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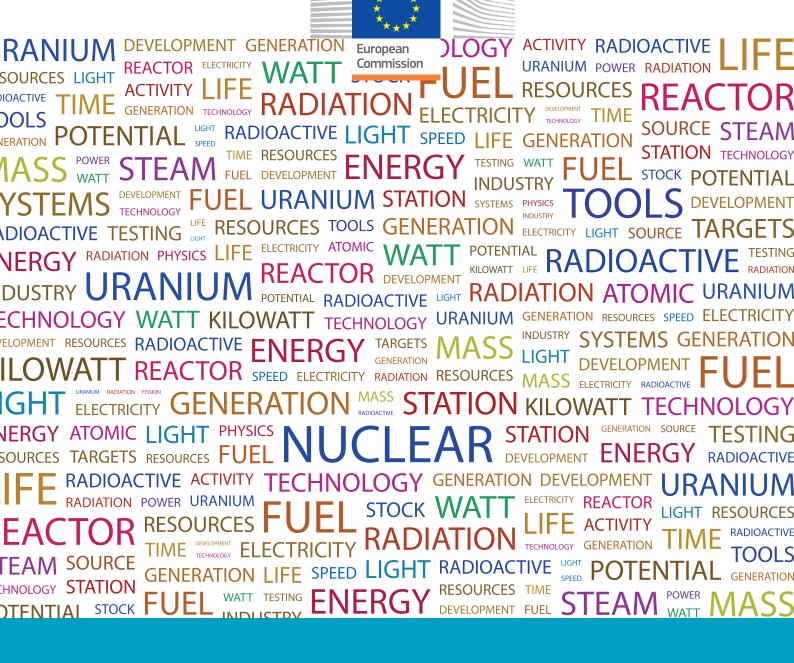
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Report on
Securing the
European Supply
of 19.75% enriched
Uranium Fuel

**Euratom Supply Agency**Advisory Committee WG Report

### **REPORT**

of the Advisory Committee to the Euratom Supply Agency on Securing the European Supply of 19.75% enriched Uranium Fuel

July 2016

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### **FOREWORD**

The present Report was drafted by a dedicated Working Group which was set up by decision of the Advisory Committee<sup>1</sup> of the Euratom Supply Agency (ESA), in its May 2012 session, in order to evaluate the feasibility and opportunity to build a European capacity for the production of metallic low-enriched uranium (LEU), at 19.75%, to cover the needs of European research reactors after their conversion. The Working Group, which convened three times, conducted a strategic, technical and economic study on the establishment of a European LEU facility. The Group's Report was endorsed and approved by the Agency's Advisory Committee, at its session of 14 November 2013.

Following the adoption and publication, in May 2014, of the European Commission Communication on the European Energy Security Strategy<sup>2</sup> (endorsed further by the European Council Conclusions of June and October 2014), the Agency's mission in support of security of supply received new impetus.

It is worth noting that the worldwide supply of LEU, at 19.75 %, destined for research reactors and the production of irradiation targets is hardly secured in the long term. For this reason, the study carried out by the Working Group of ESA's Advisory Committee remains relevant to the international discussion on metallic LEU supply and can bring a useful input to any cooperative initiative in this area, including further interested States.

In the light of the above, ESA decided to publish the Report. Two of its major contributors, URENCO and AREVA, working separately, were requested, at the beginning of 2016, to review the information each of them had provided. They both confirmed that the statements and figures, as they stood in the Report in 2013, are still valid.

Euratom Supply Agency

### 1. CONTEXT

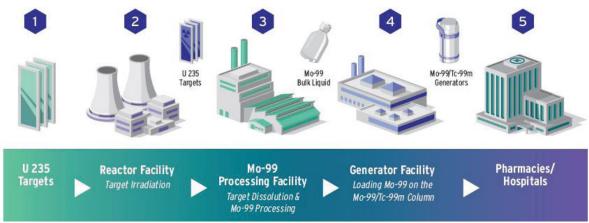
# 1.1. European research reactors' dependency on foreign supplies

Europe is currently dependent on the United States and Russia regarding the supply of enriched uranium fuels necessary to run its research reactors and to produce radioisotope, including in the medical field.

Europe is strongly committed to the international targets aiming at minimizing the use of greater than 20% en-

Accordingly, the U.S. Administration was led to set conditions regarding the HEU that are politically restrictive, and sometimes not strictly in accordance with the U.S.-Euratom agreement. The U.S. has been so far a flawless supplier of LEU material.

The HEU experience and the strong increase in the demand for LEU at the end of the on-going conversion process may only encourage the European countries to conduct a strategic assessment regarding the supply security of the 19.75% enriched uranium that will be needed by operating research reactors in the next decade and beyond.



Production of medical radioisotopes (Mo-99/Tc-99m) - ©Mallinckrodt Pharmaceuticals

riched uranium (HEU) as soon as viable technical and economical alternatives are available. In this respect, and in a time frame dependent on current technical developments, the large majority of European reactors will be using uranium enriched to 19.75% (LEU) within the next decade.

To date, there has been no problem with the LEU market. Difficulties are concentrated on the procurement of HEU. LEU is supplied mainly from the United States and European players can attest to the positive and operational state of mind behind all negotiations and delivery of this nuclear material.

However, enriched uranium is and will stay a sensitive issue and countries exporting this nuclear material are endowed with dedicated and scalable laws and regulations, often subject to public hearings and political stances. These laws and regulations are the result of a legitimate and sovereign democratic process that can seriously jeopardize the supply of LEU into Europe in the long term. European operators already experienced tensions regarding the supply of HEU. The fact that the LEU may follow a comparable route in the long term, making uncertain the supply security, cannot be understated.

The keystone of the assessment rests on an analysis which evaluates the opportunity and the feasibility to build in Europe a facility for the production of uranium enriched to 19.75%.

# 1.2. Assessment on the building of a European enrichment plant

In this context, a dedicated expert group was set up during the May 2012 session of the Euratom Supply Agency (ESA)<sup>3</sup> Advisory Committee in order to study the feasibility and opportunity to build a European capacity designed to produce LEU metal (19.75%) to cover the European research reactors' demand.

The working group conducted a strategic, technical and economic study structured as follows:

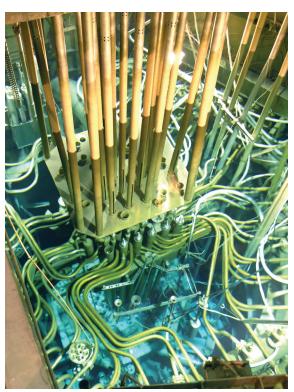
- Identification of European research reactors' demand for uranium fuels enriched to 19.75%, for the current period and for the decades to come (§2);
- Economic and technical feasibility of the project (§3);
- · Legal feasibility (§4).

# 2. ANALYSIS OF EUROPEAN RESEARCH REACTORS' DEMAND

# 2.1 Potential market for uranium metal enriched up to 19.75%

The demand for 19.75% enriched uranium in the next 10 to 20 years represents a key factor to assess the economic feasibility of the project to build an enrichment plant in Europe.

This study focuses only on the European research reactors' demand.



Maria Research Reactor, Poland ©NCBJ Otwock

This hypothesis matches the needs of this assessment. If such a project to build a European enrichment facility was indeed implemented, it would be then necessary to study the global market:

- Regarding potential customers: as a matter of fact, other non-EU countries may be interested in an investment that would both contribute to the diversification and the security of their supplies.
- Regarding the suppliers: indeed, considering the timeframe taken into consideration in this study (i.e. from one to two decades), the U.S. and/or Russian capacity to supply uranium produced by dilution from existing HEU stockpiles may soon come to an end. This would make it a necessity to restart enrichment capacities. The uranium market and its economic characteristics would then be completely overturned.

### 2.2 Assessment of European demand for Uranium

The estimation of European needs is based on assumptions about the fate of current research reactors and the development of new facilities.

Besides, the assessment includes the future conversion to LEU of research reactor fuels using at the moment HFU

The corresponding needs for medical targets is close to 10 kg per year and therefore has not been explicitly taken into consideration in this study.

The following table shows the current demand and a projection of this demand by 2025.

The figures regarding the 2025 horizon are only projections. As such, it is essential to bear in mind that there is a relative uncertainty closely linked with the fate of reactors, the implementation of new reactors and the reactors' modus operandi (numbers of days equivalent to full power on a yearly basis).

The economic study is based upon a European consumption of uranium enriched to 19.75% amounting to about 1300 kg/year.

### **REACTORS**

### ANNUAL DEMAND IN KG OF URANIUM ENRICHED TO 19.75%

Country	Designation	Power MW	Current demand	Projections by 2025
France				
	OSIRIS <sup>4</sup>	70	150	
	RJH	100		300
	RHF	58		280
	ORPHEE			65
Belgium	BR2	60		180
The Netherlands	HFR	50	130	
	PALLAS	40-80		130
Germany	BER.2	10	30	30
	FRM.2	20		280
Greece	DEMOCRITOS	5	15	15
Romania	PITESTI	14	Stock	?
Poland	MARIA	30		70
Czech Republic	LVR15	10	30	30

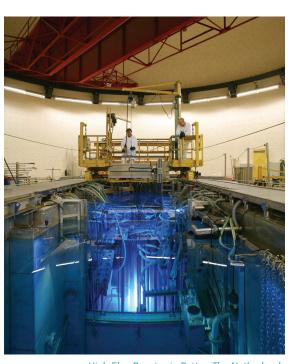
Total	355	1380
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### 2.3 Strategic implications

The findings of the working group's assessment point out a 4-fold increase of LEU demand in the next decade resulting from the high performance research reactors' conversion effort.

Therefore, it is essential to take into consideration the security of LEU supply and the conversion to LEU of research reactor fuels using at the moment HEU as concurrent goals. The issue dealing with the security of LEU demand should go together with the political issue regarding the conversion of high performance research reactors.

Therefore, the working group recommends that the Euratom Community should take the necessary actions to anticipate and to secure on a yearly basis the delivery of about one ton of uranium enriched to 19.75%, regardless of the option ultimately chosen by the European countries (i.e. the building of an enrichment plant or the strengthening of supply agreements with third countries).



High Flux Reactor in Petten The Netherlands ©Nuclear Research and Consultancy Group

# 3. TECHNICAL FEASIBILITY AND ECONOMIC SUSTAINABILITY OF THE EUROPEAN PROJECT

### 3.1 Technical feasibility

As regards the supply of Uranium Hexafluoride (UF6) for commercial enrichment, there are several suppliers of Uranium Oxide Concentrate (U308) in Europe. The conversion company, AREVA, is capable to provide Europe with UF6.

Several aspects must be taken into account in the matter of containment and storage of UF6 (approved storage cylinder, storage of these cylinders before the metal conversion, etc.). However, none of these aspects should significantly affect the project.

The Enrichment Technology Company ETC, co-owned by URENCO and AREVA, is technically capable of producing cascades and pipework dedicated to 19.75% uranium enrichment. The recent experiences of construction and the availability of existing sites<sup>5</sup> where enrichment activities are commonly performed, suggest where a 19.75% enrichment unit could be hosted most easily.

Europe currently no longer has any industrial capacity designed to transform enriched uranium compounds into uranium metal. In terms of processes, metal conversion does not raise any major difficulties. However, this step requires an installation for which the experience is much less available, leading to uncertainties that may explain different assessments among industrialists about the project's requirement and its conditions of implementation.

The metal conversion unit could be built close to the U235 enrichment process. However, the conversion unit could also benefit from other types of synergies that could justify the selection of a site different from the enrichment site.

### 3.2 Economic sustainability

Independently of one another, AREVA and URENCO conducted an internal review of the project's economic sustainability to build a facility designed to enrich uranium to 19.75% to meet the European research reactors' need for independence.



Centrifuge cascade at the Georges Besse II Enrichment Facility, ©Areva

Both companies conducted a review based on the same assumptions: an annual volume target of about 1300 kg, including a repurchase guarantee at a price of 20 k $\in$ /kg for 10 years. In the knowledge that the current market price is around 12 k $\in$ /kg, the hypothesis of a price fixed at 20 k $\in$ /kg matches with the strategic security's price. Therefore, the price of 20 k $\in$ /kg would reflect a strong commitment of the European Community.

The two companies have expressed a good level of confidence in the cost risk assessment of the project. Nevertheless, uncertainties increase significantly regarding the metal production unit.

So as to avoid the effects of an agreement with respect to the application of their respective antitrust laws, the two companies conducted independently their assessment. Each of them provided the working group with a very concise form of their findings. As a result, both companies prevented any exchange of technical and commercial information.

CAPITAL INVESTMENT	OPTIMISTIC	MID-RANGE	CONSERVATIVE
1300 kg @ € 20000 for 10 years	NO	NO	NO
1500 kg @ € 20000 for 10 years	YES	NO	NO
1300 kg @ € 22000 for 10 years	YES	NO	NO
1300 kg @ € 20000 for 15 years	YES	YES/NO	NO
1300 kg @ € 20000 for 10 years with interest free loan for capital expenditures	YES	YES	YES/NO

Besides, AREVA and URENCO characterized their findings according to three different scenarios (optimistic, midrange and conservative), independently and in isolation from each other, the working group or any other parties. By so doing, both companies allowed the working group to address their assessments on the viability of LEU enrichment and metal conversion facility.

The results provided by the two companies are very similar and can be summarized in the table below. The companies expressed their capacity to enrol in the project in each cell of the following table, depending on the selected scenario and assumptions:

The 'yes/no' expression was used in the table's cells whenever the companies' answers to a particular scenario diverged.

In spite of the synthetic nature of the companies' assessment submitted to the working group, the above table highlights that the viability of the project is both reachable and limited.

This assessment emphasizes the fact that the price of  $20 \text{ k} \in \text{/kg}$  must be considered as an order of magnitude necessary to contribute to the balance of a European self-sufficiency project. The current market costs do not enable investment in Europe on a purely commercial basis. This observation is no surprise since the uranium enriched up to 19.75%, available on the global market is

produced by dilution from existing military HEU stockpiles, which is a far less expensive production process than the enrichment process.

From this assessment emerges a scenario worthy of interest. If the financial costs were supported at a public level, a viable project would be to build a European facility designed for the production of 1300 kg on a yearly basis with a purchase guarantee established at a price of  $20 \text{ k} \in \text{/kg}$  for 10 years.

From the above assessment can be drawn the following findings:

- There are three conditions to make investment in a European LEU enrichment facility (up to 19.75%) feasible: a commitment to produce a volume of around 1300 kg every year for ten years, a commitment to sell at a price of about 20 k€/kg and, finally, a commitment to take into account the financial costs at the public level.
- These three conditions correspond to a political commitment which reflects the price of the European supply's security.
- Regarding the commitment to produce a volume of 1300 kg on a yearly basis, it will be necessary to set up a process allowing ESA to support this commitment in order to make this material available in limited quantities to end users.
- Regarding the sales price target, it should be noted that the reference value of 20 k€/kg is significantly

higher than the current market price (around 12 k€/kg). This reference value was chosen to reflect the fact that uranium produced by the enrichment process is far more expensive than by dilution from existing military HEU stockpiles. The reference value also corresponds to the cost of supply security. Nonetheless, even if this price differential has its own justification, it remains true that customers, will have major difficulties in accepting a price of 20 k€/kg if other less expensive solutions are available.

 Regarding the elimination of all financial costs beyond what the market is judged to bear, the Euratom Treaty offers solutions (see the paragraph on legal aspects). However, such a solution would have to be supported at the highest European political level.

The implementation of all three conditions mentioned above remains complex.

Therefore, the working group recommends that

- A possible implementation of an enrichment facility on European soil designed to produce uranium enriched to 19.75% must be considered as an investment and a strategic option in case of a worsening of political and market conditions that would be harmful for Europe's major interests.
- Efforts must be focused on securing the current market, in particular through the development of closer ties with traditional suppliers (see next section). This approach would be the direct consequence of difficulties in setting the right conditions for such an investment
- A monitoring of market conditions must be continuously provided by ESA in order to anticipate possible deterioration of the uranium market. This anticipation must be made sufficiently in advance to enable the launch of such a facility.

## 3.3 Supply capacity of traditional partners

Uranium enriched up to 19.75% is currently provided by the United States and produced by dilution from existing military HEU stockpiles.

The U.S. Department of Energy's capacity to supply all its customers' research reactors has not been subject to any explicit commitment from the United States on the long term. Nonetheless, sources suggest that the availability of uranium produced through dilution process may not go beyond the timeframe of 2040 to 2050, but this point needs confirmation.

Thus, the United States should have the ability to deliver Europe with uranium enriched to 19.75% over of period of time covering twenty years. However, it should be stressed that the U.S. supply is subject to a set of rules that have been gradually imposed by domestic policy debates. Feedback regarding the supply of HEU tends to show that these debates, such as public hearings (as part

of the licensing process), lead to sovereign decisions that sometimes are not in accordance with the US-Euratom agreement. These sovereign decisions may affect the EU Member States concerned.

No information is currently available about the Russian willingness and capacity to provide Europe with uranium enriched to 19.75%.

In this context, the establishment of a long-term supply contract would reconcile i) the availability of LEU uranium (19.75%) on a global market supplied by the U.S. and Russia, ii) the benefit from relatively low market price of this nuclear material produced by dilution from existing military HEU stockpiles and iii) a European willingness to secure its supply.

Therefore, the working group recommends that the Euratom Community invites the United States and Russia to discuss the opportunity to commit to a long term contract which would cover a supply period of ten years.

Within the scope of this approach, the Euratom Community would give ESA a mandate to negotiate with the United States and Russia in order to:

- Question them about their capability to supply Europe with uranium enriched to 19.75% over a period of time covering 10 to 20 years.
- 2. Establish a committing framework agreement to secure Europe's supply for a period of time or for a volume of material corresponding to ten years of European's demand in uranium enriched up to 19.75%. This framework agreement could be renewable every five years under reasonable economic and strategic conditions.
- Allow European end-users, with reference to this framework agreement, to conduct their own trade negotiations regarding the purchase of batches of nuclear materials.

ESA would then follow up the implementation of this agreement, including economic and strategic conditions. This will allow a continuous reassessment of the opportunity and timeliness to launch a European enrichment facility. The reason of this launch would be either the incapacity of traditional suppliers to supply Europe with uranium enriched to 19.75%, or the deterioration of supply conditions.

### 4. LEGAL ASPECTS

In March 2013, the ESA sub-group on legal issues submitted the ESA working group with a report on the main legal questions about the implementation on European soil of a European enrichment facility designed for the production of uranium enriched up to 19.75% as fuel for research reactors.

Three main legal questions have been identified:

- compatibility of the project with the Treaties of Cardiff and Almelo;
- enforcement of national, European and international regulations;
- · possible legal ways to secure the investment.

# 4.1 Compatibility of the project with the Treaties of Cardiff and Almelo

The project of a European enrichment facility is consistent with the main legal obligations resulting from the Almelo Treaty and Cardiff Treaty. There is no need to amend those current Treaties. However, so as to abide by the spirit of the law, the facility should only be built on the soil of one of the four states party to the Cardiff Treaty.



The Treaty of Almelo, 1970 ©Urenco

# 4.2 Enforcement of national, European and international regulations

Regarding this matter, the working group came up with the following findings:

enforcement of national, European and international laws and regulations will require a period of two
years in the overall schedule of the project;

- building an enrichment facility on an existing site will be both a factor for optimizing time and for minimizing legal risks, particularly regarding the enforcement of national regulations;
- a number of legal obligations has already been implemented for some time, including obligations resulting from the Euratom Treaty and enforcement of certain international conventions;
- other obligations or constraints would require further studies, including European competition rules and those resulting from the General Agreement on tariffs and trade of the World Trade Organization WTO. These two last legal aspects could be subject to specific studies at a further stage.

A more detailed report about legal obligations and laws, which have been identified by the sub-group, can be found in the appendix of the hereby assessment.

### 4.3 Possible legal ways to secure the investment

In addition to the compatibility of the project with different treaties and the enforcement of regulations, the sub-group in legal issues discussed several potential complementary approaches and legal tools so as to secure the business plan.

These different approaches and legal tools are described hereinafter.

### 4.3.1 Intergovernmental agreement

The working group believes that given the political and economic sensitivity of the issue, it is necessary that the principles and broad guidelines of the project of building a European enrichment capacity are approved through an intergovernmental agreement involving all states concerned by such a project.

#### 4.3.2 Consortium

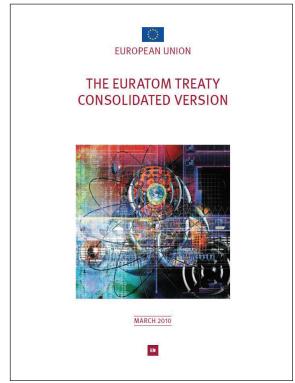
The establishment of a consortium could also be considered as a way to secure the business plan. An international consortium is a group of legally independent companies in which financial and material resources are placed under the responsibility of one division in order to perform specific common operations on behalf of all members of the group. A consortium may gather private entities, public entities, or simultaneously private and public entities. The consortium approach could be further studied.

### 4.3.3 Long term supply contracts

One way to secure the project's financial arrangements would be to resort to long-term supply contracts covering a period of time squaring with that of return on investment. ESA, which would co-sign these long term contracts, could also ask the European Commission to agree to co-sign contracts for a term exceeding 10 years.

### 4.3.4 Stockpiling under Chapter 6 of the Euratom Treaty

The Euratom Treaty contains provisions, including Art.72 which could be used to secure the investment. As a matter of fact, ESA may, from nuclear material available inside or outside the Community, build up the necessary commercial stocks to facilitate the supplies to or normal deliveries by the Community. Furthermore, the European Commission may, whenever necessary, decide to build up emergency stocks. The financial arrangements to finance such stocks shall be approved by the Council, acting by a qualified majority on a proposal from the European Commission.



The Euratom Treaty

The working group recommends that the concept of building up an emergency stock could be further investigated. Indeed, as one way to secure the investment, the production of a new plant could, partially or wholly, increment a security stock of the European Commission. ESA would be in charge of managing the emergency stock, which would then meet the European users' needs.

The risks taken by ESA and the European Commission would be limited inasmuch as users would commit themselves to use the Community stocks, in combination with long-term contracts.

Besides, users who would seek to stop using the Community stocks would then take the risk of not having their contracts with entities outside the Community co-signed by ESA. As far as the investor is concerned, this scheme would give him a buy back guarantee of all or part of its production and, therefore, would secure its investment.

Such an arrangement could be viable provided that, first of all, the European Commission put forward a proposal to that effect, and, second of all, the qualified majority is reached in the Council. This scheme is not unrealistic, but requires a strong political will and a strong support from the European Commission.

### 4.3.5 Joint Undertaking under Chapter 5 of the Euratom Treaty

Another way to secure the investment would be to fund a Joint Undertaking in order to specifically manage the project. The working group considers this approach as feasible, especially under the Art. 63 of the Euratom Treaty.

The sub-group on legal issues considers several options that may foreshadow the foundation of a Joint Undertaking:

Option 1: Purchase of the main part of the LEU production by a Joint Undertaking funded by all interested users.

Repartition of the production between interested users on the basis of a long term plan. In case of difficulties of funding from an user, the related Member state should secure the funding for the corresponding part of the production.

Option 2: Joint undertaking between the producer, interested users and related member states.

Purchase of a part of the LEU production by interested users on the basis of a long term plan. In case of difficulties of funding from a user (as an exception to the long term plan) the related Member state will have to assure the funding of the production in accordance with the long term plan.

The sub-group on legal issues stresses out that given the council voting rules to set up a Joint Undertaking, a scheme excluding Community funding is more likely to lead to the Council insofar as it is subject to a qualified majority vote. As a result, a scheme involving Community funding will require an unanimous vote of the Member States.

A Joint Undertaking can benefit from all advantages listed in Annex III to the Euratom Treaty, in particular regarding tax benefits. However, such benefits can only be conferred by a unanimous vote of the Council.

Finally, the fact that a Joint Undertaking is subject to a vote in the Council gives it a unique political legitimacy.

#### 4.3.6 Euratom loans

A Euratom loan may be granted to finance a project to build an enrichment plant. The eligibility requirements for a Euratom loan are specified in a detailed report in the annex of this present assessment.

Nonetheless, it is important to remember that the maximum ceiling for Euratom loans has not been recently restored, thereby limiting any future borrowing capacity. Therefore the Commission should soon plan to increase the maximum ceiling regarding these Euratom loans.



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### 5. EXECUTIVE SUMMARY

# 5.1 Need for mid- and long-term common policy for supplies

The ESA working group agrees that the United States and Russia are currently reliable and economically viable partners with regard to the supply of uranium enriched to 19.75%.

However, the working group stresses the necessity for the Euratom Community to develop a European strategic framework in order to secure the European research reactors' long-term supply of uranium enriched to 19.75%:

- As a matter of fact, the necessity to introduce measures to secure the mid- and long-term strategic supply of LEU (19.75%) can be justified by the small number of suppliers, by the sovereign and potentially evolving legal framework in these suppliers' countries, by the cheap but limited-in-time dilution process from existing HEU stockpiles.
- This point meets the Euratom Community's mission which is, among others, to ensure an orderly supply to the Community users in the framework of a common policy for supplies.

### 5.2 Proposed measures

Measures, that will ensure the Community security of mid- and long-term supply of uranium metal enriched to 19.75%, are based on two core principles.

These principles will have to be adapted to external factors and particularly to global market:

- The first principle deals with a claim of the Community's willingness to implement on European soil an enrichment plant together with a metal conversion unit whenever economic and strategic conditions of the market are not any more acceptable.
- The second principle is about the establishment of a long term supply contract, i.e. over 10 years, with traditional suppliers.

The articulation of these two principles is based on an assessment of market conditions by Member States and on a strengthening of this assessment by ESA.

If the market remains favourable (which is currently the case), it is then preferable that Europe keeps contracting with its usual suppliers. In this context, efforts must be made to establish a committing framework covering a period of ten years in order to anticipate any negative drift and to launch, accordingly and if necessary, initiatives in order to implement a European domestic production capacity.

Thus, the negotiation of mid- and long-term supply contracts is a step that meets the European strategic needs for securing their supply. It should be stressed that the credibility of Europe to implement its own production capacity will help strengthening the European bargaining power of these contracts.

As a consequence, the working group focused on the feasibility and the opportunity to build a European enrichment facility to meet the European Community's needs in uranium metal enriched up to 19.75%.



# 5.3 European facility designed for the production uranium metal enriched to 19.75%

The study conducted by the working group leads to the conclusion that the building of a European enrichment facility is, under certain conditions, technically and legally feasible as well as economically sustainable.

Nonetheless, it should be pointed out that the economic viability depends on three different conditions:

- a commitment to produce a volume of around 1300 kg every year;
- a commitment to sell at a price of about 20 k€/kg (to be compared with the current price of 12 k€/kg);
- a commitment to downsize all financial costs.

These conditions correspond to a political commitment which reflects the price of the European supply's security.

All three conditions are difficult to meet. The launch of an enrichment facility in Europe could only be decided to counter a major deterioration of the current global market, either due to the technical incapacity of traditional suppliers to supply Europe with uranium enriched to 19.75%, or due to a deterioration of supply conditions.

### 5.4 Securing long-term supply contracts

Given the difficulties in creating the necessary conditions to launch, on European soil, a facility designed for the production of uranium metal enriched to 19.75%, the working group highlights the necessity to secure long-term supply contracts with foreign suppliers.

Under this approach, the Euratom Community, represented by ESA, could

- Question the main traditional suppliers of uranium enriched to 19.75% about their capacities to provide European research reactors with such materials over 10 years and beyond;
- Negotiate a committing framework agreement to settle a supply guarantee and leaving it up to the operators to negotiate (with reference to this agreement) the limited volume of supply they need.
- Follow up the European supply of uranium enriched to 19.75% in order to anticipate, if necessary, the building of a European enrichment capacity, possibly through a partnership involving other countries.

# ANNEX 1 TERMS OF REFERENCE

# FOR THE ESA ADVISORY COMMITTEE WORKING GROUP ON EUROPEAN PRODUCTION OF LOW-ENRICHED (<20%) URANIUM

(Agreed at the WG's Meeting of 28 January 2013)

#### **BACKGROUND**

The European research reactors are committed to convert from high to low enriched uranium when it is technically and economically feasible.

The high enriched uranium (HEU) for European research reactors and radioisotope production targets has been supplied mainly from the US and some from Russia. The supply from the US is subject to compliance with many requirements arising from growing US laws and regulations. Some of them are not consistent with the Euratom/US cooperation agreement in the field of peaceful use of nuclear energy and raise questions related to Member States' sovereignty. This creates some difficulties for the EU actors and a Euratom Community dependence on external factors, such as public hearings and political lobbies, within the legitimate US democratic processes, making the future supply of uranium uncertain. This is not in line with the objectives of the Euratom Treaty.

In a near future similar questions and difficulties may arise for the supply of low enriched uranium (LEU, i.e. with enrichment lower than 20%), for research reactor fuels and radioisotope production targets.

Accordingly, one of the key technical issues is the long term availability and accessibility of LEU since no appropriate production facilities for LEU are in place to respond to future demand.

Europe is already utilizing low enriched uranium (LEU at 19.75%) in several research reactors including major ones. Moreover, Europe is strongly committed to the principle of HEU minimization with the objective to convert to LEU all major research reactors and targets for medical application in the most favourable time frame consistent with technical and economic constraints.

This strategic scheme is relevant if, and only if, European supply of LEU can be secured in the long term.

Without any new initiative, there will again be a strong dependence on the US supply of this low enriched uranium and its authorization system which is beyond EU control. Regarding Russia, a dependence on the Russian supply could interfere with the current discussions between the EU and Russia and the willingness of the European Atomic Energy Community to have a market access equivalent for the two parties.

As an urgent first step, there is a need to study the opportunity and the feasibility to build an European capacity responding to the Community needs in terms of low enriched uranium metal production.

In a second step, the result of this study could be used either to set up a technical project for implementing such strategic capacity or as a key element for securing compliant long term supply contract with US and/or Russia and avoiding the construction of a new facility.

### **WORKING GROUP MANDATE**

In order to study the opportunity and the feasibility to build a European capacity for producing low enriched uranium metal responding to the EU needs, a dedicated expert group was set up during the May 2012 session of the Euratom Supply Agency Advisory Committee.

The group should take into account in its works:

- the fragility of this market due to the limited size of the niche;
- the adequate management of the unbalanced economic competition between uranium enriched in a new facility and uranium produced by dilution from existing HEU stockpiles since this point could destabilize, on an economic basis, any European project;
- the need for a strategic European framework (Joint Undertaking?) to account for long term objectives (independency, sovereignty, supply securing...) beyond any short term economical optimisation;
- the need to have among the European stakeholders an acceptance of an enriched uranium price taking into account the investment in a new enrichment capacity.

A new LEU European enrichment capacity, including the conversion to a metallic form, can be addressed through a comprehensive process divided in three phases separated by go – no-go decisions:

- Phase 1 strategic and techno-economic study to assess the opportunity;
- Phase 2 technical definition of the project and funding scheme;
- Phase 3 building and operation of the facility.

The group will address the first phase in order to define the strategic specifications of the project incorporating the following:

- Identification of EU needs from 2020<sup>6</sup> by research reactors, including: the quantities of HEU or LEU *per annum*; the timescale of conversion for those research reactors still using HEU; an outline of current costs of the fuel cycle as far as confidentiality agreements allow; the order of magnitude of future expenditure on nuclear fuel by European research reactors; the likely operational lifetime of the research reactors. The ultimate goal is to define as adequately as possible what is required to meet the research reactors' future needs for fuel.
- Companies having competences in the enrichment of material should identify related technical requirements: enrichment facility specification, conversion to metal capacity, timeframe necessary to establish the required new capacity and the identification of preparatory work that could reduce the time to result from a construction decision since the construction phases have to be triggered in case of a potential supply failure.

- A first assessment of the project economy, including global investment cost (up to and including dismantling), price range for the enriched metallic uranium produced, minimal price to guarantee the sustainability, need for public commitment if any ...This should also consider the possibility of supplying research reactors outside Europe.
- Proposal for a suited legal framework (consortium terms of reference, identification of legal constraints ...).

The first phase could last about one year. It implies sensitive and complex questions. The extent of elaboration of the questions and precision of the answers will be chosen in order to fit with this timeframe and to produce a first report after this one year phase.

After this first phase, a decision should be taken at a political level to deepen the analysis or to set up the conditions necessary to launch the second phase in order to elaborate the technical detailed scheme allowing the building of a facility in an estimated adequate time. The legal and financial arrangements for the project should also be evaluated. After the second phase, the third phase should consist of the building of the facility according to the project definition.



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# ANNEX 2 LEGAL ASPECTS

The aim of this report is to summarize the main legal questions with regard to a study by the ESA working group on the feasibility to build a European enrichment facility for producing LEU up to 19.9% as fuel for research reactors and for medical radio-isotopes.

The context is the following: two main EU industrial actors are able to manage/implement such a project on the basis of the Gas Centrifuge Process owned by the Enrichment Technology Company (ETC). This project should be managed in conformity with the rules and regulations that govern the current EU facilities producing LEU. The envisaged market is a "niche" market with a need to secure the investments.

Three main legal questions have been identified:

- 1. compatibility of the project with the treaties of Cardiff and Almelo;
- 2. implementation of national, European and international regulations;
- 3. best legal ways to secure the business plan.

# 1. Compatibility of the project with the treaties of Cardiff and Almelo

The use of the ETC technology in some EU countries is possible on the basis of the Almelo Treaty (Germany, Netherlands and United Kingdom) and Cardiff Treaty (France, Germany, Netherlands and United Kingdom).

The main obligations resulting from these Treaties are the following:

- no production of weapons grade uranium for the manufacture of nuclear weapons or other nuclear explosive devices i.e. only low enriched uranium less than 20%;
- Application of Euratom and IAEA safeguards;
- nuclear material produced by the use of ETC technology subject to physical protection measures;
- confidentiality rules i.e. protection of classified information by special security measures;
- supervision by the Joint Committee/Quadripartite
   Committee established by the aforementioned treaties of the provisions above;
- ETC technology is subject to black box clauses: no access to the technology by others than ETC.

Taking into account these obligations, our opinion is that:

 the facility could be built only in the territory of one of the four states party to the Cardiff Treaty;  uranium up to 19,9% is not a direct use material (cf. IAEA Safeguards Glossary) and is not a weapons grade uranium for the manufacture of nuclear weapons or other nuclear explosive devices (the uranium will be used in research activities or for the production of medical radioisotopes).

There is no need to amend the current Treaties and this operation could be done on the basis of the existing legal framework. Nevertheless, independently of the legal aspects, political questions could be raised in some countries.

Besides the application of the Treaties of Almelo and Cardiff the facility needs to comply with the following national and international regulations:

# 2. Implementation of national, European and international regulations

### • National laws and regulations

The application of these laws and regulations will depend on the location of the facility. A specific study should be done when a final decision on the location will be taken.

Nevertheless, it is possible to identify the main topics to take into account:

- licensing process (including siting)
- safety rules
- security rules
- nuclear civil liability
- waste and decommissioning

Time schedule: at least two years (if the facility would be built at an existing site)

### • Euratom Treaty obligations

The following declarations should be sent to the European Commission:

- Declaration by the interested Member state of the general data relating to any plan for the disposal of radioactive waste in whatever forms (Art. 37).

Art. 37: Each Member State shall provide the European Commission with <u>such general data relating to any plan</u> for the disposal of radioactive waste in whatever forms

will make it possible to determine whether the implementation of such plan is liable to result in the radio-active contamination of the water, soil or airspace of another Member State.

Time schedule: around one year for the entire process.

- <u>Declaration by the operator of the investment project</u> on the basis of Art. 41.

Art. 41: Persons and undertakings engaged in the industrial activities listed in Annex II to the Euratom treaty shall communicate to the European Commission investment projects relating to new installations and also to replacements or conversions which fulfil the criteria as to type and size laid down by the Council on a proposal from the European Commission.

Production of enriched uranium is listed in Annex II (par 7).

Time schedule: around one year for the entire process.

Declaration under chapter VII (Safeguards) and regulation 302/2005

The operator should send the following declarations to the European Commission:

<u>Basic technical characteristics</u>: declaration at least 200 days before the first consignment of nuclear material is due to be received (article 4 and 3.1 of the Euratom regulation n° 302/2005).

Specific information: for new installations with an inventory or annual throughput of nuclear material of more than one effective kilogram, all relevant information relating to the owner, operator, purpose, location, type, capacity and expected commissioning date shall be communicated to the European Commission at least 200 days before construction begins. (Article 4 of the Euratom regulation 302/2005).

#### EU rules

- Competition rules

A specific study should be done at a further stage.

The project should be submitted to the competent competition authorities.

The presentation of the project should include:

- the legal and financial scheme;
- the international context;
- the nature (research and supply of radioisotopes) and the size of the market;
- the need of an EU independency and security of supply.

Time schedule: around one year

 Council regulation (EC) n°428/2009 of 5 may 2009 setting up a Community regime for the control of exports, transfer, brokering and transit of dual-use items

Intracommunity transfer of enrichment technology and equipment is subject to this regulation.

#### - Directive 2011/92/UE

The Directive 2011/92/UE on the assessment of the effects of certain public and private projects on the environment applies, according to its article 4 and its annex 1 §3b, in particular to the installations designed for the production or enrichment of nuclear fuel. This means that such projects are made subject to a requirement for development consent and an assessment with regard to their effects" (art. 2 §1). The article 3 states that the environmental impact assessment shall identify, describe and assess the direct and indirect effects of a project on these factors: human beings, fauna and flora; soil, water, air, climate and the landscape; material assets and the cultural heritage; Eventually, the Directive intends the possibility for some exceptions to the provisions laid down in the Directive in exceptional cases (art.2§4) and guarantees the respect of commercial and industrial confidentiality, including intellectual property, and the safeguarding of the public interest, according to national legislations (art.10).

Time schedule: around one year taking into account the national laws and regulations.

### • International obligations

The following international obligations should be respected:

- IAEA Safeguards agreement

<u>Design information</u>: declaration by the European Commission to the IAEA at least 180 days before the first consignment of nuclear material is due to be received.

Specific information: for new installations with an inventory or annual throughput of nuclear material of more than one effective kilogram, all relevant information relating to the owner, operator, purpose, location, type, capacity and expected commissioning date shall be communicated to the IAEA by the European Commission at least 180 days before construction begins.

- Additional protocol to IAEA Safeguards agreement
The declaration of the general plans for the succeeding ten-year period relevant to the development of the nuclear fuel cycle (including planned nuclear fuel cycle-related research and development activities) when approved by the appropriate authorities should be sent by the interested Member State to the IAEA.

#### - Espoo convention

The European Union and the Member States are party to the Convention.

The article 2.2 of the Espoo convention indicates that: "Each Party shall take the necessary legal, administrative or other measures to implement the provisions of this Convention, including, with respect to proposed activities listed in Appendix I that are likely to cause significant adverse trans-boundary impact, the establishment of an environmental impact assessment procedure that permits public participation and preparation of the environmental impact assessment documentation described in Appendix II."

Among the activities listed in Appendix I there is: "Installations solely designed for the production or enrichment of nuclear fuels, for the reprocessing of irradiated nuclear fuels or for the storage, disposal and processing of radioactive waste."

Time schedule: depending on the national law of the location of the facility.

#### - Aarhus Convention

The European Union and the Member States are party to the Convention.

This convention is related to access to information, public participation in decision-making and access to justice in environmental matters.

The article 6.1 of the Aarhus convention indicates: "Each Party ... shall apply the provisions of this article with respect to decisions on whether to permit proposed activities listed in annex I".

Among the activities listed in annex I there is a reference to "Installations designed for the production or enrichment of nuclear fuel."

Time schedule: depending on the national law of the location of the facility

 Convention on the physical protection of Nuclear material (CPPNM) as amended if appropriate

The European Union and the Member States are party to the Convention

The Installation and the nuclear material produced by it shall be subject at all times to adequate physical protection measures which shall satisfy, as a minimum, the levels set out in Annex C to the Guidelines for Nuclear Transfers.

- World Trade Organization (WTO)

General Agreement on tariffs and trade agreement (GATT).

The GATT rules should be taken into account in case of product supply.

In particular, article 2 of the agreement indicates:

"2.1 Members shall ensure that in respect of technical regulations, products imported from the territory of any

Member shall be accorded treatment no less favourable than that accorded to like products of national origin and to like products originating in any other country.

2.2 Members shall ensure that technical regulations are not prepared, adopted or applied with a view to or with the effect of creating unnecessary obstacles to international trade. For this purpose, technical regulations shall not be more trade-restrictive than necessary to fulfil a legitimate objective, taking account of the risks non-fulfilment would create. Such legitimate objectives are, inter alia: national security requirements; the prevention of deceptive practices; protection of human health or safety, animal or plant life or health, or the environment. In assessing such risks, relevant elements of consideration are, inter alia: available scientific and technical information, related processing technology or intended end-uses of products."

Furthermore article XXI of the GATT could apply (protection of the security interests relating to fissionable materials or the material from which they are derived)

Depending on the business plan, the question of the restriction of importation could be raised by some counterparts. Nevertheless, it seems possible to consider that taking due account of the situation (size of the market, current supply constraints, possible shortage of medical radioisotopes ...) there is a risk for the national security justifying the implementation of a specific commercial scheme.

General Agreement on Trade in Services (GATS)

If needed and as far as services are concerned, the security exception referred in article XIV a) of the GATS could be invoked.

## 3. Possible legal ways to secure the business plan

It is essential to secure the investment done by the producer. Most of the LEU production of the facility should be bought by EU users at a fixed market price and for a determined period to allow the economic viability of the project.

It seems necessary to involve ESA, interested Member States, interested users and the producer into the legal process.

The main legal tools identified by the group are the following:

- Intergovernmental agreement between interested EU Member states
- Intergovernmental agreement between interested EU and non EU member states
- International consortium
- Shareholding
- Long term supply contracts between the producer and interested users

- Specific ESA and European Commission role
- Joint Undertaking
- Euratom loans
- Others

#### • Intergovernmental agreement(s)

An intergovernmental agreement between the interested parties could allow to express the common willingness to have an European solution to manage a potential LEU supply crisis. This agreement could also cease the way to legitimate at a political level the building of an European capacity up to 19.9%. This intergovernmental agreement should be open to the four ETC countries and to other countries interested by the supply of LEU.

#### • International consortium

An international consortium is a group of legally independent companies in which financial and material resources are placed under the responsibility of one division in order to perform specific common operations. Several consortium options are possible:

- Consortium of private entities
- Consortium of private and public entities
- Consortium of public entities

#### Long-term contracts

Long-term contracts (as current practice for security of supply) should be elaborated between the users and the producer and submitted to ESA. ESA will initiate the file to obtain European Commission agreement if these contracts exceed a 10 years period.

### • Specific ESA and European Commission role

ESA has an important role to play in the security of supply of nuclear material in the Community.

On the basis of Art. 72, the Agency may, from material available inside or outside the Community, build up the necessary commercial stocks to facilitate supplies to or normal deliveries by the Community.

Furthermore, the European Commission may, where necessary, decide to build up emergency stocks. The method of financing such stocks shall be approved by the Council, acting by a qualified majority on a proposal from the European Commission.

The concept of build-up emergency stocks could be further investigated. These emergency stocks could be build up on the basis of a new European capacity.

Time schedule: depending on the level of crisis.

#### Joint Undertaking

The Art. 45 of the Euratom Treaty states that "Undertakings which are of **fundamental importance to the development of the nuclear industry in the Community** may be established as Joint Undertakings ..."

At the time of the creation of the Community, it seems that its "fathers" decided to introduce the concept of Joint Undertaking in order to allow the Community to have its own enrichment capacity.

Such interpretation seems confirmed in the Art. 63 (Chapter 6) of the Euratom Treaty which states that: "ores, source materials and special fissile materials produced by Joint Undertakings shall be allotted to users in accordance with the rules laid down in the statutes or agreements of such undertakings."

The opinion of the group is that this concept could be further explored to manage the security of the investment

The Council voting rules for a Joint Undertaking are the following:

- qualified majority, or
- unanimity in case of participation by the Community in the financing of the Joint undertaking or participation by a third state, an international organization or a national of a third State in the financing or management of the Joint undertaking.

Furthermore, The Council may, acting <u>unanimously</u> on a proposal from the European Commission make applicable to each Joint Undertaking any or all of the advantages listed in Annex III to the Euratom Treaty; each Member State shall for its part ensure that these advantages are conferred.

Some options have been identified:

Production of LEU by a producer

Option 1: Purchase of the main part of the LEU production by a Joint Undertaking funded by all interested users.

Repartition of the production between interested users on the basis of a long term plan. In case of difficulties of funding from an user, the related Member state should secure the funding for the corresponding part of the production.

Option 2: Joint Undertaking between the producer, interested users and related member states.

Purchase of a part of the LEU production by interested users on the basis of a long term plan. In case of difficulties of funding from a user (as an exception to the long term plan) the related Member state will have to assure the funding of the production in accordance with the long term plan.

Time schedule: depending on the political preparedness to follow this route.

#### Euratom loans

The granting of a Euratom loan for an investment project aiming to build an industrial fuel cycle installation is possible under the Article 1 of the Council Decision of 21 March 1994 amending Decision 77/270/Euratom. The Decision establishes a mechanism for providing loans to finance nuclear projects in the EU and is based in particular on the Article 2 of the Euratom Treaty, which aims to facilitate investment and the basic installations necessary for the development of nuclear energy in the Community. The decision applies to enrichment activities. The Decision states, in its article 1:

"The European Commission is hereby empowered to contract, on behalf of the European Atomic Energy Community (Euratom), and within the limits fixed by the Council, borrowings, the proceeds of which will be allocated in the form of loans to finance, within the Community, investment projects relating to the industrial production of electricity in nuclear power stations and to industrial installations in the nuclear fuel cycle. [...]

For these projects to be eligible they must:

- relate to nuclear power stations or installations in the nuclear fuel cycle which are in service, or under construction, or to the dismantling of installations where modification cannot be justified in technical or economic terms,
- have received all the necessary authorization at national level and in particular the approval of the safety authorities,
- have received a favourable opinion from the European Commission in technical and economic terms.

The European Commission may borrow only within the limits of loans requested of it. The borrowing and corresponding lending operations shall be denominated in the same monetary unit and carried out under the same conditions as regards repayment of the principal and interest payments. Cost incurred by the Community in concluding and executing each operation shall be borne by the recipient undertakings. "

It should also be noted that the "URENCO" company has filed an application for a Euratom loan amounting to EUR 100 million in order to increase its capacity to enrich uranium in its production sites of Gronau and Almelo in July 2010.

Accumulated Euratom loans approaching their "warning threshold" as defined by the Council Decision of 23 April 1990 and considering the failure of negotiations in 2002 to expend the credit limit from 4 billion EUR to 6 billion EUR, it is recommended to launch soon a new discussion about further increases in maximum ceiling for Euratom loans. Under these technical conditions, it is also essential to keep the scope of Euratom loans mechanism on financing, as stated in the Decision, investment projects relating to the industrial production

of electricity in nuclear power stations and to industrial installations in the nuclear fuel cycle. It would be detrimental to the Community and objectives of the Euratom Treaty (as cited especially at the Articles 1 and 2 of the Treaty), to limit funding opportunities by Euratom loans only on financing investment projects improving nuclear safety in some third States.

Eventually, it is useful to add that, as confirmed by the Special report of the Court of Auditors on loans and borrowings, the priority to get a Euratom loan is given to projects involving several Member States and Euratom loans are limited to 20% of the total cost of the project but a nuclear energy development project may benefit from both the Euratom and European Investment Bank loan.

Time schedule: around one year independently the need to increase in maximum ceiling.