about whether either former Soviet supplies or U.S. government-owned supplies will reach the market have been a factor in lowered production and lower world prices. Whether or not this material will become available for civilian reactor requirements remains a key uncertainty in projecting future production and price levels.

In October 1994, DOE released its *Interim Uranium Inventory Report to Congress*, which summarized DOE stocks of unclassified inventory (DOE 1994). According to the report, the U.S. inventory includes approximately 410,000 metric tons (MT) of depleted

uranium,[14] around 16,000 MT of natural uranium (or about 41.6 million lbs $U_3O_8$), approximately 5,000 MT of LEU (with U-235 concentrations greater than 0.7111%, but less than 20%), and approximately 259 MT of HEU (U-235 concentrations greater than 20%). In December 1994, the Clinton Administration announced a plan to begin selling off part of this inventory. Although the exact terms of the sale have yet to be made public, the initial sell-off is expected to raise approximately $400 million (Nuclear Fuel 1995).

The U.S. has signed a purchase agreement with Russia whereby the U.S. will buy 500 MT of highly enriched uranium (HEU) blended down to low enriched uranium (LEU) for use in civilian reactors. The terms of the agreement call for the equivalent of 8 million lbs $U_3O_8$ per year for the first 5 years and 24 million lbs for the next 15 years, for a total of 400 million lbs $U_3O_8$ equivalent. Note that at the 24-million-lb level, the addition of this material to the world market would be equivalent to adding a new supplier of the magnitude of Canada, which led the world in 1993 with production of 23.9 million lbs $U_3O_8$. If this material is not used as overfeed[15] at the USEC enrichment plants, or stockpiled for later use, this large addition could have significant effects on world prices.

The disposition of Soviet military stocks could be done in a manner that does not negatively impact the world market. In a recent environmental assessment, the USEC concluded that it would be technically feasible to offset any negative market effects via overfeeding. In their analysis, they indicate that by increasing operating tails assays[16] from 0.28% to 0.355% for the first five years and to 0.498% for the following 15 years, they could use all of the Russian material as overfeed without reducing the levels of feed supplied by utilities. Electrical requirements under these two changes in tails assay would decrease from the current level of 3.2 GWe to 2.4 GWe for the first five years, and 1.2 GWe for the next 15 years (USEC 1994).

In addition to the large quantities of highly enriched uranium that may enter the market from both Russia and the Ukraine, there is also considerable uncertainty regarding sales of newly produced uranium from the FSU Republics, which first entered the market following the dissolution of the Soviet Union. This low-priced uranium is also affecting uranium prices. In the U.S., a coalition of producers brought suit in 1991 contending that the FSU Republics were selling uranium at below market value. In 1992, the U.S. signed suspension agreements with six republics, including Russia, Kazakhstan, Kyrgyzstan, Tajikistan, Ukraine, and Uzbekistan. Ukraine and Tajikistan terminated their suspension agreements in 1993. The Department of Commerce subsequently resumed its antidumping investigations of imports of uranium from these two Republics. The International Trade Commission subsequently ruled

[14]Depleted uranium has a U-235 content lower than natural uranium and is a byproduct of the enrichment process. The DOE transferred 36,000 MT of natural uranium to USEC on July 1, 1993. This is equivalent to 93.6 million lbs $U_3O_8$.

[15]Overfeeding means using more uranium feed than normal during the enrichment process. While more uranium is used, this process saves large quantities of electricity. This overfeeding can be viewed as the substitution of uranium for electricity in the input process.

[16]The amount of U-235 remaining in the "waste" stream. It does not have to remain waste however, as these depleted tails could be used in later years for their uranium content should world prices rise significantly, or supplies become scarce.

that uranium from Ukraine, other than HEU, did materially injure or threaten to injure the domestic uranium industry, and it imposed a duty of 129 percent. No dumping duties were applied to Ukrainian HEU. In the case of Tajikistan, the ITC ruled that Tajikistan-origin uranium did not materially injure or threaten to injure the domestic uranium industry. Any uranium of Tajikistan origin may thus be imported into the U.S. without restriction. For the remaining four republics, the agreements limited the amount of uranium that could be imported into the U.S. Below a world price of $13/lb, no imports were allowed. Above this base price, increasing quantities could be imported. The thought was that these agreements would remove some of the uncertainty in the marketplace and result in higher prices, thus allowing for imports from these financially strapped countries. This did not happen.

Although the suspension agreements deal primarily with newly produced uranium, in 1994 the Russians effectively tied resolution of their concerns with the suspension agreements to the agreement transferring Russian HEU to the U.S. Amendments to the Russian Suspension Agreement were announced on March 12, 1994. The Agreement now allows sales of up to 6.6 million lbs (approximately 15% of annual domestic requirements) of Russian-origin $U_3O_8$ equivalent that are "matched" to an equivalent amount of U.S.-origin uranium and 2 million Separative Work Units (SWU) per year for 1994 and 1995.[17] For Russia, this uranium must be uranium, either in $U_3O_8$ or $UF_6$ form, produced in Russia and not yet exported from Russia.[18] Uranium derived from Russian stocks of HEU is not covered by this agreement. For the U.S., uranium must be newly produced, meaning that it must contain $U_3O_8$ produced after March 11, 1994, the effective date of the Agreement.[19]

Uncertainty regarding the effectiveness of these agreements remains. Both Canada and Australia are unhappy with the agreements; Canada has started official talks under the terms of NAFTA, claiming that the "matched sales" concept in the Russian agreement provides preferential treatment to U.S.-origin uranium.

Amendments to the Uzbekistan agreements were announced in October 1994. Under the terms of the proposed amendments, Uzbekistan can import to the U.S. up to 440,000 lbs $U_3O_8$ per year for two years at a price greater than an unspecified reference price.[20] Commencing November 1, 1996, Uzbek-origin uranium would be allowed on a quota basis, tied to U.S. production levels.

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[17]Separate Work Units (SWUs) are the standard measure of enrichment services and denote the amount of effort required, in terms of electricity, to concentrate a certain mass of uranium. For the period 1996–2003, additional matched sales of uranium, but not SWU, are allowed. The quantities allowed are (in million lbs $U_3O_8$): *1996*–1.93; *1997*–2.71; *1998*–3.6; *1999*–4.0; *2000*–4.0; *2001*–4.0; *2002*–4.9; and *2003*–4.3.

[18]Uranium stockpiled in Europe can not be used for matched sales.

[19]The Agreement allows for an exception to this definition. If sales do not exceed 2.2 million lbs $U_3O_8$ equivalent by Sept. 11, 1994, then up to 1 million pounds of already mined, but not milled, $U_3O_8$ may be substituted.

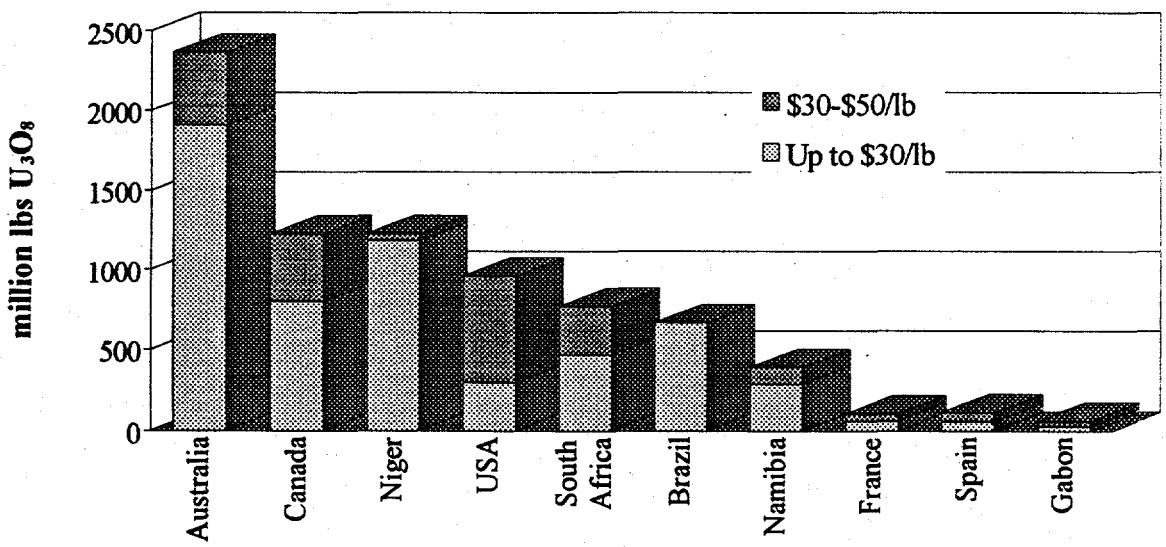
[20]DOC has yet to clarify the mechanism by which this price level will be determined. The draft amendment states that in "determining the reference price, the Department will average a benchmark ISL reference price" with the Uzbek reference price.

A similar type of agreement with Kazakhstan was announced on November 15, 1994. Negotiations are continuing with Kyrgyzstan. The Suspension Agreements are discussed in more detail in Section IV.

In summary, key uncertainties in the uranium market remain and will continue to impact both production and price. Existing production (86.3 million lbs) is far below current demand (151.9 million lbs). Commercial inventories cannot continue filling this shortfall indefinitely; industry analysts expect inventories to reach desired levels in the mid-1990s. The largest uncertainty is the disposition of government stocks, particularly from the dismantlement of nuclear weapons in Russia, the Ukraine, and the U.S. Until this question is resolved, with few exceptions,[21] producers will be unlikely to make plans for increasing production.

## Existing Resources

Figure 1 shows the distribution of recoverable $U_3O_8$ resources for 10 countries. These estimates include both Reasonably Assured Resources (RAR) and Estimated Additional Resources - Category I (EAR-I), recoverable at prices below $30/lb and between $30 and




Source: OECD, 1994.

**Figure 1. Distribution of Uranium Resources**

[21]Some additional Canadian production will probably become operational due to that country's high-quality ore.

50/lb.[22] Canada leads the world in production. Australia far outweighs Canada in low-cost available resources. However, internal government policies prevent Australia from leading world production (see Section III). Note also that while the U.S. has large resources, a large percentage of these are higher-cost resources than those found elsewhere in the world. Certain other countries, most notably the FSU Republics, are not included in this figure because of discrepancies in reporting techniques, although it is known that significant additional resources exist in China, India, Kazakhstan, Mongolia, Russia, Ukraine, and Uzbekistan. Worldwide resources that exist with some certainty are estimated at a total of 11.66 billion lbs $U_3O_8$, sufficient to last 76 years at current consumption rates. Table 4 shows the classification of worldwide $U_3O_8$ resources.[23] Of the total estimated resources, an estimated 7.3 billion lbs is recoverable at costs below $30/lb.

The OECD forecasts total uranium demand to 2010 of 3.081 billion lbs. As discussed previously, this likely represents an upper range for uranium demand. Thus, even under a high growth scenario, it is unlikely that higher price (>$30/lb) reserves will be economical

**Table 4. Classification of Worldwide $U_3O_8$ Resources**

| | Price | $U_3O_8$ (billion lbs) |
|---|---|---|
| Reasonably Assured Resources | < $30/lb | 3.7 |
| | $30–50/lb | 1.7 |
| Estimated Additional Resources - Category I | < $30/lb | 1.7 |
| | $30–50/lb | 0.8 |
| Other Known Resources | < $30/lb | 1.9 |
| | $30–50/lb | 1.9 |
| **Total** | | **11.7** |

[22]The OECD defines Reasonably Assured Resources (RAR) as "uranium that occurs in known mineral deposits of delineated size, grade and configuration such that the quantities which could be recovered within the given production cost ranges with currently proven mining and processing technology, can be specified. Estimates of tonnage and grade are based on specific sample data and measurements of deposits and on knowledge of deposit characteristics. Reasonably Assured Resources have a high assurance of existence." It defines Estimated Additional Resources–Category I (EAR–I) as "uranium in addition to RAR that is inferred to occur, mostly on the basis of direct geological evidence, in extensions of well-explored deposits, or in deposits in which geological continuity has been established but where specific data, including measurements of the deposits, and knowledge of the deposits' characteristics are considered to be inadequate to classify the resource as RAR. Estimates of tonnage, grade and cost of further delineation and recovery are based on such sampling as is available and on knowledge of the deposit characteristics as determined in the best known parts of the deposit or in similar deposits. Less reliance can be placed on the estimates in this category than on those for RAR." Additional categories include Estimated Additional Resources–Category II (EAR–II) and Speculative Resources (SR) (OECD 1994).

[23]This includes known resources that are not strictly consistent with NEA/IAEA resource terminology or definitions. These resources exist in Kazakhstan, Mongolia, Russia, and Ukraine. Additional resources in Chile, China, India, Romania, and Uzbekistan were included in the $30–50/lb category; the OECD lists these resources as "Cost Range Unassigned" (OECD 1994).

prior to 2010. This implies that the U.S. industry will have to rely on its lower cost reserves, which total just 296 million lbs $U_3O_8$ (RAR and EAR-I). It also suggests that uranium prices are unlikely to reach the levels of the 1970s.[24]

While resource estimates are useful to provide a general idea of remaining reserves, these estimates should be viewed with caution. Chapman (1993) notes how uncertain such estimates are and how likely they are to change. (Although Chapman uses oil reserves, his argument is still instructive). In 1983, Chapman notes, there was a 95% probability that original world oil endowment was at least 1,500 billion barrels (bbls) and just a 5% probability that the endowment exceeded 2,600 bbls. But by 1991, estimates had shifted so that there was a 95% probability that the endowment was at least 2,000 bbls, with a 5% probability that it exceeded 2,500 bbls (Chapman 1993). Indeed, over this time period, the growth in estimates of reserves exceeded growth in production, partially explaining the continued worldwide decline in oil prices over time.

## Summary and Conclusions

Worldwide demand exceeds production levels by a large margin. Drawdowns from a large stockpile continue to fill the difference, a trend that cannot continue indefinitely. Uncertainty regarding the disposition of government military inventories of uranium and the status of the suspension agreements with the FSU Republics act to curb production, limit exploration, and depress global prices.

Available resources recoverable at less than $30/lb are sufficient to cover aggregate demand requirements through 2010. This implies that while some new production will be necessary as inventories decline to desired levels, under free market conditions uranium prices are unlikely to increase rapidly. Foreign government actions that could change this conclusion include a tightening of Australian policy regarding its three mine policy (unlikely) or stricter Canadian environmental regulations (possible).

[24]Uranium prices peaked at $43.40/lb in May 1978 (NUEXCO 1993b).

## Section III. Foreign Governmental Policies Affecting the World Uranium Market

This section explores the impact of government policy on the uranium industries of three countries: Australia, Canada, and France. The goal is to examine whether national policies in those countries, either directly or indirectly, account for their uranium industry's overall success.

While the uranium industries in the FSU Republics are also competitors in the uranium market, they are not discussed in this section as there is no doubt that these countries' policies have had a very direct impact on the status of their domestic uranium industries. The former Soviet Union tightly controlled its uranium industry so as to assure a secure supply of uranium for its military and civilian needs. After the breakup of the Soviet Union, low priced uranium from the FSU Republics entered the world market in large quantities, depressing prices. U.S. producers sought to halt this flow through an antidumping suit. In ruling on the validity of the claims, investigators found that the republics were unable to supply actual production cost estimates (Dunn 1993), so the U.S. Department of Commerce (DOC) was forced to rely on estimates of likely production costs. Based on these estimates, the DOC determined that the material from the FSU Republics was entering the world market at less than fair market value. As a result, the amount of uranium allowed into the U.S. from the republics is now controlled (see Section IV).

### Australia

Australia ranks first in estimated uranium resources worldwide, but has no domestic nuclear power program. Australia's uranium requirements, production, and resources are presented in Table 5.

The overall goals of the Australian national nuclear policy are to limit the opportunities for nuclear proliferation, to assure sustainable prices for its producers, to limit environmental damage from the mining of uranium, and to protect the interests of the Aboriginal people. As a result, the government has imposed restrictions on the nuclear fuel cycle, including a prohibition on enrichment facilities and nuclear power plants.

Since 1983, the Australian government has also actively limited uranium production through a "three mine policy." The three approved mines are Nabarlek, Ranger, and Olympic Dam. Production at Nabarlek ended in 1988 because its resources were mined out. Combined production from the two remaining mines totaled 5.9 million lbs $U_3O_8$ in 1993, only 6.8% of total world production (NUEXCO 1994). (Both Canada and Niger produced more uranium than Australia.) Production has decreased from its peak in 1986 of 10.8 million lbs due to unfavorable market conditions (OECD 1994). Industry sources suggest that absent government intervention, Australia could capture as much as 25% of the world uranium market (NUEXCO 1993c). Employment in the uranium industry is estimated at about 385 person-years in 1993, down from a high of 621 person-years in 1988 (OECD 1994).

**Table 5. Australian Uranium Resources**

| | |
|---|---|
| Nuclear Capacity (GWe) | 0 |
| Annual Uranium Requirements (million lbs $U_3O_8$) | 0 |
| 1993 Uranium Production (million lbs $U_3O_8$) | 5.9 |
| % of 1993 World $U_3O_8$ Production | 6.8% |
| Resources (million lbs $U_3O_8$) | |
| Reasonably Assured Resources (< $30/lb) | 1,201 |
| Reasonably Assured Resources ($30–50/lb) | 143 |
| Estimated Additional Resources–I (< $30/lb) | 707 |
| Estimated Additional Resources–I ($30–50/lb) | 317 |
| Speculative Resources | 8,450 |
| **Total Resources** | **10,819** |

The Australian government is currently selling off a 4.5-million-lb uranium stockpile that it began to amass in the 1960s as a secure backup source for the British Ministry of Defense. The 1993–94 budget included income from the sell-off and noted that restrictions on FSU Republic-origin material in key world regions (the U.S. and the European Atomic Energy Community EURATOM countries) had improved market conditions for this inventory (DOS 1993). This sell-off had been previously contemplated, but was not instituted because of unfavorable market conditions. It will take two years to complete the sell-off.

While there are no formal restrictions on foreign investment in uranium production, the three mine policy does limit incentives for foreign investment. The policy, however, does not prevent Australian companies from operating in foreign countries.

Recently, the Australian government notified the U.S. that it may challenge the Amendments to the Russian Suspension Agreement as violating fair trade practices under GATT. The Australians are awaiting the outcome of the Canadian challenge under NAFTA.[25] Because there is considerable internal opposition in Australia to the three mine policy, an official U.S. response to these charges, which impacts the character of the international market, could exert an influence on future Australian policy.

### *Australian Uranium Industry*

As shown in Table 6, the two operating uranium production centers in Australia are the Ranger Mine in the Northern Territory and Olympic Dam in South Australia. Energy Resources of Australia, Ltd. (ERA) operates the Ranger mine. European shareholders hold a

[25]See Section IV for a further discussion of the Canadian challenge under NAFTA.

**Table 6. Australian Uranium Production**

| Location | Company | 1993 Output (million lbs $U_3O_8$) | 1992 Output (million lbs $U_3O_8$) | Capacity (million lbs $U_3O_8$) |
|---|---|---|---|---|
| Ranger | Energy Resources of Australia, Ltd. | 3.0 | 2.9 | 6.6 |
| Olympic Dam | Western Mining Corporation | 2.9 | 3.2 | 4.2 |
| **Total** | | **5.9** | **6.1** | **10.8** |
| Sources: NUEXCO 1994, OECD 1994. | | | | |

15% share in ERA, Ltd.[26] Western Mining Corporation (WMC), a wholly owned Australian company, operates the Olympic Dam site.

The Ranger site is an open-pit mine with an average uranium concentration of 0.2-0.27% (Mackenzie et al. 1991, NAC 1993). Since 1991, ERA has reduced operations at Ranger. Mining is limited to the months from June to December, and milling, from January to June. This has reduced output to less than half of the mine's production capability.

Mining at Ranger #1 is scheduled to end in 1994 as existing reserves are mined out, but uranium from existing stockpiles will allow milling to continue at current levels until 1999. ERA plans on developing a second mine (either Ranger #2, formerly known as Jabiluka #2, or Ranger #3) for initial production in 1998. Mining at Jabiluka is not permitted under the current three mine policy. If ERA fails to obtain permission for operating at Jabiluka, it will proceed with the Ranger #3 site.

At the Olympic Dam location, uranium is found in association with copper and gold reserves. Ore grades average 0.05% uranium, 1.6% copper, and 0.6 grams per metric ton gold (Mackenzie et al. 1991). Uranium output in 1993 was 2.9 million lbs. The location has government approval to increase annual output to 8.8 million lbs, although such an increase would depend on market conditions.

Australia has substantial low-cost reserves available. The OECD reports RAR and EAR-I reserves recoverable at less than $30/lb of 1.9 billion lbs, with an additional 460 million lbs recoverable at $30-50/lb (OECD 1994). In addition, speculative reserves, for which no recovery price estimate is given, are estimated at between 6.7 and 10.1 billion lbs. Australia does not provide estimates of EAR-II resources.

Employment in the Australian uranium industry is estimated at about 385-person years in 1993, down from 621-person years in 1988 (OECD 1994). Based on a 1993 production

[26]The shareholders are: Rheinbraun Australia, a subsidiary of Germany's RWE; UG Australia Developments; Interuranium Australia; Cogema Australia; and OKG Aktiebolag (Nuclear Fuel 1993a).

level of 5.9 million lbs, this translates into 15,324 lbs $U_3O_8$/employee/year, slightly lower than the productivity levels reported in Canada (see next section).

## *Australian National Policies Affecting Uranium Trade*

### Background[27]

Uranium exploration and mining in Australia has experienced several cycles. Exploration for uranium began in the 1940s and continued into the 1950s. During this time, demand was driven by the defense programs of the U.S. and the U.K. In 1962, the Australian government banned the production and export of uranium, claiming uranium to be "dangerous and destructive" (NUEXCO 1993c). This ban lasted until 1967. Lifting the ban led to a resurgence in exploration and a thirty- to fifty-fold increase in Australia's resource base within five years. Exploration abruptly ended again in 1972 with the election of the Australian Labor Party (the Labor Party), which put a hold on future sales and further development of uranium mines. NUEXCO reports that prior to this announcement, companies had long-term contract commitments totaling 23 million lbs of concentrates (NUEXCO 1993c). A third exploration boom began in 1975 and continued through 1982, sparked by the return of the Liberal/National Coalition. This boom ended in 1983 with the return of the Labor Party and the institution of the three mine policy. The Labor Party remains in power today.

### Export Control Policies

Australia's export policy seeks to assure the orderly development of national uranium resources, while making supplies of uranium available only to those countries that have bilateral safeguards agreements with Australia. In June 1978, the government instituted the requirement that companies obtain a "Ministerial Declaration" from the Minister for Primary Industries and Energy before entering into legally binding contractual commitments for the export of uranium. The basic conditions for a ministerial declaration included compliance with the Australian government's nuclear safeguards policy, provision for deliveries to be made within a specified period and not to exceed a specified quantity, a suitable method of shipment, and compliance with the floor price requirement (discussed in the next section). Exports require an export permit issued under the Customs regulations.

These export policies were relaxed in 1989, vastly simplifying the export process and adding considerable flexibility for uranium producers. Companies are now advised of the government pricing and safeguard requirements and are expected to abide by them.

### Floor Prices

As part of its general export control policies, the Australian government in 1978 instituted a floor price of U.S. $30/lb $U_3O_8$ for sales after January 1, 1980. An express purpose of this floor price was to try to stabilize uranium prices and to avoid the traditional boom and bust nature of the uranium market. Also, the floor price was meant to ensure that new projects were underwritten by long-term viable contracts sufficient to cover the large

[27]This section draws from OECD (1994), Mackenzie et al. (1991), and NUEXCO (1993c).

up-front development costs (Livingston 1982). At the time, this floor price was significantly below the NUEXCO exchange value of $40/lb. While this did not hamper sales in the near term, this policy did begin to slow future contracts as world prices dropped in the early 1980s. The government responded in 1986 by changing the policy to require that contracts average $31/lb for long-term contracts and $28/lb for short-term contracts (U.S. Senate 1989).

The floor price mechanism ended in 1989. The policy now requires producers to demonstrate that contract prices are comparable with those being received by others in the market and that they will provide a fair return for a community-owned resource.

### Three Mine Policy

The Australian Labor Party initiated the three mine policy in 1983 as a means of tightly controlling every aspect of the nuclear fuel cycle. There is considerable opposition to this policy, particularly from the opposition party (a conservative coalition) and mine owners. An independent industry commission study in 1991 recommended that the three mine policy be abandoned and that government intervention in the industry be limited to ensuring adequate safeguards. The commission also recommended that the government allow uranium enrichment, subject to strict environmental and other safeguards. The Labor Party is split on these issues. The opposition party generally supported the recommendations during the 1993 elections. However, with the reelection of the Labor Party, the three mine policy remains. It was recently reviewed at the annual Labor Party conference in September 1994. Although a reversal of the policy had been predicted, the policy did not come up for a vote. An industrial dispute between a miner's union and one mining company over workers' pay and conditions put the issue on hold until the next party conference, to take place in 1997. If market conditions have improved by that time, the policy will likely be reversed. The Australian government's perception of the fairness of the U.S.-Russian Suspension Agreement, in terms of GATT, could affect the future of this policy. Any relaxation of the policy would result in an increase in Australian exports of uranium.

ERA has publicly argued for a reversal of the three mine policy stating that it believes there "is a clear opportunity for increased sales from 1996" that would result in increased jobs and increased royalty and tax payments to Australia. ERA has noted that a failure to relax the policy will simply result in an increase in the Saskatchewan (Canadian) domination of the world uranium market and cast doubt on Australia's willingness to be a reliable supplier (Nuclear Fuel 1993a).

## *Summary and Conclusions*

Australia possesses vast reserves of low-cost uranium. However, government policy in Australia restricts the potential of Australian uranium producers through a three mine policy. This three mine policy was initiated in 1983 with the election of the Australian Labor Party as part of a broader policy that bans both further processing of nuclear fuels and the use of nuclear power to generate electricity. Only two mines remain in operation today; together they supplied 5.9 million lbs $U_3O_8$ in 1993, making Australia the number three uranium-producing nation behind Canada and Niger. Given the large uranium reserves and the

potential to create jobs and increase exports, there is considerable opposition to the three mine policy. During recent elections, the opposition party used it as a campaign issue, and there was some speculation that it would be overturned. There is also considerable opposition within the Labor Party to the continuation of this policy, and it could be relaxed if market conditions improve. If the government decides to relax the three mine policy, Australia could capture a much larger share of the world uranium market.

The official U.S. response to claims by Canada and Australia that the recent Amendments to the Russian Suspension Agreement violate GATT and NAFTA could impact the future of the three mine policy. If the U.S. is viewed as protective of its own domestic industry at the expense of these two major trading partners, public opinion may sway Australia to relax its restrictive policies. Australian environmental groups remain opposed to any change, however, and how actively they support the continuation of the three mine policy could also affect the outcome.

Australian mining companies have made a strong case for relaxing the three mine policy. One such company, ERA, notes that a failure to relax the policy will simply result in an increase in the Saskatchewan (Canadian) domination of the world uranium market and cast doubt on Australia's willingness to be a reliable supplier. At the 1994 Pacific Basin Nuclear Conference, I.J. Duncan, General Manager of the Australian company, Western Mining Corporation, noted that key export opportunities exist in Japan, South Korea, China, China/Hong Kong, and possibly Indonesia, and that Canada would continue to be Australia's major competitor (Duncan 1994). Duncan does not consider the U.S. to be a competitor, viewing the liberalization of trade between the U.S. and Canada as the final injury leading to the demise of the U.S. uranium industry.

### Canada

Canadian uranium requirements, production, and resources are presented in Table 7. Canada led the world in uranium production in 1993, capturing 28% of the global market. At the same time, Canada is not number one in uranium reserves; that distinction remains with Australia. The Canadian government has been very supportive of its uranium industry in the past. This support has waned slightly in recent years because of environmental concerns. In 1993, the Joint Federal Provincial Panel (JFPP), which had been formed in 1991 to review proposed uranium mining projects, recommended delaying the development of the high-grade McClean Lake site for five years in order to perform a full review of tailings management, and recommended halting all development at the Midwest project. The government rejected the recommendation to delay McClean; it approved the Midwest ban.

While the U.S. is a net importer of uranium, Canada is a net exporter. This is primarily because of Canada's high-grade ore deposits. Sites in Saskatchewan have ore grades as high as 15% (Cigar Lake). Canada has no tariff barriers to the import of uranium products.

**Table 7. Canadian Uranium Resources**

| | |
|---|---|
| Nuclear Capacity (GWe) | 15.5 |
| Annual Uranium Requirements (million lbs $U_3O_8$) | 4.9 |
| 1993 Uranium Production (million lbs $U_3O_8$) | 23.9 |
| % of 1993 $U_3O_8$ World Production | 27.7% |
| Resources (million lbs $U_3O_8$) | |
| Reasonably Assured Resources (< $30/lb) | 720 |
| Reasonably Assured Resources ($30–50/lb) | 312 |
| Estimated Additional Resources–I (< $30/lb) | 81 |
| Estimated Additional Resources–I ($30–50/lb) | 112 |
| Estimated Additional Resources–II (< $30/lb) | 130 |
| Estimated Additional Resources–II ($30–50/lb) | 260 |
| Speculative Resources | 1,820 |
| **Total Resources** | **3,435** |

Canadian uranium production declined from 29.5 million lbs in 1989 to 23.9 million lbs in 1993. Employment declined from 4,280 employees to 1,310 in 1992. These declines are largely due to the phaseout of mining operations at the lower-grade Ontario sites (OECD 1994, NUEXCO 1994).

Foreign firms are very active in the various operations of uranium production in Canada. Although official Canadian policy restricts nonresident ownership to 49% in any individual operation, exceptions to this rule can, and have, been made. Most recently, in 1993, the French firm, Cogema, was allowed to purchase Cameco's 20% share in Cluff Lake, making Cogema the sole owner of this rich deposit.

Canada is challenging the legality of the U.S.–Russia Suspension Agreement under Article 309 of NAFTA. In this case, Canada argues that the U.S. negotiated an agreement with Russia that is preferential to U.S. uranium producers, thereby restricting the potential import of Canadian-origin uranium. Canada and the U.S. are holding talks to resolve Canadian complaints.

### *Canadian Uranium Industry*

#### Uranium Production

Canadian uranium production totaled 23.9 million lbs $U_3O_8$ in 1993, as shown in Table 8. Uranium is mined at four locations: Cluff Lake, Key Lake, and Rabbit Lake, all in Saskatchewan; and Stanleigh (at Elliot Lake) in Ontario. A fifth site, operated by Denison Mines Ltd. and located at Elliot Lake, stopped production in 1992.

## Table 8. Canadian Uranium Production

| Location | | Ownership | 1993 Output (million lbs $U_3O_8$) | 1992 Output (million lbs $U_3O_8$) | Capacity (million lbs $U_3O_8$) |
|---|---|---|---|---|---|
| Ontario | Elliot Lake | Denison Mines Ltd. | 0 | 0.7 | * |
| | Elliot Lake, Stanleigh | Rio Algom Ltd. | 1.8 | 1.8 | * |
| Saskatchewan | Cluff Lake | Amok Ltd. (80%) Corona Grande (20%) | 2.1 | 1.9 | 4.0 |
| | Key Lake | Cameco (66.7%) Uranerz (33.3%) | 14.0 | 14.2 | 14.5 |
| | Rabbit Lake | Cameco (66.7%) Uranerz (33.3%) | 6.0 | 5.62 | 12.0 |
| **Total** | | | **23.9** | **24.2** | **30.5** |

*Production at these sites is to be, or has, ceased, and is not expected to resume.

Sources: NAC 1993, NUEXCO 1994, OECD 1994.

The Stanleigh site at Elliot Lake, the only remaining operating mine in the Province of Ontario, is operated by Rio Algom Ltd. This low-grade uranium mine will cease production in 1996 after existing long-term contracts with Ontario Hydro expire. The future of uranium production in Canada is therefore in the Province of Saskatchewan. The three operating sites, Cluff Lake, Key Lake, and Rabbit Lake, produced over 22 million lbs $U_3O_8$ in 1993.

The Cluff Lake site is operated by Amok Ltd. and Corona Grande, both subsidiaries of Cogema of France. In 1993, Cameco sold its 20% share in the Cluff Lake partnership to Cogema, a sale that required federal approval under the uranium nonresident ownership policy (OECD 1994). Cluff Lake, which started production in 1980, is an open pit and underground mine with an average ore grade of 0.75% $U_3O_8$. The annual capacity of the mine has been estimated to be 4 million lbs $U_3O_8$, which is more than double the mine's current production (NAC 1993).

The Key Lake site is held in partnership by Cameco and Uranerz. This open pit mine began operations in 1983 and has an ore grade of 1.58% $U_3O_8$. It is operating at close to its estimated capacity of 14.5 million lbs $U_3O_8$. Cameco was formed by the merger of Eldorado Nuclear, a Crown Corporation, and Saskatchewan Mining and Development Corporation, a Provincial Corporation, in July 1988. Its current ownership is 42% private, 19% federal government, and 39% Saskatchewan government. The Canadian federal government intends to make Cameco a private company by 1995. Uranerz Exploration and Mining Limited is a subsidiary of Uranerzbergbau mbH of Germany.

The Rabbit Lake site, which began operations in 1976, is another joint project of Cameco and Uranerz. The main operating site is an open pit mine with an ore grade of over 3.5%. An underground mine, Eagle Point, also exists on site and may begin operations in 1994, bringing total capacity to an estimated 12 million lbs per year. The Eagle Point site received the go-ahead from the JFPP on December 7, 1993.

Direct employment in the Canadian uranium mining industry fell from 4,280 to 1,310 between 1989 and 1992 owing to the reductions at the Elliot Lake sites (OECD 1994). Note that these estimates are for those employed at the mine sites only. This rather large drop in employment did not correspond to large production declines because of the large differences in productivity levels at the sites. NUEXCO estimates that the Saskatchewan sites produce 21,800 lbs/employee/year while the Elliot Lake sites produce only 2,750 lbs/employee/year (NUEXCO 1994).[28]

### Future Production

Several large projects could begin operations in the next several years, depending on market conditions and government approvals. These are shown in Table 9. The future of the Midwest project is unclear, following the governmental ruling to halt development at this underground mine while environmental concerns are examined. The McClean site is now clear for development following the government decision to reject the JFPP recommendation to defer development for five years while a full-scale study of tailings management was conducted. NAC estimates an average ore grade at McClean of 4.1% $U_3O_8$ (NAC 1993). The owners include: Cogema, 70%; Denison Mines Ltd., 22.5%; and, OURD, 7.5%.

The Cigar Lake site is still in the development stage and must receive JFPP approval before it can move towards active production. This site is one of the richest in the world; test bores have produced ore containing in excess of 15% $U_3O_8$ (OECD 1994).

The McArthur River site, which has an ore grade of about 4.0% $U_3O_8$, is located near the Key Lake production site and will utilize the Key Lake Mill. This will allow the mill to continue operating after Key Lake ceases production. The operators expect to file an Environmental Impact Statement with the JFPP by the end of 1994, with expected production to begin in 1997.

## *Canadian National Policies Affecting Uranium Trade*

All nuclear fuel cycle activities in Canada are governed by the Atomic Energy Control Act of 1970 and its subsequent revisions. This Act established the Atomic Energy Control Board (AECB) to regulate the "production, import, export, transportation, refining,

[28]For purposes of comparison, U.S. total productivity in 1979 was 37.472 million lbs for 12,755 miners (EIA 1993b). This calculates to an annual production of 2,938 lbs/employee. By 1992, 219 miners produced 5.645 million lbs, or 25,776 lbs/employee, comparable to the Saskatchewan productivity levels. This increase in productivity is a result of the closure of inefficient sites and increased reliance on ISL technology.

**Table 9. Future Canadian Uranium Production Sites**

| Location | Ownership | Reserves (million lbs $U_3O_8$) | Estimated Annual Capacity (million lbs $U_3O_8$) |
|---|---|---|---|
| Cigar Lake | Cameco (48.75%)<br>Cogema (36.75%)<br>Idemitsu (12.875%)<br>KEPCO (2.0%) | 385 | 12 |
| McArthur River | Cameco (56.4%)<br>Uranerz (27.3%)<br>Interuranium Canada Ltd. (9.1%)<br>Cogema (7.2%) | 260 | 15 |
| McClean Lake | Cogema (70%)<br>Denison (22.5%)<br>OURD (7.5%) | 45 | 6 |
| Midwest | Cogema (56%)<br>Denison (19.5%)<br>Uranerz (20%)<br>OURD (4.5%) | 36 | 6 |
| Sources: NUEXCO 1994, OECD 1994, NAC 1993. | | | |

possession, ownership, or sale of prescribed substances and any other things that in the opinion of the board may be used for the production, use or application of atomic energy" (OECD 1988). The board consists of five members who report to Parliament through a designated Minister. This board has imposed varying levels of control over the years, but most requirements, at least in terms of export controls, have been greatly relaxed. Since the establishment of the JFPP in 1991, however, environmental and safety controls have been tightened.

## Export Policy

After implementation of the U.S.-Canada Free Trade Agreement (CFTA) on January 1, 1989, the Canadian government launched a comprehensive review of its export policy. In May 1990, the Canadian Minister of Energy, Mines and Resources announced that the government would extend the approval period on export contracts from 15 to 30 years, increasing flexibility for uranium producers. More recently, in November 1992, the government eliminated the requirement that any export contract must contain an escalating floor price mechanism. This requirement, which had been affirmed in 1990, was meant to ensure stability in the marketplace, both in terms of productivity and employment. In

eliminating this requirement, the government noted that Canadian producers were "well placed to compete on an equal footing with any in the world" and that it is the producers who are in the best position to determine the appropriate way of protecting their investment through diversification of contracts (OECD 1994).

Another long-standing policy requiring that Canadian-origin material be converted to the maximum extent possible prior to export was also recently rescinded and will be phased out by December 1995. This policy was instituted in 1974 and went through several variations. The current official policy, which will expire in 1995, is that any uranium destined for use as enriched fuel must be converted to the maximum extent possible before export, providing that 1) Canadian conversion facilities have the capacity, 2) that the material is not to be converted or enriched or consumed in the U.S., and 3) that the Canadian converter is the successful bidder for conversion services. The second condition was added following passage of the CFTA. The third condition makes Canadian policy conform to GATT, while still ensuring that Canadian converters have the opportunity to bid on all non-U.S. destined material. However, given the third provision, that the converter be price-competitive, this policy by itself has little impact.

All uranium export contracts must be reviewed by an interdepartmental uranium exports review panel. This panel ensures that the contracts are consistent with the Atomic Energy Control Act and the Export and Import Control Act. Under these Acts, exports are authorized only if the importing country can assure that material of Canadian-origin or its derivatives will be used for peaceful purposes only. Exports are in effect limited to those countries that have signed the Treaty on the Nonproliferation of Nuclear Weapons (NPT) or have agreed to equivalent controls (OECD 1988). Other conditions require the existence of adequate safeguards and physical security to prevent diversion of uranium to non-peaceful purposes, and that "the retransfer of items produced and supplied with the material (including subsequent generations thereof) will be accomplished only with the consent of the Canadian government" (OECD 1988). In spite of these conditions, one source notes, the contract review process is straightforward and efficient (Mackenzie et al. 1991).

## Environmental Policy

The AECB was initially (in 1973) assigned the responsibility of reviewing environmental, health, safety, and socioeconomic impacts of uranium mine development. The province of Saskatchewan established a similar panel in 1980. These two entities merged their review responsibilities in 1991, establishing the JFPP. In 1993, a JFPP report recommended a five-year deferment of future development at the McClean Lake site pending a complete environmental study of the tailings disposition issue. The same report also recommended a halt to future development at the Midwest project. In January 1994, the government approved the recommendation to halt further development at the Midwest project. It did not, however, agree with the recommendation regarding McClean Lake, noting the effective handling of tailings at the nearby Rabbit Lake site for over a decade. NUEXCO notes that the two recommendations of the JFPP came as a surprise to the industry and signaled a new attitude within the government that could dampen future industry enthusiasm (NUEXCO 1994).

### *Canadian Assistance to the Uranium Industry*

There have been lingering questions about the role of the Canadian government in assisting its uranium industry.[29] The general trend appears to be a move away from government help or support as Canadian producers emerge as world class competitors in their own right. Seven specific examples of potential subsidies are discussed below. These are 1) shared ownership on the part of the government of Canada and the Province of Saskatchewan in a major uranium producer, Cameco; 2) ownership of a major uranium user, Ontario Hydro, by the Province of Ontario, a major uranium producer; 3) Canadian government purchase and stockpiling of uranium; 4) Canadian government involvement in uranium exploration; 5) government assistance in infrastructure, such as road-building; 6) selling at less than production costs; and 7) government involvement in price fixing.

#### 1) Shared Ownership on the Part of the Government of Canada and the Province of Saskatchewan in a Major Uranium Producer, Cameco

Cameco was formed in July 1988 by the merger of Eldorado Nuclear, a Crown Corporation, and Saskatchewan Mining and Development Corporation, a Provincial Corporation. The intent is to completely privatize Cameco by 1995. At the end of 1992, ownership was 42% private, 19% federal government, and 39% Saskatchewan Province. Cameco is subject to federal and provincial income taxes at the same rates as any privately owned company and does not enjoy any special privileges as far as its long-term debt is concerned. In Senate Hearings in 1989 (U.S. Senate 1989), the EIA concluded that all Canadian producers, including Cameco, are "subject to the same market conditions as other producers in the world, and are not receiving subsidies to enhance their production." In recent confidential interviews, industry sources have indicated that Canadian government support of its industry is no longer a dominant factor in industry's ability to capture market share.

While this appears to be the case now, Cameco did benefit from government support in the past. In particular, the government transferred a 14.4-million-lb stockpile to Eldorado Nuclear in 1981. The primary purpose of this transfer was to provide "Eldorado with a capital structure that will facilitate its plan to borrow in private markets in order to finance its expansion program" (OECD 1982).

#### 2) Ownership of a Major Uranium User, Ontario Hydro, by the Province of Ontario, a Major Uranium Producer

Ontario Hydro manages 18 of the country's 21 operable reactors. Although there have been rumors of a possible move towards privatization, there are no plans to proceed with privatization at this time (NUEXCO 1994). At one time, Ontario Hydro required a 30-year advance purchase requirement as a means of assuring a long-term, secure supply of nuclear fuel for its reactors. This policy resulted in several high-price contracts for uranium from Ontario uranium producers that guaranteed profits to the producers; however, this policy no longer exists, and the existing contracts were renegotiated in 1991, leading to an outstanding

[29]See for example, Hearings on the Implementation of the CFTA (U.S. Senate 1988) and Hearings on the Need for Uranium Enrichment Enterprise Restructuring and Uranium Mining Revitalization (U.S. Senate 1989).

domestic commitment reduction by a factor of 10 (OECD 1994). Denison's Stanrock mine was dedicated to the Ontario Hydro contract, but produced just 14 million lbs or about 12% of the long-term contract in force for 1980–2011. Ontario Hydro agreed to forego repayment of a $150 million loan made to Denison in return for allowing it to cancel the long-term contract (Nuclear Fuel 1994b). Uranium production in Ontario will end by 1996 as these contracts expire.

Ontario Hydro's new policy regarding uranium procurement requires consideration of issues other than price. Factors now considered by the company in evaluating bids include 1) the quality and life of ore reserves; 2) the political stability and tax policies of the producing country; 3) the environmental record and environmental acceptability of production operations; and 4) the financial soundness of the uranium producer (Luke 1992). Luke notes that for public utility companies, such as Ontario Hydro, environmental acceptability is becoming increasingly important (Luke 1992).

As a result of recent bidding, Ontario Hydro has signed its first contract with a foreign producer, Western Mining Corp. of Australia, for 390,000 lbs $U_3O_8$/year for 7 years (OECD 1994). Similar contracts were signed with Cameco Corporation, Uranerz Exploration and Mining Limited, and Cogema Resources Inc.

### 3) Canadian Government Purchase and Stockpiling of Uranium

The Canadian government purchased over Can$101 million in uranium from Canadian producers from 1963 to 1970 (U.S. Senate 1988). This program was initiated in response to a 1959 decision by the U.S. AEC to not purchase additional Canadian uranium beyond that which was already contracted for. As in the U.S., the AEC's demand for uranium supplies for both military and civilian needs had launched the Canadian program. However, by 1959, U.S. domestic production capabilities were sufficient to meet expected demand and the purchase of foreign uranium became a political liability.

Even with the government stockpiling program, Canadian production declined over an eight-year period to just 24 percent of its peak level in 1959 (Gray 1992). This stockpile was eliminated through domestic channels by 1982. There was a second stockpile program from 1971 to 1979 that cost the government an additional Can$29.3 million. The government established Uranium Canada Limited (UCAN) in 1971 to manage the stockpile. In 1981, as noted earlier, the balance of the stockpile (14.4 million lbs) was transferred to Eldorado Nuclear, another Crown Corporation. In 1988, Eldorado Nuclear merged with Saskatchewan Mining and Development Corporation to form Cameco, which is to be completely privatized by 1995.

### 4) Canadian Government Involvement in Uranium Exploration

Government expenditures for uranium exploration were limited to approximately Can$100,000 per year in 1992 and 1993. Expenditures in previous years were substantially higher. For the period 1975–1982, the Canadian government spent over Can$20 million for exploration. From 1983 to 1991, expenditures averaged Can$1.6 million per year (OECD

1990, OECD 1994). For comparison, during the period 1974–1983, the U.S. government reported expenditures of $324 million. U.S. expenditures from 1983 to 1991 averaged $3.3 million per year (OECD 1990, OECD 1994). In 1992 and 1993, U.S. expenditures were $1.5 million per year.

### 5) Government Assistance in Infrastructure, Such as Road-Building

The Canadian government has built some roads that directly benefit the uranium producers. This is common in remote areas where roads serve several purposes. The Saskatchewan Province spent Can$5.3 million building the roads to the Key Lake site (U.S. Senate 1988). At the same time, these mines have paid large taxes to both the provincial and federal government (Mackenzie et al. 1991).

### 6) Selling at Less Than Production Costs

During 1989 hearings before the U.S. Senate Subcommittee on Energy Research and Development, charges were made that Canada might be selling at less than full production costs. In particular, Senator Ford asked how, with spot prices at or below $10/lb and reported production costs of more than $10/lb, Canadian producers could add new production capability without Canadian subsidies (U.S. Senate 1989). In response, it was noted that there is a difference between spot prices and contract prices and that new production capability was unlikely unless world uranium prices rose. Specifically, although the spot market price hovered around $10/lb in 1988, the average contract price to the U.S. was $20.41, significantly above spot market prices and within the range likely to cover production costs (U.S. Senate 1989). The OECD reports the following as the average export price per lb for each year in the period 1988–1992: *1988*–$25; *1989*–$24; *1990*–$24; *1991*–$21; and *1992*–$19 (OECD 1994). For 1992, less than 1% of export sales occurred on the spot market (OECD 1994).

### 7) Government Involvement in Price Fixing

An international uranium cartel existed in the early 1970s (U.S. House of Representatives 1977, Taylor and Yokell 1979, Spar 1994). Several countries participated, including Australia, Canada, France, Great Britain, and South Africa. The cartel was organized because of growing frustration with low market prices brought about by excess supply and the U.S. prohibition on the enrichment of foreign-origin uranium, which effectively shut these other uranium suppliers out of the U.S. market. The cartel's purpose was to stabilize global uranium prices outside of the U.S. at a level that would benefit the participants directly. While uranium prices did soar during this time, this has been attributed to causes other than actions taken by the cartel.[30] NUEXCO reported that "the prices reportedly established by the 'cartel' at its periodic gatherings were, by the time such prices

[30]Prices increased from around $6/lb in 1973 to $26/lb in 1975 and $40/lb in 1976 (NUEXCO 1993b). These other factors include: the AEC restrictions on the enrichment of foreign-origin uranium and the requirement that customers have long-term supply contracts in place, the first oil shock of 1972 and, later, the announcement by Westinghouse in September 1975 of its inability to fulfill its contract requirements due to higher-than-expected uranium prices.

were implemented, below those prevailing in the domestic marketplace, as opposed to leading it" (reprinted in U.S. House of Representatives 1977).

The recognition of the existence of a cartel in uranium led to contentious hearings before the U.S. House of Representatives in 1977, as well as several lawsuits, the most notable of which involved Westinghouse. Westinghouse claimed that the cartel had caused world prices to increase, thereby making it impossible for Westinghouse to economically fill several long-term contracts. The case was eventually settled out of court for a reported $400 million from the producers (Spar 1994).

During the 1989 Senate Hearings, evidence emerged that indicated that both the Canadian and French governments had been involved in the organization of this cartel. In Canada, the key agency involved was the Ministry of Energy, Mines, and Resources (EMR), which coordinated this effort through the Canadian government. In 1972, the Canadian government issued a regulation that authorized the AECB to review export permits to ensure that the prices and quantities conformed to guidelines set down by the EMR (Spar 1994). Spar notes that these prices were set in meetings by the cartel. This regulation had the effect of shielding individual companies from Canadian antitrust violations because they were acting according to official government regulation and were therefore not engaged in illegal price setting.

The cartel contrived a system of noncompetitive bidding, whereby a board existing within the CEA in Paris (Spar 1994) would determine which company would win each bid and then other companies would submit bids slightly higher than that of the "winner" (U.S. House of Representatives 1977). It appears that France was selected as the location for this board because of the lack of public scrutiny over French nuclear issues and the probability that the board's activities could remain a secret.

The Canadian government actively impeded the U.S. investigation into the cartel by passing the Uranium Information Security Regulations, which made it illegal for any Canadian citizen to release any information related to uranium to a foreign government. Spar reports that there was considerable internal opposition to this "gag order" because it was viewed as counter to the notion of participatory government (Spar 1994). It remained in effect, however, and prevented Canadian citizens from appearing in U.S. courts and hearings.

### *Summary and Conclusions*

Canadian uranium production will continue to supply a large percentage of the world's uranium demand for the foreseeable future. The primary reason is the high grade of the country's uranium deposits. Governmental export policies have been greatly relaxed in recent years, reflecting a trend towards a more open market philosophy with less government control. At the same time, there appears to be a tightening of environmental restrictions, as evidenced by the recent decision to delay development at the Midwest site pending further environmental analysis.

In general, the Canadian government has played a very supportive role in the development of its uranium mining industry. The government stockpiled uranium in the 1970s to protect its uranium industry from the negative effects of the U.S. policy that restricted the non-domestic enrichment of imported uranium. The Canadian government required that utilities secure long-term uranium supply contracts, which required government approval. Ontario Hydro, a provincial government-run utility, signed long-term contracts with Ontario uranium producers, thereby assuring that Ontario uranium mining would continue. Government involvement even went so far as to include involvement in global price fixing in the 1970s.

Several companies have benefited from this involvement, including Cameco, the number two uranium producer in the world. However, Canadian government involvement in the industry has been reduced considerably over the years as Canada has relaxed various policies to maintain its obligations under the free trade agreements and GATT. One could argue that it has been willing to do this because of the overall success of its uranium industry in capturing a large share of the global market, making further governmental involvement unnecessary. One could also argue that this is because of the Canadian government's desire to pursue free trade. In 1988, the U.S. Trade Representative noted that both the U.S. and Canadian governments have played a large role in supporting their respective uranium industries over the years, and that "both industries still have some residual benefits of past government practices, but their effects are small in comparison with the larger impact of market conditions and are continuing to diminish with time" (USTR 1988).

Foreign uranium producers have established a strong presence in Canada, attracted by the high-grade deposits and the favorable government atmosphere. In response to this investment, the government has relaxed its nonresident ownership requirements considerably. In 1993, it approved Cameco's sale of its 20% Cluff Lake interests to Cogema, giving Cogema of France sole control over this rich deposit. At the same time, U.S. company presence in Canada is practically nonexistent. Those countries that maintain a strong presence, including France and Japan, are countries whose governments have a strong national nuclear program and seek long-term demand assurances.

## France

Nuclear power plays a very important role in France, with 57 nuclear reactors providing 78% of its electricity. Four additional units are under construction. This commitment to nuclear power was reemphasized by the oil shocks of 1974 and 1978. French uranium requirements, production, and resources are presented in Table 10. Since 1973, France has reduced its dependence on imported energy use by 50% (OECD 1992). Accomplishing this level of energy independence has required strong state involvement.

The national utility, Electricité de France (EdF), is an integrated generation, transmission, and distribution company, and accounts for 90% of all generation and 95% of all distribution within France. The Commissariat a l'Energie Atomique (CEA) is the government agency responsible for the nuclear sector, including the development of all aspects of nuclear technology, both civilian and military. CEA is also the majority shareholder of Cogema,

**Table 10. French Uranium Resources**

| | |
|---|---|
| Nuclear Capacity (GWe) | 56.8 |
| Annual Uranium Requirements (million lbs $U_3O_8$) | 20.5 |
| 1993 Uranium Production (million lbs $U_3O_8$) | 4.5 |
| % of 1993 $U_3O_8$ World Production | 5.2% |
| Resources (million lbs $U_3O_8$) | |
| Reasonably Assured Resources (< $30/lb) | 52 |
| Reasonably Assured Resources ($30–50/lb) | 36 |
| Estimated Additional Resources–I (< $30/lb) | 9 |
| Estimated Additional Resources–I ($30–50/lb) | 8 |
| Estimated Additional Resources–II (< $30/lb) | 0 |
| Estimated Additional Resources–II ($30–50/lb) | 3 |
| Speculative Resources | 0 |
| **Total Resources** | **108** |

which services all aspects of the nuclear fuel cycle, including uranium production, conversion and enrichment, and fuel fabrication and reprocessing, and which has become an international competitor in the uranium market.

The French have succeeded in building a nuclear program where other countries have failed. This has been the result of (among other things) strong state support, a simplified licensing process, standardization of design, and relatively limited public hearings (OECD 1992). In addition, the judicial branch, when faced with direct challenges to the licensing process, has been hesitant to second-guess the CEA and has limited its role to ensuring compliance with proper process (Schoenbaum and Ainley 1988). However, there are signs of public unrest concerning future nuclear development, in particular with the siting of nuclear waste sites, and the recent recession has resulted in a slowdown of future capacity additions. There is also disagreement within the government regarding the future direction of the nuclear industry. EdF and Framatome[31] (the government-owned reactor supplier) want to build one nuclear reactor every 12-18 months during the 1990s, whereas the Ministry of Industry, which provides policy direction to EdF, wants to rely more on energy efficiency than on increasing supply in the near term. There is also rising public concern abroad that EdF is exporting large quantities of nuclear-generated electricity to countries that do not want nuclear facilities within their own borders.

[31]The French government controls 51% of Framatome. The current ownership is: CEA, 36.2%; EdF, 9.8%; Credit Lyonnais, 5.0%; Alcatel-Alsthom, 44.1%; and Framatome employees, 4.9%. The French government intends to reduce its ownership to 34.0%, enough for a blocking minority under French law. (Nucleonics Week 1994).

### *French Uranium Industry*

French annual uranium production has declined steadily since 1988 from 8.8 million lbs to 4.5 million lbs in 1993. This decline has resulted from increased environmental concerns, the phaseout of low grade resources, and the availability of lower-priced resources elsewhere. Employment in uranium production has also declined, from 2,786 in 1989 to 1,443 at the end of 1992 (OECD 1994).

Cogema dominates the uranium supply business in France. Two other French mine operators exist: Compagnie Française de Mokta (CFM), which is a subsidiary of Cogema, and Société Auxiliaire d'Energie (SAE), which is a subsidiary of EdF and is not actively involved in uranium production at this time. Cogema's control of the French uranium market was consolidated in 1993 with the acquisition of Total Compagnie Minière France's (TCMF's) uranium rights worldwide. That year, TCMF acquired a 10.8% share of Cogema, making it the first private shareholder of Cogema.

The decline in French production belies Cogema's strength as a dominant force in the global uranium market. Cogema was created in 1976 by governmental decree as a subsidiary of CEA. By law, the government must control a minimum of 51% of Cogema. Until the TCMF acquisition in 1993, Cogema was a 100% government-owned entity.

With the acquisition of TCMF's uranium resources, Cogema became the world's largest uranium producer as measured by market share (NUEXCO 1994). With resources in Australia, Canada, France, Gabon, Namibia, Niger, and the U.S., Cogema's estimated worldwide reserves total 622 million lbs $U_3O_8$, as shown in Table 11. In Canada, Cogema either controls or shares operation of the richest reserves in the world, including a 36.75% ownership in Cigar Lake, a 70% ownership in McClean Lake, and 100% ownership in Cluff Lake.

France has a long-term relationship with the two major uranium-producing countries in West Africa, Gabon and Niger. France has continued uranium production in these countries at above-market prices as a means of maintaining influence in these former colonies and diversifying its uranium reserves. In Gabon, Cogema holds a 68.4% share in Comuf; the remaining shares are owned by Cofimer (France), 5.8%, the Gabon government, 24.8%, and private individuals, 1%. In 1993, NUEXCO estimated that "Gabon's uranium production costs substantially exceed current market prices, but higher-priced contracts essentially subsidize uranium production in Gabon and provide France a continuous avenue of influence in this country" (NUEXCO 1993a). Total uranium production from Gabon totaled 1.4 million lbs $U_3O_8$ in 1993, down from 2.3 million lbs in 1989 (NUEXCO 1994).

Similarly, in Niger, Cogema maintains a strong presence, controlling 34% of the Akouta site and 61.4% of the Arlit mine. In 1993, Niger was the world's second largest Western uranium producer, with total production of 7.5 million lbs, down only slightly from 8.0 million lbs in 1989 (NUEXCO 1994). NUEXCO (1994) estimates that France paid more than $20/lb $U_3O_8$ in 1993 "for a majority of the country's uranium production."

## Table 11. Cogema's Worldwide Resources

| Country | Mine | wnership (%) | Reserves (million lbs $U_3O_8$) | Ore Grade (%) | Status |
|---|---|---|---|---|---|
| Australia | Ranger | 1.2 | 180.0 | 0.27 | Operating |
| | Jabiluka | 1.2 | 400.0 | 0.40 | Undeveloped |
| | Koongarra | 70 | 24.2 | 0.79 | Undeveloped |
| | Manyingee | 82 | 11.5 | NA | Undeveloped |
| Canada | Cluff Lake | 100 | 39.0 | 0.75–1.0 | Operating |
| | Cigar Lake | 36.75 | 385.0 | 9.2 | Startup late 1990s |
| | McArthur River | 16.3 | 260 | 5.0 | Startup 1997 |
| | McClean Lake | 70 | 43.7 | 2.7–4.1 | Startup late 1990s |
| | Midwest | 55.6 | 36.0 | 3.8 | Undeveloped |
| | Baker Lake | 56 | 40.0 | NA | Undeveloped |
| France | Herault | 100 | 21.7 | NA | Operating |
| | La Couzille | 100 | 10.8 | NA | Shutdown due 1996 |
| | La Bernardan | 100 | 9.1 | 0.5 | Operating |
| | Bertholene | 100 | 0.220 | NA | Shutdown 1994 |
| | Bessines | 100 | 43.0 | NA | Shutdown 1993 |
| Gabon | Mounana | 68.4 | 63.2 | NA | Operating |
| Namibia | Rössing | 5 | 320.0 | 0.04 | Operating |
| Niger | Akouta | 34 | 44.0 | NA | Operating |
| | Arlit | 61.4 | 79.0 | NA | Operating |
| | Imourara | 35.1 | 327.0 | NA | Undeveloped |
| United States | Christensen Ranch (WY) | 71 | 58.4 | 0.10 | Operating |
| | Irigay Ranch (WY) | 71 | 22.7 | 0.10 | Operating |
| | El Mesquite (WY) | 71 | 2.8 | 0.10 | Operating |
| | West Cole (TX) | 73 | 2.2 | 0.6 | Standby |
| | Alta Mesa (TX) | 100 | 13.2 | 0.09 | Startup 1994 |
| | Highland | 25 | 20.0 | 0.12 | Operating |

Note: NA indicates that the information was not available.
Sources: NUKEM 1993, NAC 1993.

In 1994, both Gabon and Niger devalued their currencies in 1994 by 50%, effectively halving labor costs relative to the French franc. This step will lower overall production costs and make these higher-priced resources more valuable to Cogema.

Cogema also has a strong presence in the U.S., with involvement in several in situ leaching (ISL) projects. Cogema operates uranium production facilities in Texas and Wyoming on behalf of Malapai Resources Company. Its Holiday/El Mesquite, Christensen/Irigaray Ranch, and Highland operations are all active ISL mines and represent a total annual capacity of over 1.7 million pounds of uranium ore per year, with approximately 23 million pounds in reserve. In addition, Cogema owns two mines that are in the development stages: Alta Mesa, in Texas; and North Butte, in Wyoming. Both are ISL facilities and would add over 13 million pounds of uranium to Cogema's reserve base.

Another reason Cogema has been able to weather the steep uranium price declines is that Cogema is much more than just a uranium supplier; it is an integrated nuclear fuel service company. Its goal is to sell complete fuel service packages to utilities worldwide, including conversion and enrichment services, fuel fabrication and, eventually, reprocessing services. In the conversion market, Cogema owns 100% of Comurhex, a large French converter. It has a 51% ownership in Eurodif, the European enrichment company that supplied 20% of the world market in 1993 from its gaseous diffusion plant. It owns half of the reactor design firm Fragema, 49% of Franco Belge de Fabrication de Combustibles (FBFC), the European fuel fabricator, and 49% of B&W Fuel Company, a U.S. fuel fabricator located in Lynchburg, Virginia. Finally, Cogema has also become a fuel trader, with a 70% ownership in the German Urangesellschaft (UG), and a 35% share in Internexco.

In 1992, Cogema announced net earnings of about $95 million, down from $158 million in 1991. During the same period, revenues originating from uranium reprocessing (37.2%), enrichment (35.5%), mining (18%), and fuel fabrication and other activities (8%) increased 4% to $4.2 billion. Cogema is one of the world's largest uranium producers and is very competitive on the global market. At the same time, several of its production sites are noncompetitive, especially those in France, Gabon, and Niger. Much of this higher-priced uranium is marketed under long-term contracts with EdF, allowing Cogema to market the lower-cost uranium on the global market. Neither EdF nor Cogema divulges pricing information for their contracts.

### *French National Policies Affecting Uranium Trade*

France is a uranium-importing country with no official tariff barriers. French supply policy is based on diversification of sources (OECD 1994). However, the national utility, EdF, relies on French companies to provide adequate supplies worldwide. Cogema supplies EdF with approximately 90% of its uranium requirements. Cogema is a subsidiary of the CEA, the government agency charged with overall responsibility for both civilian and military nuclear programs. Davis (1988) notes that because the CEA is responsible for both of these programs, there has been little attempt to distinguish between civilian and military fuel or facilities. In 1988, Georges Vendryès of the CEA noted that "it is highly significant that the French nuclear program has been only rarely discussed in Parliament . . . . For forty years, the big decisions . . . have been made by a very limited group of people occupying key posts in the government or high administration of EdF, of the CEA, and of a few industrial companies concerned with the program. The approach remains unchanged, in spite of changes

of minister, thanks to the permanence of the people who generally occupy the same post for some dozen years" (Davis 1988).

The French government subsidized uranium exploration from 1977 to 1981, providing subsidies of 35% of the total costs of both domestic and international exploration. Companies were required to repay this subsidy only if the site was profitable (OECD 1982).

Backed by strong national support, Cogema became the Western world's largest uranium producer in 1993, surpassing Cameco in market share (NUEXCO 1994). As of 1993, TCMF owns 10.8% of Cogema. In theory, private owners may purchase up to 49% of Cogema but have not done so, suggesting either that Cogema's financial returns are not attractive to private investors or that there is some kind of official discouragement of investment.

Whether or not the French government actively subsidizes Cogema is a complicated question. EdF, also government-owned, is a large, dedicated purchaser for Cogema's uranium. Information regarding contract pricing is not disclosed. However, there has been speculation that long-term contracts with EdF at higher-than-market prices have allowed Cogema to continue mining higher-cost French, Gabon, and Niger resources. NUEXCO has called this subsidized production (NUEXCO 1993a). At the same time, Cogema has aggressively pursued resources in Canada, the U.S., and Australia. What is clear is that government support for nuclear power has created an environment that has allowed Cogema to survive and to build its global resources to a point where it is now a major global competitor for nuclear fuels and services.

### *Summary and Conclusions*

In general, the French view strong industrial policy as a means of protection against foreign economic domination, as a mechanism to "catch up" to other international players through the focused application of government resources, and as a means to garner international prestige through excellence in a particular field. In the energy arena, the French recognized nuclear power as a resource that would allow them energy independence and provide for a future export market. The French political structure has allowed the French to proceed with this long-term energy program and to succeed with its nuclear power program where others, with the exception of the Japanese, have failed. This success has required strong state control and the creation of a global, integrated supply network.

The national utility, EdF, builds and operates all of the country's nuclear power plants. EdF is a subsidiary of the CEA, the government agency charged with overall responsibility for both civilian and military nuclear programs. Cogema, also a subsidiary of the CEA, supplies 90% of EdF's uranium needs. It also converts, enriches, fabricates, and eventually reprocesses the fuel. Cogema has invested globally, in Australia, Gabon, Niger, Canada, and the U.S., in order to control adequate reserves to meet the uranium requirements of EdF.

All of this has occurred with only minimal oversight by Parliament and with little public participation. This is in contrast to the situation in the U.S., where public participation

at almost all levels of the policy process result in few secrets, and where intragovernmental checks and balances are built into the decision-making process.

## Section IV. Policies Impacting the U.S. Uranium Industry

The U.S. domestic uranium industry remains severely depressed owing to low market prices. The EIA has ruled it "nonviable" every year since 1983 (EIA 1993b).[32] Production has decreased from a peak of 26.27 million lbs $U_3O_8$ in 1973 to 3.3 million lbs in 1993. Employment has dropped correspondingly, from 21,521 in 1979 to 682 in 1992. The only operating production sites are those using either ISL or by-product recovery. No open pit or underground mines are currently in operation.

Certainly a major cause of the economic difficulties of the U.S. uranium industry is the higher-cost reserves as compared with the reserves of major foreign competitors (see Figure 1). However, there are other causes related to government policy that are not so obvious. These include 1) an open market economy that rewards utilities for purchasing, and often requires them to purchase, the lowest-cost uranium regardless of origin; 2) obligations under international trade agreements that limit any direct restrictions on, or any policies that negatively impact, the import of foreign-origin uranium; 3) various regulatory fees, which increase the cost of U.S. uranium; and 4) a general regulatory setting that is not particularly favorable to the uranium industry.

This section discusses both international agreements and national policies that impact the U.S. domestic uranium industry. International agreements principally include trade agreements, such as GATT, CFTA, and NAFTA. National policies include 1) those requirements added to the Atomic Energy Act (AEA) by the Nuclear Nonproliferation Act of 1978, 2) enforcement of antidumping statutes; and 3) various fees, such as NRC licensing fees, the Customs User Fee (CUF), and the Harbor Maintenance Tax (HMT).

### International Trade Agreements

The premise behind free trade is that, in the absence of government intervention, each country will optimally allocate resources according to its relative strengths, and each country will benefit from such trade. The purpose of trade agreements is to attempt to allow for the free flow of trade by eliminating government intervention and subsidies in individual markets. Three international trade agreements specifically affect the domestic uranium industry: GATT, CFTA, and NAFTA.

#### *General Agreement on Tariffs and Trade (GATT)*

GATT has been the guiding force behind free trade since 1948. Participants to the agreement, known as contracting parties or members, are expected to provide equal opportunity for those goods covered by GATT for each other. Negotiators recently completed the Uruguay Round of GATT after seven years of negotiation. This latest version will cover more goods and services than ever before, resulting in reduced tariffs and providing an

[32]Section 170B of the Atomic Energy Act of 1954, as amended by the Nuclear Regulatory Commission Authorization Act of 1983, required the Secretary of Energy to annually evaluate the viability of the domestic uranium industry for the years 1983 to 1992. The Energy Information Administration developed four criteria for evaluating viability, including resource capability, supply response capability, financial capability, and import commitment dependency (EIA 1993b).

international forum in which countries may air grievances about the unfair trading practices of other contracting parties. However, the new GATT will not significantly alter U.S. obligations in regard to uranium trade.

## Defining a Subsidy

In general, GATT prohibits subsidization of any covered industry if the effect of that subsidization results in domestic goods being favored over imported goods. Examples of subsidies that are prohibited by GATT are:

- Subsidies contingent upon export performance;
- Subsidies contingent upon the use of domestic over imported goods;
- Ad valorem subsidization;
- Subsidies covering operating losses; and,
- Debt forgiveness.

The test for whether a subsidy is covered by GATT is to ask if "the effect of the subsidy is an increase in the world market share . . . in particular subsidized primary product or commodity as compared to the average share it had during the previous three years and this increase . . . follow(s) a consistent trend over a period when subsidies have been granted" (Agreement on Subsidies and Countervailing Measures (ASCM), Art. 6.3). If the answer is in the affirmative, the subsidy is prohibited. However, there are exceptions to the list of prohibited subsidies (ASCM, Part IV, Art. 8). Examples include: funding for research activities, assistance to disadvantaged regions, and assistance to cover added environmental requirements imposed by law.

## Other Prohibited Activities

GATT also prohibits any action that results in adverse trade effects to other contracting parties. Prohibited actions include injury to the domestic industry of another country or nullification or impairment of benefits accruing directly or indirectly to other members under GATT (ASCM, Art. 6).

## Conflict Resolution

GATT provides a formal procedure to resolve complaints between members. If a country believes that prohibited subsidies are taking place and wishes to make a complaint, the following procedure must be followed:

1) The country first requests consultation with the member thought to be using prohibited subsidies. (ASCM, Art. 4.1).

2) The requested member has an obligation to enter into consultations as soon as possible.

3) If either side is not satisfied with these consultations, it may request that the matter go to the Dispute Settlement Body (DSB).

4) If the DSB finds that a prohibited subsidy exists, then that member will be requested to desist immediately.

5) Members may appeal the decision, with a decision required within 30 days.

6) If the offending member does not remove the subsidy, then the DSB can grant authorization for appropriate countermeasures.

### *U.S.–Canada Free Trade Agreement*

CFTA was signed in 1988 and took effect January 1, 1989. Although CFTA was superseded by NAFTA, many of the provisions applicable to the uranium industry were incorporated into the new agreement. The most important component of CFTA for this study is the requirement that Canadian uranium be treated like U.S. uranium. CFTA is similar to GATT in several ways, but goes further in some key areas. For example, it specifically prohibits restricting energy trade under the guise of national security (CFTA, Art. 2003). An exception for military needs is provided, but uranium for civilian needs is not mentioned in the exception. Dispute resolution under CFTA follows the GATT procedure (outlined above).

### *North American Free Trade Agreement*

With respect to uranium, there are few differences between the provisions of CFTA and NAFTA. NAFTA, which was passed on December 17, 1993, and became effective January 1, 1994, reaffirms the conditions outlined above regarding uranium trade with Canada, e.g., the U.S. cannot impose measures that restrict the import of Canadian-origin uranium. Further, under NAFTA, the U.S., Canada, and Mexico may not cloak uranium industry protection for civilian needs in terms of national security.

### *Examples of Impacts of Trade Agreement on U.S. Uranium Industry*

#### Past

#### *Foreign Enrichment Limitations*

The 1964 amendments to the AEA allowed the AEC to restrict the enrichment of foreign-source uranium for domestic use "to the extent necessary to assure the maintenance of a viable domestic uranium industry" (AEA, Sec. 161). The AEC used this clause to totally prohibit the enrichment of foreign uranium for domestic use from 1969–1977. These restrictions were phased out between 1977 and 1984.

It is possible that these import restrictions were in violation of GATT. Although no formal complaints were ever lodged against the U.S., both Canada and Australia objected to the restrictions (Wilch 1989). Apparently, GATT issues were considered by the AEC and perhaps played a role in preventing direct prohibitions against foreign natural uranium imports

(Wilch 1989). In 1964, the State Department notified the AEC that this arrangement probably violated GATT.[33]

### *Foreign Uranium Restrictions*

After the AEC import restrictions on foreign uranium were lifted, a group of U.S. uranium producers brought suit against DOE in 1984 on the grounds that section 161(v) of the 1964 amendments to the AEA required DOE to impose import restrictions on foreign uranium whenever the domestic uranium industry was considered nonviable. Western Nuclear, Inc. v. Huffman, No. 84-C-2315 (D.Colo. June 20, 1986). DOE argued that section 161(v) applied only if the imposition of the import restrictions could guarantee the viability of the domestic industry (Griffin and Dorin 1989).

The case went all the way to the U.S. Supreme Court, which gave DOE a partial victory by sending the case back to the lower court to determine if the imposition of the import restrictions would restore the industry's viability. This issue was never decided, however, because the uranium producers dropped their suit in 1988, following the passage of CFTA, which added language to Sec. 161(v) excluding Canadian uranium from consideration as foreign-origin uranium. The logic for dropping the suit was that there was no longer any way to prove that the imposition of import restrictions could guarantee the future viability of the domestic industry.

### *Domestic Uranium Revitalization*

Recent attempts on the part of Congress to assist the domestic uranium industry have raised questions about potential violations of GATT or CFTA. In 1988, Senate Bill 2097 proposed a surcharge on amounts of imported foreign uranium that are in excess of 37.5% of domestic needs. The bill passed the Senate but died in the House. Critics, including legislators, the U.S. Trade Representative, and the press argued that these fees would clearly violate CFTA (Wilch 1989).

Senate Bill 83 in 1989 (originally attached to Senate Bill 2443 in 1988) included an amendment for the U.S. government to purchase $750 million of domestic uranium over a five-year period. This would have amounted to a short-term subsidy for the U.S. uranium industry. To mute concerns about violations of GATT and CFTA, the bill also would have repealed section 161(v) of the 1964 amendments to the AEA, resulting in "free market conditions" by 1995 (Wilch 1989). Furthermore, so as not to negatively affect uranium demand, the bill proposed using the uranium as overfeed for the enrichment plants. The bill did not survive a conference committee.

[33]Letter from Alexis Johnson, DOS, to Glenn Seaborg, Chairman, AEC (U.S. Senate 1964).

## Present

### *Amendments to the Russian Suspension Agreement*

The recently amended Russian Suspension Agreement allows increased imports of low-priced Russian-origin uranium, as long as the quantities are matched by equivalent quantities of newly-produced U.S. uranium. Both Canada and Australia have stated publicly that the amendments violate GATT. Canada further argues that the amendments violate NAFTA. Commenting on the proposed amendments in January 1994, Canada argued that, "This amendment will, if enacted as proposed, endanger the viability of Canada's uranium production industry" (Nuclear Fuel 1994a). As such, Canada noted that the amendment "is inconsistent with the obligations of the U.S. under both the GATT and the North American Free Trade Agreement" (Nuclear Fuel 1994a).

The Australians have voiced similar concerns, stating that "the establishment of a mechanism under which imports sold at less than fair market value are utilized to subsidize domestic production sold at higher than fair market value, together with a market sharing arrangement, which provides an incentive to purchase from domestic sources and from one foreign source at the expense of other GATT members, is inconsistent with the U.S. obligations to Australia" (Nuclear Fuel 1994a).

Canada has since requested direct consultations with the U.S. under section 2006 of NAFTA. The U.S. and Canada are now engaged in talks to resolve the dispute. Australia has stated that it is awaiting resolution of the U.S.–Canadian dispute before it decides whether to proceed with a challenge under GATT.

## Future

There are many proposals for revitalizing the U.S. uranium industry. Many, if not all of these, may violate either GATT or the free trade agreements. For example, a proposal to turn over LEU (from HEU stocks) of FSU Republic-origin to U.S. producers would amount to a subsidy to the industry (unless sold at true market cost) and raise objections by at least Canada and Australia. Similarly, a proposal to give title of the material to the USEC could be termed a subsidy and hence violate GATT. One alternative that would not violate U.S. obligations under the free trade agreements would be to allocate rights to this material to both domestic and foreign producers. Such a proposal, however, is likely to be politically unpalatable.

# U.S. Policies Affecting Uranium Trade

## *Cooperation Agreements*

The AEA requires the negotiation of a cooperation agreement between the U.S. and the intended recipient country before the export of nuclear production or utilization facilities, special nuclear material, and certain source materials, including natural uranium, can occur. The basic rationale is to assure that such exports "would not be inimical to the common defense and security" (AEA, Sec. 123). Additional requirements regarding exports were

added by the 1978 Nuclear Nonproliferation Act (NNPA). In particular, the NNPA added the requirement that no exported material can be retransferred to another nation without the *prior approval* of the U.S. Further, it requires that the U.S. have prior approval rights over the reprocessing of U.S.-origin material.

The U.S. initially signed a Cooperation Agreement with the European Atomic Energy Community (EURATOM) on June 11, 1960.[34] This agreement did not give the U.S. prior approval rights. The U.S. has avoided the NNPA requirement of prior approval by invoking section 126(a) of the AEA, which allows the President to exempt certain countries from the prior approval requirement if not doing so would be "seriously prejudicial to the achievement of the U.S. nonproliferation objectives or would otherwise jeopardize the common defense and security." The President has signed such exemptions on a yearly basis for EURATOM; however, the U.S.-EURATOM Cooperation Agreement will expire on December 31, 1995.

## Status of Negotiations[35]

Formal negotiations towards a new cooperation agreement began in December 1991. Primary negotiating responsibility on the U.S. side rests with the U.S. Department of State (DOS). The lead negotiator is Fred McGoldrick, Deputy Director, Office of Nuclear Energy Affairs, Politico-Military Bureau. Disagreement over the issue of prior approval has slowed negotiations. As of January 1995, negotiations remained at an impasse; negotiators warn that the completed text must be presented to the U.S. Congress no later than late April 1995 in order to satisfy U.S. law that requires new agreements to lie before Congress for 90 days of continuous session in order to become effective.

The EURATOM countries are unwilling to accept the requirement of prior approval for the following reasons:

- No such approval rights were required by the U.S. in the past.
- The NPT guarantees signatories the right to develop nuclear technologies for peaceful purposes and does not discuss prior approval rights for any particular group.
- EURATOM countries have developed their own complete nuclear power industry, including a complete fuel cycle industry; therefore, they are no longer dependent on U.S. technologies or materials.

The U.S. had similar problems during negotiations on the U.S.-Japanese Cooperation Agreement during the 1980s. In the final agreement signed in 1988, the U.S. gives Japan programmatic approval for reprocessing U.S.-origin spent fuel. A similar type of agreement has been offered to EURATOM. EURATOM, however, has voiced reluctance to agree to any form of U.S. approval requirements, which it argues amounts to unilateral demands by the

[34]The countries of EURATOM include Belgium, Denmark, Germany, France, Greece, Italy, Ireland, Luxembourg, Netherlands, Portugal, Spain, and the United Kingdom.

[35]Edlow International provided background research for this section.

U.S. EURATOM has noted that current U.S. policy does not favor plutonium recycling and that such programmatic approval could be withdrawn in the future (Nuclear Fuel 1993b).

Mr. Jonathan Heller, Secretary General of the European Atomic Forum Association, notes: "A system which potentially—however improbably—allows another state to withdraw its original consent to an existing plant, in which billions of dollars have been invested, or to veto the construction of a new plant, even if there are already contracts with third-party states for fuel to be processed through that plant, cannot honestly be seen as acceptable either to the state that wants to build the plant, or to the new plant's customers" (Heller 1994). As an example, critics note that an amendment was added to the Defense Authorization Bill (HR 4301) for FY95 by Rep. Edward Markey (D-Massachusetts). This amendment, while ultimately unsuccessful, would have required suspension of programmatic consent whenever material accounting discrepancies occur. The amendment was added by Markey as a way of publicizing an "accounting discrepancy" regarding 70 kg of plutonium at the Tokai-Mura fuel fabrication facility in Japan. According to Japanese officials, the material is not missing, but is contained in the processing lines of the plant.

Differences in interpretations of the language in the NNPA are also having an impact on the negotiations. The NNPA requires U.S. prior consent to the reprocessing or enrichment of any material "used in or produced through the use of any materials, production facility, or utilization facility" (NNPA, Title IV). The issue of contamination is central to European concerns about consent rights. Europeans are interpreting the phrase "used in or produced through the use of" to mean that the use of U.S.-origin material could potentially contaminate other processes involving non-U.S. material and the language therefore broadens the application of consent rights. Heller notes that, based on his understanding, U.S. consent rights would be extended to material irradiated in a U.S.-origin reactor or a reactor moderated with U.S.-supplied heavy water (Heller 1994). The U.S. interpretation of the NNPA, as articulated by U.S. State Department legal staff, centers on the issue of key components, i.e., components without which a facility or reactor could not operate. Material produced in or through the use of facilities containing key components of U.S.-origin would be subject to U.S. consent rights. The U.S. interpretation is based on the notion of proportionality. For example, if 10 percent of the fuel is irradiated in a reactor that has key components of U.S.-origin, only 10 percent of the irradiated fuel would be subject to U.S. consent rights. The Europeans interpret this differently; under their interpretation, if any of the fuel is of U.S.-origin, then all of the fuel would be subject to U.S. prior consent.

Each side does have some leverage points in the negotiations. Without an agreement in place, the contracts that the EURATOM countries have with the Japanese for reprocessing of U.S.-origin fuel would be void. Further, any retransfer of U.S.-origin fuels from third countries, such as Switzerland or Sweden, to EURATOM countries could not occur. However, the U.S. would be the biggest loser if the two sides do not reach agreement. If an agreement is not reached, the U.S. would lose EURATOM countries as customers. No exports of major nuclear components or fuels could occur. The French have also explicitly linked the signing of a new agreement to their future support of the NPT, which comes up for renewal in 1995. One French official recently stated, "We're responsible partners . . .

frankly, it's a little shocking to be asked to submit to U.S. approval rights, too" (Nuclear Fuel 1993b).

EURATOM would like to see the legislative requirements changed. EURATOM countries have been urging the U.S. nuclear industry to lobby Washington for changes in the legislation. In particular, EURATOM would like to obtain a waiver to the requirement for prior consent rights. The NNPA does make provision for a waiver of consent rights. Title IV of the Act states: "The President may exempt a proposed agreement for cooperation from any of the requirements of the foregoing sentence (regarding prior U.S. approval) if he determines that inclusion of any such requirement would be seriously prejudicial to the achievement of U.S. nonproliferation objectives or otherwise jeopardize the common defense and security."

Obtaining approval for the waiver, however, would be extremely difficult. Such a waiver requires the passage of a joint resolution in Congress as well as Presidential approval. In 1994, the State Department indicated that obtaining the waiver is not politically feasible given the composition of the current Congress and Administration. A number of factions within the Administration oppose the waiver, including senior officials at the DOS, the National Security Council, and particularly DOE. Even assuming that these agencies could agree to pursue a waiver and obtain support from the President, it is unclear whether the new Republican-controlled Congress would act on the waiver given the complicated issues involved and the full legislative agenda. It seems equally unlikely that President Clinton would be willing to expend any political capital on a waiver.

Japan has also noted that if the U.S.-EURATOM agreement is any less strict than the U.S.-Japan agreement, it will require renegotiation of its agreement.

If the current agreement lapses, parties holding validated NRC licenses with expiration dates beyond December 31, 1995, for end-users in EURATOM countries, will not be able to export against these licenses. To avoid revoking such licenses, the NRC has adopted a policy of assigning expiration dates of December 31, 1995, to licenses for EURATOM countries. This NRC decision has already increased the cost of doing business with EURATOM countries; licenses are valid for a very short time period. If a new agreement is approved, exporters will have to obtain new licenses, which will require additional time and expense.

## Conclusions

Satisfactory resolution of the issues between the U.S. and EURATOM is desirable because U.S. uranium producers will be effectively shut out of the EURATOM market without this agreement. Moreover, any disruption in the U.S.-EURATOM Cooperation Agreement would have ripple effects because third-party countries could not receive or retransfer U.S.-origin fuels from or through EURATOM countries. Finally, this would send a negative message about the reliability of U.S. supply options.

### *Protection Against Dumping*

The U.S. government responds aggressively to charges by U.S. companies of imports at less than fair market value (dumping) under the terms of the 1979 Trade Act. Because the Act mandates rigid time frames for responding to such charges, once an action is started it can be very difficult to stop. As Heller notes: " . . . while some trade laws gave the government considerably more discretion as to what actions to take or not to take, Congress reflected its distrust of the Executive Branch by passing painfully detailed laws governing antidumping and countervailing duty actions . . . . There is no 'public interest' test, no 'political question' exemption, not even a 'national security' exemption to these laws" (Heller 1994).

Under the mandates of the Trade Act, the U.S. signed suspension agreements with six FSU Republics in 1992, thereby settling a suit brought on November 8, 1991, by a coalition of domestic uranium producers to stem the flow of low-cost former Soviet uranium entering the U.S. The six Republics were Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Ukraine, and Uzbekistan. Ukraine and Tajikistan terminated their suspension agreements in 1993. The Department of Commerce subsequently resumed its antidumping investigations of imports of uranium from these two Republics. The International Trade Commission subsequently ruled that uranium from Ukraine, other than HEU, did materially injure or threaten to injure the domestic uranium industry, and it imposed a duty of 129 percent. No dumping duties were applied to Ukrainian HEU. In the case of Tajikistan, the ITC ruled that Tajikistan-origin uranium did not materially injure or threaten to injure the domestic uranium industry. Any uranium of Tajikistan origin may thus be imported into the U.S. without restriction.

The remaining four suspension agreements placed quotas on the annual amounts of uranium that each of the four republics could export to the U.S. Under the terms of the suspension agreements, as long as the U.S. average price, as calculated by the DOC, remained below \$13/lb $U_3O_8$, no uranium (signed contracts were grandfathered) could be exported to the U.S. from the FSU Republics. It was thought that, because this would reduce world uranium supply, prices would rise above the \$13/lb base price and future imports of FSU Republic-origin uranium would then be allowed. This did not happen, effectively barring the import of this uranium into the U.S. From the U.S. perspective, the agreements were not working either. Petitioners to the original dumping suit have claimed that suspected circumvention of the Russian Suspension Agreement through third-party sales has depressed prices, keeping U.S. domestic production at very low levels.

Proposed amendments to the Russian Suspension Agreement were announced in December 1993. The key proposed change was to allow importation of Russian-origin uranium as long as it was matched with equal quantities of U.S. uranium. Several questions regarding the proposed amendments were posed, including whether the agreement would actually result in increased U.S. production and whether the circumvention language was strong enough. The Amended Russian Suspension Agreement was signed on March 12, 1994.

## Key Components of the Amended Russian Suspension Agreement

### *Matched Sales*

The Amended Russian Suspension Agreement allows "matched sales" of up to 6.6 million lbs (approximately 15% of annual U.S. domestic requirements) of Russian-origin $U_3O_8$ equivalent and 2 million SWUs per year for 1994 and 1995.[36] For Russia, this uranium must be uranium (either in $U_3O_8$ or $UF_6$ form) produced in Russia and not yet exported from Russia.[37] For the U.S., the uranium must be newly produced, meaning that it must contain $U_3O_8$ produced after March 11, 1994, the effective date of the Agreement.[38] Uranium derived from Russian stocks of HEU is not covered by this agreement.

### *Company Limitations*

Any single U.S. producer is limited to matching no more than 20% of the total quantity allowance. Any single group of producers under common ownership or control may not exceed 50% of the total allowable matches.

### *Department of Commerce (DOC) Approval*

Any deal made under this agreement must have the prior approval of the DOC. DOC will review each request within 15 days of submission. Review is limited to the following three questions:

- whether the contract falls within total annual limits;
- whether the contract would exceed any one company's annual quota for participation; and,
- whether the unit price paid to the U.S. producer exceeds the unit price paid by the end user.[39]

### *Safeguards*

The Amended Russian Suspension Agreement sets up safeguards to prevent producers or brokers from making deals and then not making delivery on the domestic component. If the Russian material arrives first, an escrow account must be established by the company arranging for the contract (producer, broker, or utility). This account is forfeited should the U.S. producer fail to deliver any portion of the U.S. component. Any company forfeiting an

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[36]For the period 1996-2003, additional matched sales of uranium, but not SWU, are allowed. The quantities allowed for each year are as follows (in million lbs $U_3O_8$): *1996*-1.93; *1997*-2.71; *1998*-3.6; *1999*-4.0; *2000*-4.0; *2001*-4.0; *2002*-4.9; and *2003*-4.3.

[37]Uranium stockpiled in Europe can not be used for matched sales.

[38]The agreement allows for an exception to this definition. If sales do not exceed 2.2 million lbs $U_3O_8$ equivalent by Sept. 11, 1994, then up to 1 million pounds of already mined, but not milled, $U_3O_8$ may be substituted.

[39]The Amendments require that the U.S. producers be paid more, per unit basis, for their component than the Russians.

escrow account may not participate in future matched-sales contracts. The purpose of these safeguards is to assure that contracts result in the new production of U.S. uranium.

### *Anticircumvention Language*

One of the largest issues of contention during the negotiations of the Amended Agreement involved the requirement by the DOC that Russia supply information on third-party sales so that the DOC could monitor compliance with the Agreement. At issue here was whether uranium sold by Russia to a third country could then be re-exported to the U.S. as material of non-Russian-origin, thereby circumventing the Agreement. The Russians agreed to give DOC all requested information on third-country sales, as long as this information is treated as proprietary information and not shared with others, such as the U.S. producers.

## Issues of Concern

### *Overall Effectiveness*

It is by no means certain that the Amended Russian Suspension Agreement will result in increased U.S. uranium production. This will depend on whether producers believe that they can make profitable contracts given the many restrictions. For example, will Russian material be cheap enough to allow some producers to reopen closed production centers? Will the uranium market stabilize enough so that producers will be able to think long-term? Or will the continued restriction on the free flow of uranium from these countries simply translate into higher world uranium prices and a larger market share for Canada and Australia? There is also uncertainty about whether the petitioners in the antidumping case will be satisfied by this amendment. They initially filed suit on June 1, 1994, in the U.S. Court of International Trade in New York to overturn the Amended Russian Suspension Agreement. The actual intent of the petitioners in bringing this suit may not be to overturn the agreement but rather to force the Department of Commerce to resolve remaining ambiguities to the satisfaction of the petitioners. As of January 1995, action in this suit is on indefinite hold.

### *Utilities*

Utilities want to minimize fuel costs while maximizing the flexibility and the security of the fuel supply. In theory, utilities would prefer that there be no restrictions on the import of material from the FSU Republics. They do not see the protection of the domestic uranium industry, or the domestic oil and coal industries, as their responsibility. The problem that utilities have with the Amended Russian Suspension Agreement is reduced overall flexibility due to several restrictions. For example, utilities cannot loan material obtained through matched sales, and the uranium cannot, in most cases, be resold. Utilities are also concerned with the notion of the mandatory escrow account because this could prevent individual utilities from initiating matched-sales deals (leaving them up to producers and brokers). The impact of this increased uncertainty may result in utilities demanding a lower price (a risk premium) for contracts involving matched-sales materials. As of January 1995, three matched deals had been announced, and the DOC reported that several other deals are in progress. The first deal, announced in September 1994, involved the sale of 250,000 lbs of $U_3O_8$ by Rio Algom to

Commonwealth Edison. It will be matched by an equal quantity of Russian-origin uranium. Two trading firms, Internexco and UG U.S.A., were also parties to the deal.

### *Circumvention*

Despite the inclusion of anticircumvention language in the Suspension Agreement (Section VII), petitioners in the antidumping case claim that a rather large legal loophole remains. Under this so-called "enrichment bypass option," U.S. utilities can indirectly purchase Russian uranium. The Suspension Agreement specifically states: "Uranium enriched in $U^{235}$ in another country prior to direct and/or indirect importation into the U.S. is not considered uranium from the Russian Federation and is not subject to the terms of this Agreement" (Section III). This has been taken by some to mean that as long as the uranium is at least partially enriched (referred to as "substantial transformation"), it is no longer "of Russian origin."

Joseph Spetrini, deputy assistant secretary for compliance in the DOC's International Trade Administration, who has responsibility for overseeing and enforcing the suspension agreements, vigorously denies that this bypass option even exists. In comments before an Nuclear Energy Institute forum in October 1994, Spetrini said, "Let me dispel any misconception that there was ever a DOC determination that there is such a thing as a bypass option, or that there is indeed anything remotely like that option. It's not true." Further, Spetrini noted that section VII of the suspension agreement gives the DOC authority to take action if anything undermines the spirit of the agreements and warned that his office was looking into what "countermeasures would best be in the event that this nonsense about bypass continues to be seen as an option."

The petitioners formally asked the DOC to close the bypass option in December 1994, noting in part that, as a result of this loophole, U.S. utilities "are not interested in fairly priced U.S. produced uranium supplied on either a direct or matched sale basis."

U.S. utilities are opposed to any changes in the Agreement. Utilities emphasize that what they are looking for is the most competitive fuel package, which includes not just the uranium, but also the conversion, enrichment, and fabrications services. In terms of percentages, the uranium costs are approximately 25%, conversion 4%, enrichment 50%, and fabrication 25% (NAC 1993). Hence, if foreign enrichment costs are lower, this may be a more important factor in determining the overall competitiveness of a package. USEC has also requested that the "bypass option" be closed; this would enhance their likelihood of winning enrichment contracts.

### *GATT/Free Trade Agreement Violations*

The DOC argues that the Amended Russian Suspension Agreement does not violate either GATT or the existing free trade agreement (Spetrini 1994). Joe Spetrini of the DOC notes that other countries are free to sell as much uranium in this country as they can and that this agreement will not negatively affect them. It may actually positively affect the whole uranium industry if it reduces uncertainty and stabilizes the global market.

This issue is unlikely to go unchallenged, however. GATT prohibits subsidization of any industry if "the effect of the subsidy is an increase in the world market share" of a particular industry (ASCM, Art. 6.3). While the Amended Russian Suspension Agreement does not provide a direct subsidy to the domestic uranium industry, it does allow for monitored "dumping" of Russian uranium at below fair market prices, as previously determined by the DOC. Other uranium-producing countries will likely claim that this is an indirect subsidy and hence a GATT violation.[40]

GATT also covers any action that results in adverse trade effects, such as the injury of the domestic industry of another country (ASCM, Art. 6). Hence, if a uranium-producing country can show that this action by the U.S. severely reduces that country's uranium sales, it may seek relief under GATT.

Under the free trade agreements, Canadian uranium is, in the eyes of the law, equivalent to U.S. domestic uranium. The Canadians therefore claim that they should also be allowed to make matched sales. Spetrini, commenting on this issue, noted that he couldn't imagine why Canadian producers would want to do matched sales with all of the requirements for prior approval and paperwork, when providers already have free access to the market (Spetrini 1994).

In a March 18, 1994, letter to the U.S. Trade Representative, Canada requested direct consultations with the U.S. under section 2006 of NAFTA. The U.S. and Canada began consultations in April 1994. As of this writing, consultations are continuing. If Canada is still unhappy after the conclusion of these talks, it may then request a hearing before the NAFTA Commission. Failing resolution before that forum, both sides may take the issue before a panel of representatives.

This issue may not go that far, however. In a confidential interview, a representative from a Canadian producer noted that while Canada could be expected to protest the amendments, it will probably not press the issue to conclusion. The purpose of the protest is to make the U.S. aware of the precedential nature of this issue and to indicate that the Canadians are not pleased. The Australians could provide serious long-term competition if the current restrictions on output are relaxed or removed, allowing more low-cost Australian uranium on the market.

## Changes to the Remaining Suspension Agreements

Amendments to the Uzbekistan agreements were announced in October 1994. Under the terms of this agreement, Uzbekistan could export up to 440,000 lbs $U_3O_8$ per year for two years to the U.S. at a price greater than an unspecified reference price. The reference price

[40]The Australians voiced their initial objections to the draft amendments, stating that "the establishment of a mechanism under which imports sold at less than fair market value are utilized to subsidize domestic production sold at higher than fair market value, together with a market sharing arrangement, which provides an incentive to purchase from domestic sources and from one foreign source at the expense of other GATT members, is inconsistent with the U.S. obligations to Australia . . . of the GATT" (Nuclear Fuel 1994a).

will be calculated by averaging a benchmark U.S. ISL reference price[41] with the Uzbek reference price, which must be calculated using the DOC's nonmarket economy factors of production methodology for ISL production. The agreement also allows an additional 100,000 lbs $U_3O_8$ in each of these two years, as long as the contract price is greater than current market price, as calculated by the DOC.[42]

Beginning November 1, 1996, Uzbek-origin uranium could be imported according to a quota tied to U.S. production levels. Allowable imports would range from 200,000 lbs for a U.S. production level of 3,000,001-3,500,000 lbs $U_3O_8$ to 1 million lbs for U.S. production levels between 7.5 and 9 million lbs. Above U.S production levels of 9 million lbs, Uzbek-origin imports would be unlimited.

On November 15, 1994, the DOC announced similar amendments to the Kazakhstan Suspension Agreement. Similar to what the Uzbeks would be allowed under their agreement, Kazakhstan, under its agreement, would be allowed to export 440,000 lbs $U_3O_8$ to the U.S. in each of the next two years. After that, imports would be permitted under a quota system.

## Conclusions

The suspension agreements provide examples of the U.S. government actively protecting the interests of a particular industry by ensuring that other countries do not dump goods in the U.S. But they also demonstrate how difficult it is to please all sides, including our international trading partners and our former Cold War adversaries. The DOC has had to walk a thin line in negotiating these agreements. On one side are the U.S. producers that want to keep material from the FSU Republics out of this country in order to increase domestic uranium prices. These producers want strong agreements with measures to ensure compliance. On the other side are utilities that want to buy the cheapest uranium and the FSU Republics that want foreign currency. In the middle are other uranium-producing countries that benefit from restrictions on material from the FSU Republics, since restrictions increase price (although not high enough to benefit U.S. producers), but that oppose the terms of the amendments since they allow some dumping to continue to the benefit of domestic producers.

The Amendments to the Russian Suspension agreement should be viewed positively in terms of U.S. domestic uranium revitalization as they provide the opportunity for increased domestic production. To what extent domestic producers actively negotiate matched sales will depend on 1) the utilities' willingness to accept "matched-sales" contracts, 2) the perceived effects of regulatory (DOC) involvement; and most important, 3) whether the producers can negotiate prices from Russian producers low enough to assure profitability in the long-term. The amendments have drawn protests from other uranium-producing countries as violating both GATT and the free trade agreements.

[41]For one publicly traded company, Uranium Resources Inc., the declared ISL production cost is $10/lb (Nuclear Fuel 1994c).

[42]As of October 1994, this market price was $11.95/lb (Nuclear Fuel 1994c).

### *Nuclear Regulatory Commission (NRC) License Fees*

This section discusses the NRC mandate to assess annual and license fees, outlines the difference between general and specific licenses, and reviews the implications for the domestic uranium industry.[43]

#### Background

The Omnibus Budget Reconciliation Act of 1990 requires the NRC to recover 100% of its budget authority through annual licensing and inspection fees. The NRC policy for assessing these fees is to assess those activities that require the greatest expenditure of NRC resources with the largest fees. In the first year of full-cost recovery (FY91), budget recovery was set at $465 million, the bulk of which was assessed on the 109 operating power reactors ($290.9 million). Table 12 shows the NRC FY91 assessments.

#### Uranium Production Facilities

Uranium recovery facilities must pay annual NRC fees. The assessments to the industry for FY94 (the most current approved schedule) total approximately $639,000. Specifically, the annual fee for Class I facilities (facilities with uranium mills) is $74,500. The annual fee for Class II facilities (those not generating tailings) is $41,200. For Class III facilities (by-product recovery), the annual fee is $36,200. Approximately 44% of the fees are assessed to Class I facilities; 39% to Class II facilities, and 17% to Class III facilities (NRC 1994). These fees are collected whether or not the facilities are actively producing uranium.

**Table 12. Nuclear Regulatory Commission FY91 Budget Recovery**

| Source | US$million |
|---|---|
| Nuclear Waste Fund | 19.7 |
| Part 170 License/Inspection Fees | 79.5 |
| 10 Test/Research Reactors | 0.5 |
| 20 Major Fuel Facilities | 10.6 |
| 4 Spent Fuel Storage | 1.5 |
| 20 Uranium Recovery Licenses | 1.9 |
| 574 Transportation Licenses | 4.8 |
| 9,000 Materials Licenses | 22.3 |
| Generic/Unrecovered Activities | 33.3 |
| Power Reactors | 290.9 |
| **Total** | **465.0** |

[43]Edlow International provided background research for this section.

The NRC has shown an unwillingness to consider exemptions for specific groups, including the domestic uranium industry.[44]

The approved FY94 fees are significantly higher than the FY93 fees. In FY93, the annual fees were: Class I - $58,000; Class II - $25,400; Class III - $21,100. Proposed fees for FY94 for Class I facilities ($94,300) were significantly higher than finally accepted ($74,500). In assessing the higher fees for FY94, the NRC noted that while the total amount of fees to be recovered from uranium recovery licensees decreased by about 10% over FY93, the annual fees increased for two basic reasons (NRC 1994):

- The amount expected to be recovered through Part 170 fees (licensing and inspection) has decreased as a result of the completion of the licensing process for the Envirocare by-product disposal facility; hence, the need to collect a larger amount of money through Part 171 annual fee assessments.

- The total number of licensees to be assessed annual fees for FY94 has decreased.

In addition to these annual fees, each facility may be subject to additional NRC fees. For example, additional fees may be charged for certificates of compliance, sealed source and device registrations, and approved Quality Assurance Programs. The annual cost of these fees may add several thousand dollars to the average annual operating cost for a uranium recovery facility.

## Export and Import Licenses

The NRC is also responsible under the 1975 amendments to the Atomic Energy Act (AEA) for administering export and import controls over nuclear materials. Two types of import and export licenses exist, general licenses and specific licenses.

### *General Licenses*

A general license grants standing authority to import or export materials in compliance with 10 CFR Part 110, Subpart C. No fees are charged for use of general licenses. Countries eligible for general licenses must have good nonproliferation credentials and have a valid cooperation agreement with the U.S.[45]

For exports, general licenses are very restrictive and, except for shipments of small samples, are not issued. For example, the maximum quantity of U-235 that can be exported under a general license is 625 grams enriched to 4.0%.

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[44]In denying a proposed exemption for the domestic uranium industry in 1993, the NRC noted that it does not have the "expertise or information needed to undertake the subtle and complex inquiry whether in a market economy particular licensees can or cannot easily recapture the costs of annual fees from their customers" (NRC 1993).

[45]General licenses are not issued to countries listed in 10 CFR Part 110.28 (Embargoed Countries). Certain other restrictions apply to those countries listed in 10 CFR Part 110.29 (Restricted Countries).

For imports, however, general licenses are the rule rather than the exception. Except for the imports of irradiated fuel, Part 110.27 states that a general license will be issued to any person for the import of source and special nuclear material as long as the consignee is authorized to possess the material in accordance with 10 CFR.

*Specific Licenses*

For those cases for which a general license is not adequate, a specific import or export license from the NRC is required.

A specific license is an import or export license issued by the NRC to a named person pursuant to an application filed under the regulations of 10 CFR Part 110, Subpart D. Any person wishing to import or export nuclear material/equipment that does not fall under general license authority must file a license application with the NRC. The export license application requests detailed information about the applicant, intermediate and ultimate consignee(s), proposed intermediate and ultimate end uses, the material to be exported, and the country of origin of the source material.

Procedures established under NNPA outline the internal U.S. government review process for import and export license applications; this process is detailed in 10 CFR Part 110, Subpart E. This process depends on a number of factors, including type of material/commodity, end use, ultimate consignee, and relevance to sensitive policy issues (i.e., reprocessing). For proposed imports and exports involving HEU, plutonium, heavy water, or initial (since March 10, 1978) exports of source or special nuclear materials for nuclear end use, NRC Commissioner review is required (10 CFR Part 110.40).

Applications to export certain commodities, such as initial exports of nuclear material to a foreign reactor (initial cores) or source or special nuclear material to be exported under the U.S.-IAEA Agreement for Cooperation, also require Executive Branch review (10 CFR Part 110.41). For such applications, the NRC will forward the application to the DOS with copies to the DOE, the Departments of Defense and Commerce, and the Arms Control Disarmament Agency.

DOS, as the lead agency, will prepare a coordinated Executive Branch judgment. The NRC will also conduct an internal review. Dispute resolution and escalation mechanisms exist if there is disagreement between the government agencies.

For import and export applications involving LEU (such as a routine reload) and source material, simplified review procedures have been adopted that permit the application to be processed and approved by NRC staff without referral to the Executive Branch or NRC Commissioners. These routine cases constitute approximately 90 percent of all applications received.

An additional component of the review process is the requirement for foreign government assurances. These assurances take the form of official government communiqués that confirm both the material end use and that the end user is authorized to possess the

material. Response time varies between governments. (For example, EURATOM generally issues assurances within 30 days, whereas countries such as South Korea or Japan often take several months).

All licenses are subject to terms and conditions that affect the use of the licenses. The following conditions apply to all general and specific licenses:

- Licenses are subject to all applicable provisions of the AEA;
- Licenses are subject to amendment, suspension, or revocation by the NRC; and,
- The packaging requirements of 10 CFR Part 71 must be met.

Additionally, specific licenses are subject to the following conditions:

- Licenses have a set expiration date;
- Licensee may import or export only for the purpose stated on the application; and,
- Licenses may be transferred to another party only with NRC approval.

Additional conditions may be assigned as determined by the NRC.

The period of validity is an important condition because an additional charge is required to extend the expiration date under NRC full-cost recovery mechanisms. Expiration dates are often tied to nuclear cooperation agreements. As an example, the NRC is currently issuing licenses for end users in EURATOM countries with expiration dates of December 1995, when the U.S.-EURATOM cooperation agreement expires. (A recent approval to export HEU from the Fort St. Vrain reactor in Colorado to France for recovery of the uranium and thorium could serve as a precedent to challenge this practice.) Uncertainty regarding extension of the EURATOM cooperation agreement makes it difficult to ensure that exports can be made after this date. (This is particularly relevant for material suppliers, who, in spite of long-term supply contracts, would be unable to export the material). The short period of validity also has a cost implication. A license application obtained today will only be valid for 18 months; additional fees are required for new, amended, or extended licenses.

Implementation of NRC full-cost recovery includes the establishment of fees for import and export licenses. License fees for specific import or export licenses are identical and range from $1,300 to $8,600, depending on the amount of review required. Members of the nuclear energy industry argued against imposition of fees in this area on the basis that they act as a restraint on trade; in fact, many foreign customers view the fees for import/export licenses as a duty or tax. It was argued that the fees could not be absorbed solely by U.S. companies and would have to be passed on to foreign customers—thereby increasing the cost of doing business with U.S. suppliers.

Despite these arguments, the NRC established a fee schedule for approval and amendment of import and export licenses. The current schedule is as follows:

- For applications for the import or export of HEU and other materials requiring Commission and Executive Branch review, the fee is $8,600.

- For applications for the import or export of special nuclear material and source material requiring Executive Branch review only (such as exports of material for initial cores), the fee is $5,300.

- For applications for the export of routine reloads of LEU reactor fuel and exports of source material requiring foreign government assurances only, the fee is $3,100.

- For applications for the import or export of other materials not requiring Commissioner or Executive Branch review or foreign government assurances, the fee is $1,300.

- For minor amendments to any import or export license, for example, to extend the expiration date, change domestic information, or make other revisions that do not require analysis or review, the fee is $120.

No fees are charged for imports and exports made under general license conditions. However, most exports of natural and enriched uranium from the U.S. (except for the small general-license quantities) do not qualify for general licensure and are subject to specific approval by the NRC. As such they are also subject to application fees of thousands of dollars. In contrast, imports of natural and enriched uranium into the U.S. routinely qualify for general license import; accordingly, no NRC user fees are assessed on such material.

To reduce the impact of the NRC user fees, some companies have structured their license applications to reflect larger quantities of material, multiple end users, and longer validity periods. For example, a company that anticipates long-term supply of enriched uranium to Europe may structure an application to make provision for export of significant quantities of material over a five-year period for use in all light-water reactors in EURATOM countries (provision should also be made for intermediate uses at all possible conversion and fabrication facilities and for all possible origins of source material). The NRC has approved such "bulk licenses" for several countries. Other countries have been unwilling to apply for bulk licenses, preferring to obtain specific licenses for each export.

The value of bulk licenses is limited, however, for the European case, given the link between license validity and existence of a valid nuclear cooperation agreement, as noted above. The use of bulk licenses can reduce the cost of NRC user fees, but does not avoid them. For example, any import or export license that requires both an NRC and an Executive Branch review costs $8,600. A license that requires a NRC staff review and foreign government assurances, such as for a routine reload, costs $3,100.

## Conclusions

The NRC fee structure places heavy financial burdens on the domestic uranium industry. First, substantial annual fees on uranium recovery facilities increase the bottom line

cost of domestic uranium. Second, most exports require specific export licenses, costing thousands of dollars, whereas most imports are covered under general licenses that have no fees.

### Customs User Fees

The Omnibus Budget Reconciliation Act of 1986 authorized the Customs Service to assess a merchandise processing user fee, known as a CUF, on formal entries of imported merchandise. A CUF is an example of a fee that applies to uranium imports, but not to exports. The proceeds of the user fees are deposited in a dedicated account in the Treasury, are subject to appropriation, and are to be used to offset Customs appropriations for operating expenses in processing imports.

Originally, this ad valorem user fee was based on the appraised Customs value of the merchandise and amounted to a fee of 0.22 percent of the declared value of the commodity. Beginning October 1, 1987, the fee was reduced to 0.17 percent. The fee was originally scheduled to expire on September 30, 1989, but has been extended continuously since that time. However, its structure has been changed to comply with GATT and the free trade agreements.

Both Canada and the European community initiated official complaints against the U.S. in GATT proceedings in November 1987. They charged that the ad valorem fees did not relate to actual processing costs and hence were thinly disguised taxes that violated U.S. trade commitments. Further, CFTA initiated a steady phaseout of CUFs applicable to Canadian goods. For uranium imports, this meant that Canadian-origin material could be imported into the U.S. at a lower cost than material from other countries of origin.

The Customs and Trade Act of 1990 changed the structure of the CUFs by maintaining the 0.17 percent fee but placing a ceiling of $400 on the amount collected. Given the high dollar value associated with uranium products, most imports are subject to the $400 fee, although imports of Canadian material remain exempt from the fee. At this level, the CUF does not seriously impact uranium import decisions.

### Harbor Maintenance Tax

The Harbor Maintenance Tax (HMT) applies to both imports and exports of uranium. The Water Resources Development Act of 1986 imposed a 0.04 percent ($4 per $10,000 of value) ad valorem fee on all imports and exports passing through U.S. harbors and ports, effective April 1, 1987. The proceeds of the fee are deposited in the Harbor Maintenance Trust Fund which, subject to appropriation, is made available to the U.S. Army Corps of Engineers for maintenance of U.S. harbors and ports. The HMT was effectively tripled (0.125 percent) as of January 1, 1991. As an example, for a recent shipment of approximately 600,000 lbs natural uranium, the HMT was approximately $7,000.

Since the HMT applies to imports or exports made through U.S. ports and harbors, a side effect of the HMT has been a decrease in business at American ports with a corresponding

increase at Canadian ports. The goods then enter the U.S. by either road or rail to avoid the HMT.

There is a possibility that Congress will change the way in which the HMT is structured. One proposal is to place a ceiling on fees collected per shipment, similar to the CUF. Alternatively, other proposals suggest stepping up enforcement of HMT payments, which will allow a decrease in the fee.

The HMT reduces the chances for domestic uranium producers to win export contracts as it directly increases cost. However, because it also applies to imports of uranium from other countries, it provides an incentive for U.S. consumers to use U.S. uranium.

## Section V. Commentary and Recommendations

DOE was required to conduct annual viability assessments of the domestic uranium industry from 1983 to 1992. For each year, 1984 to 1992, DOE declared the industry nonviable. The existence of thriving (or at least reasonably healthy) uranium industries in other countries helped spur the inclusion of a section in the EPAct aimed at revitalizing the U.S. uranium industry and led to this study of the "levelness" of the international playing field.

Accidents of history and geology are some of the reasons, locating large, high-quality reserves in some countries and lower quality or none in others. Australia has the world's largest low-cost available reserves, although production is limited for political reasons. Canada has large amounts of very high quality reserves (up to 15% $U_3O_8$) that will probably lead Canada to continue to supply a large percentage of the world's uranium demand in the foreseeable future. While the U.S. has large resources, a large percentage of those are high-cost. The use of ISL technology may allow certain sites, classified as high-cost in terms of conventional mining, to be economically recoverable.

Those countries without large domestic high-quality supplies can become healthy contenders in the world market by gaining control over sources located in other countries through the acquisition of uranium rights. Cogema, the French company, is a case in point, owning resources in Australia, Canada, France, Gabon, Namibia, Niger, and the U.S. In 1993, Cogema became the world's largest uranium producer as measured by market share, despite the absence of significant reserves in France.

The case of Cogema illustrates another aspect of the unlevelness of the playing field. Until 1993, Cogema was a 100% government-owned entity, potentially allowing it access to the government's deep pockets when market conditions were bad and to various types of nonfinancial support. Cogema supplies the national utility, EdF, with most of its uranium. Although specific cost and pricing information is not available, circumstantial evidence, such as the continued mining of higher-cost French, Gabon, and Niger resources, suggests that EdF pays higher-than-market value for its uranium. Furthermore, the commitment by the French government to nuclear power, which provides over 75% of France's electricity, ensures Cogema of continued government interest in its viability.

The Canadian government has also historically had strong involvement in its uranium industry. The federal government and the Province of Saskatchewan share partial ownership of Cameco, a major producer. The primary uranium user in Ontario, Ontario Hydro, owned by the Province of Ontario, required long-term advance purchases of uranium to ensure a stable supply; these contracts went to Ontario producers. Finally, in an explicit move to protect the Canadian producers in the face of U.S. policies in the 1960s and 1970s, the Canadian government purchased and stockpiled uranium, allowing Canadian mining operations to continue. Although many of these direct means of government support have now been attenuated (there are plans to privatize Cameco, Ontario Hydro canceled its long-term contracts, and the federal government sold off most of the stockpile), the result of these support measures have left the Canadian uranium-producing industry in a very strong position, well-equipped to compete on the world

market on its own. Despite such support, the main reason for the continued strength of the Canadian uranium industry is its high-quality resource.

During the development of the uranium industry, weapons procurement programs acted as a type of government support, providing a relatively stable market. Military programs were soon supplemented by a rapidly growing domestic nuclear power industry that, although privately owned (unlike Ontario Hydro), purchased most of its uranium from domestic sources. The government prohibition on the enrichment of foreign-origin uranium from 1967 through 1984 helped guide U.S. utilities to the purchase of domestic-origin uranium. As a result, the market for U.S uranium producers could have been characterized as a domestic one with relatively constant growth. However, significant changes in the public attitude toward nuclear power over the last decade combined with other factors to significantly slow the growth of the U.S. nuclear power sector. Faced with the loss of a rapidly growing domestic market, U.S. uranium producers found themselves poorly positioned to take advantage of opportunities in the international market.

Uranium production also may serve political ends that make it attractive for a government to choose a particular position in relationship to the industry. France, for example, may be supporting uranium production in West Africa, Gabon, and Niger as a means of maintaining influence in these former French colonies. Australia's three mine policy and lack of a civil nuclear power program reflect strong environmental concerns about the effects of all stages of the nuclear fuel cycle. And certainly (although not covered in this study) national security concerns played a large part in the attitudes of many governments towards the uranium-producing industry in its early years.

The general political climate and philosophy within a nation may allow it to adopt industrial technology policies that make the field truly unlevel for the U.S. France's rather closed system of government has allowed its government-owned and -controlled nuclear energy industry to operate with little public scrutiny over the years. This has been reinforced by a general commitment to strong industrial policies guided by the central government and a clear investment in nuclear power and therefore in its associated industries. The absence of a strict antitrust climate and associated legislation in Canada led to government support of the development and operation of the alleged cartel in the 1970s. A commitment to secure supplies led government-owned Ontario Hydro into long-term contracts for uranium very favorable to Canadian producers. The one bright spot for U.S. producers in the international political arena is the strength of the environmental movement in Australia, which has significantly restricted exploitation of that country's reserves. In terms of its own government, the U.S. uranium industry (as do all other U.S. industries) works in an environment characterized by the rhetoric of unfettered markets and a hands-off policy towards industry on the part of the government.

The U.S. has also, in some sense, been hampered in its efforts to support its domestic uranium-producing industry by its own commitment to free and open global markets as captured in international agreements such as GATT, CFTA, and NAFTA. Designed to support the free flow of goods and services, all of these agreements prohibit actions that result in adverse trade effects to other signatories. Most government actions designed to help the U.S. uranium producers can be challenged under one or more of these agreements. Canada has been the most vociferous in its challenges, as both NAFTA and CFTA explicitly require Canadian uranium to be

treated the same as U.S. uranium. Furthermore, the Canadian industry is operating from a position of relative strength based on high-grade deposits and a supportive atmosphere.

Although not addressed directly in this study, national security concerns have certainly had an impact on the global flow of uranium. Current negotiations over the renewal of the U.S.–EURATOM Cooperation Agreement have stalled due to U.S. insistence on its (U.S.) approval of any resale of U.S.-origin nuclear material to a third party. This insistence arises from U.S. nonproliferation concerns, but threatens to derail the negotiations and possibly exclude U.S.-origin uranium from sale in the European market.

In summary, the unlevelness of the playing field for U.S. uranium producers is the result of a combination of geology, which gave the U.S. its relatively high-cost uranium reserves, history, and a general U.S. political philosophy that has precluded the type of industrial policy focused on specific industries that has benefited the uranium producers in other countries. (It should be underscored here that the industry-specific policies described for countries such as France are legal and ethically acceptable to the sponsoring countries.) Given these political and geological constraints, there are areas, such as export promotion and coordination, in which the U.S. may be able to provide more support to its domestic uranium industry than it does now, always making the tradeoff between direct industry support and the belief in the efficacy of truly free markets, and between support of this particular industry and other agendas, such as nonproliferation and national security, that such support might endanger.

The U.S. has traditionally eschewed taking an overt and active role in the support of the export efforts of particular industries or companies, adopting the viewpoint that the most effective operation of the market occurs when it is completely free of government or other outside intervention. However, the recent trends toward the globalization of markets has forced a modification of this position. The recently issued *Toward a National Export Strategy* calls for the government to be more proactive in its support of U.S. industry in foreign markets. This could benefit the U.S. uranium industry as it seeks to strengthen its position overseas and faces competition from other countries, such as France, that actively support their industries. Failure to successfully renegotiate the U.S.–EURATOM Cooperation Agreement could exclude U.S. producers from nuclear trade with European countries.

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