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**Negotiation Experience in the Fuel Conversion  
for the TRIGA Reactor in Mexico**

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**ABSTRACT**

Foreign policy and regulatory framework in some countries can pose difficulties to the conversion from highly enriched uranium (HEU) to low enriched uranium (LEU) fuel in research reactors. Explained is the case of Mexico, where a number of compromises had to be made on the part of all parties involved to make the conversion possible.

Mexico completed the conversion of the TRIGA research reactor at the National Institute for Nuclear Research (ININ) from a mixed core of 70% and 20% enriched uranium fuel to a complete core of new 20% LEU fuel in March 2012. The conversion was financed by the Governments of Canada and the United States through a Project and Supply Agreement overseen by the International Atomic Energy Agency (IAEA).

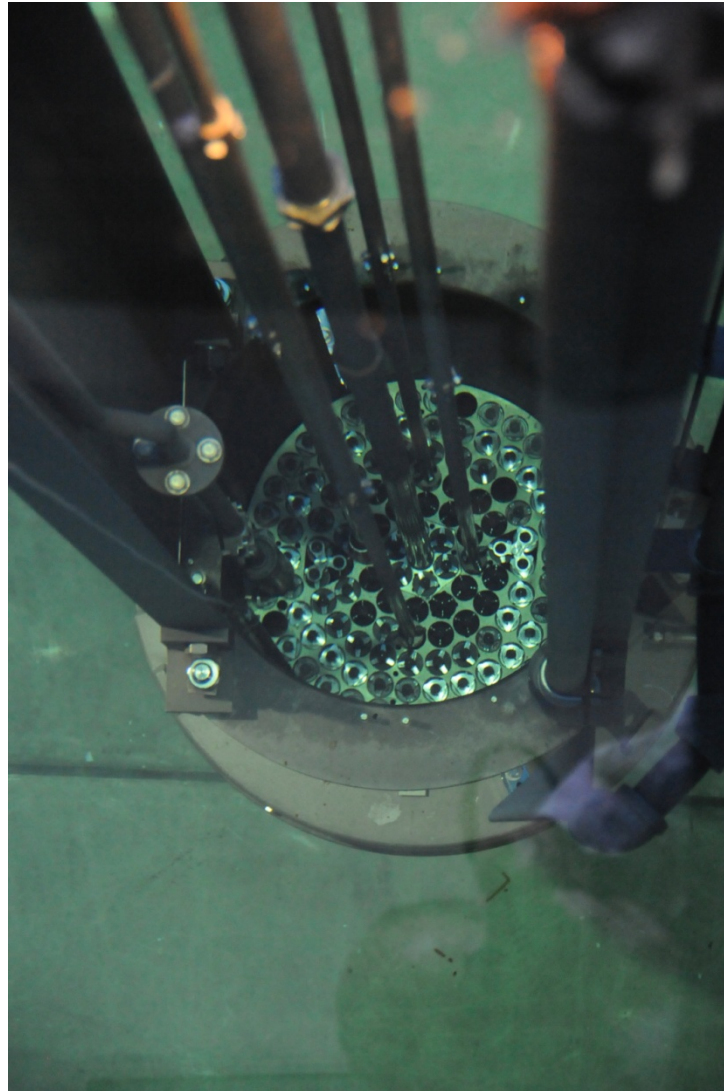
Lessons learned from this case show that it is important that the parties involved recognise each other's differing political, legal and administrative requirements and subsequently make efforts to accommodate them by devising workable compromises. The experience also showed that it is important to address the strong sensitivity that a project like this can have in some sectors of public opinion lest more difficult problems arise and do not allow the project to continue.

**1. Introduction**

Mexico completed the conversion of the TRIGA research reactor at the National Institute for Nuclear Research (ININ) from a mixed core of 70% and 20% enriched uranium fuel to a complete core of new 20% LEU fuel in March 2012. The reactor had both fresh and irradiated HEU fuel at the time and all of it was exchanged for new LEU fuel. The conversion was financed by the Governments of Canada and the United States through a Project and Supply Agreement (PSA) overseen by the International Atomic Energy Agency (IAEA). The financial support arrangement included covering all costs incurred during the conversion

process including transportation, and providing Mexico with sufficient fuel to compensate for the value of the existing HEU fuel in the reactor.

The arrangements for the conversion process, however, had political and legal difficulties early on during negotiations due to particularities of the Mexican nuclear law and also because of practices in Mexican foreign policy regarding the acceptance (or rather the non-acceptance) of additional obligations or commitments as a result of the establishment of new agreements.



TRIGA reactor at ININ.

Difficulties spawning from the nuclear law had to do in part with the treatment that the law gives to the concept of nuclear fuel ownership which, as is detailed later, had effects on the

way negotiations were carried out and required special treatment in the way nuclear fuel was incorporated in the different agreements and contracts.

On the issue of acceptance of new commitments, as would be required in an agreement that included nuclear fuel and that would necessitate implementing specific safeguards and reporting, the normal procedure in Mexican foreign policy has been to avoid any such agreements with individual countries and opting instead in favour of adhering to existing multinational treaties or establishing agreements with recognised international organisations.

## **2. Nuclear fuel ownership in Mexican nuclear law**

The law that governs nuclear activities in Mexico is the Regulatory Law on Nuclear Matters of Article 27 of the Constitution (the “Nuclear Law”)<sup>1</sup>. This law covers all activities of the nuclear industry and derives from Article 27 of the Constitution that deals with the country’s natural resources.

Article 5 of the Nuclear Law states that radioactive minerals (uranium, thorium and any others that could be used as nuclear fuel) are the property of the Nation, and that their exploration, exploitation and processing cannot be the subject of concessions nor contracts.

Article 17 of the same law states that nuclear fuel is owned by the State. Without any provisos or conditions attached to it, this statement is interpreted to mean that nuclear fuel is owned by the State irrespective of its origin. Therefore, for the purposes of the law, it does not matter if the nuclear fuel material originated within national territory or if it was introduced into the country as a result of a purchase, a donation or any other kind of transaction. Nuclear fuel in Mexico becomes the property of the Nation for the simple fact that it exists or is located inside national territory.

Therefore, according to Articles 5 and 17, both nuclear material and fuel that are sourced either from the country’s mines, or procured from foreign sources for power plants or for research reactors, are the property of the Nation.

Article 18, on the other hand, states that only the Ministry of Energy can carry out the importation and exportation of nuclear fuel and materials, and that in the case of exports, a primary consideration will be the country’s self-sufficiency. The last part of this sentence means that only excess quantities after domestic needs are met can be exported.

There are different implications to this concept of fuel ownership in Mexico. One is that it imposes restrictions on any negotiations that are made with nuclear fuel. For instance, its ownership cannot be compromised, or subject to any conditions in an agreement with a foreign organisation or country.

Another implication is that any negotiation regarding nuclear fuel with a foreign government for the purposes of trade, or exchange, or any other action affecting its ownership status, has to be made by the proper federal authority. Although the law states clearly that fuel materials are the property of the Nation, it is not specific about which governmental instance is

qualified to make decisions concerning said ownership, as in a transfer to another country. Nor does it specify the conditions under which such transference can be made.

Given that the law names the Ministry of Energy as the entity responsible for import and export of nuclear materials, the interpretation agreed upon was that this was the instance that could negotiate and decide over ownership of these materials. Still, this interpretation was challenged by at least one organisation in Mexico, as can be seen in Numeral 5, “Public perception of Mexico’s participation in the fuel conversion program”. In the article cited it is implied in the first paragraph that the Executive branch (the President and its cabinet Ministers) by law can only authorise the use of nuclear fuel, but cannot change its ownership status.

For the governmental officers involved in the negotiations and signature of the different accords and agreements related to this project, the issue of fuel ownership was no small subject. Not reaching a favourable agreement on the negotiations for the exchange or trade of State-owned fuel, or accepting stipulations in contracts that compromise the Nation’s property, could result in incurring in a form of offense known as damage to the Nation’s patrimony.

### **3. Mexican foreign policy and international organisations**

Mexico’s foreign policy has a long history of relying on the international community to oversee and arbitrate on international public policy matters. This tradition comes as a result of its experience in the international arena where as a nascent country was the subject of interference, interventions and even intrusions from contemporary world powers.

Out of necessity Mexico has sought alliances with other parties worldwide to strengthen its position as a small, growing country and allow it to have more leverage in international relations. Mexico therefore has been active in promoting the establishment and becoming part of multinational treaties and internationally recognised institutions.

In certain cases where a bilateral agreement would impose additional conditions or obligations considered unnecessary given the particular situation, there would be a tendency to opt instead for the mediation of an international organisation. Such is the case here where negotiating with the United States for the acquisition of the new LEU fuel would require the imposition of a new system of safeguards and reports regarding this new fuel.

It merits explaining that Mexico has a long history of supporting international efforts to thwart nuclear proliferation and promote nuclear disarmament. Mexico was the main promoter of the Tlatelolco Treaty for the prohibition of nuclear weapons in Latin America and the Caribbean, and is also one of the original parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and of the Safeguards Agreement with the IAEA for the control of nuclear materials, including the Additional Protocols.

Mexico therefore is active in this type of activities, but its participation has to be understood as a belief in the virtues of these actions and a commitment to contribute to the joint efforts of

the international community in these matters. It was important during the course of these negotiations to take care that the implementation of safeguards for the new fuel to be provided was not seen as an imposition or requirement of an individual country, especially within some sectors of public opinion within Mexico.

#### **4. Actual negotiations**

After a number of years of talks and consultations regarding the possible participation of Mexico in a program to reduce the enrichment of its research reactor's nuclear fuel, the Government of Mexico finally committed to participate in such a program in April 2010 when the Heads of State of Canada, Mexico and the United States at the Nuclear Security Summit in Washington announced their desire to collaborate with Mexico in the project.

In the beginning of formal negotiations, talks were positive. From the beginning the representatives of the Department of Energy of the Government of the United States (USDOE) offered to finance the complete project. However it became obvious early on that ways had to be found to do the conversion (including the contractual documents) in a way that complied with the regulatory framework and foreign policy needs.

##### ***Mediation by the IAEA***

Owing to the limitations regarding bilateral accords, it was decided from the beginning that the conversion project would require the participation of the IAEA. For that purpose the IAEA established a Project and Supply Agreement between the IAEA, the Government of Mexico and the Government of the United States Concerning the Replacement of Highly Enriched Uranium by Low Enriched Uranium (PSA).

Aside from the valuable support in the form of expert advisors, visits to reactor installations, and other technical assistance, the IAEA's main involvement would be as a mediator between Mexico and the United States for the exchange of nuclear fuel. Mediation from a recognised international organisation would provide credence to the transaction. It would be better accepted inside the country as a contribution to the IAEA's and the international community's efforts for non-proliferation, rather than a trade imposed by an individual nation for unknown motives.

Also, because Mexico already complies with IAEA safeguards, it would eliminate the need to have additional safeguards as required by the US government.

Previous agreements for fuel conversion projects sponsored by the IAEA considered only the supply of the new LEU fuel to the receiving country, with the IAEA involved only in overseeing the transaction and providing technical support. Mexico required an agreement not only for obtaining a supply of LEU fuel, but for *exchanging* LEU for HEU fuel. Mexico intended to use this agreement to justify to the public opinion inside the country that the HEU fuel would be surrendered to a foreign country only because it was part of an exchange deal in which the state would receive fuel of at least similar characteristics and with at least the same worth. Initially the IAEA was reluctant to make this an "exchange" agreement because of the

legal implications and risk for the IAEA of being involved in a potential dispute over the commercial arrangements of the negotiation. The IAEA eventually agreed to the “exchange” agreement when Mexican representatives insisted the approach was required for Mexico to justify the conversion process, and when it was made clear that the commercial arrangements were exclusive to the parties signing the US-Mexico Bilateral Implementation Agreement (described in the next few paragraphs) included as part of the PSA.



Reactor building at ININ

***US-Mexico Bilateral Implementation Agreement.***

Even with the IAEA’s PSA in place, another pact was required that would contain the specifics of the actual transaction and other arrangements like importation, exportation, transportation and fuel installation details between the United States and Mexico.

This pact was not favoured by Mexico initially because it constituted a bilateral agreement thought to have been obviated with the implementation of the PSA. It was however deemed necessary by all involved later on as it was not possible to include details about the specific arrangements between two of the parties in the IAEA trilateral agreement. And so that it would not stand as a bilateral agreement on its own, with the aforementioned liabilities, it was decided to put it under the coverage of the IAEA PSA including it as a referenced component of a Supplemental Contract to the PSA. (The “Supplemental Contract” to the PSA is a

document signed by the three parties to the PSA to specify the exact quantities of fuel to be exchanged and the mechanics of the transfer of title. For the specifics and arrangements for the actual transference, the Supplemental Contract directs the reader to the “Bilateral Implementation Agreement”, signed only by the two parties directly involved: US and Mexico).

Also, to denote that the Bilateral Implementation Agreement was not a full-scale agreement between countries, but only a document to work out the implementation details, it was agreed that the signatories would be representatives of the DOE and of the ININ.

Of course, the major negotiation issue in this accord between the US and Mexico would be the actual terms of the trade, i.e.: how much LEU fuel would be provided by the US in exchange for the existing HEU fuel in the Mexican reactor facility. This was a rather sensitive issue in Mexico given that fuel is the property of the nation and cannot be relinquished or traded without a proper justification, and in any case not without obtaining a beneficial deal in return. It had to be demonstrated to public opinion in Mexico that the trade of the nation’s nuclear fuel would result in the obtainment of fuel that was worth at least the same as that surrendered. And it had to be proven that no matter what parameter was used to compare the worth of both the relinquished and the received fuels, that the LEU fuel received would be worth more.

An agreement was finally reached in which sufficient LEU fuel was provided to Mexico to compensate for the value of all of the HEU fuel existent in the reactor from the point of view of three different parameters: estimated cost, U-235 content, and remaining service life. Both irradiated and fresh HEU fuels were present at the Mexican reactor and traded for new LEU fuel.

### ***Exchange of Diplomatic Notes between the US and Mexico***

An exchange of diplomatic notes is customary between some governments like those of the United States and Mexico when entering an agreement. In this case a diplomatic note exchange was proposed by the United States as a preamble to entering into this joint fuel conversion project.

This Diplomatic Note proposed to Mexico is one that is used for fuel conversion projects of the same type for research reactors in other countries, and is a format that has the approval of the Department of State of the United States. Therefore making changes to it would require submitting the new text for the approval of the Department of State and would not be an easy nor prompt undertaking.

The Diplomatic Note proposal from the US had a few issues that were problematic in terms of what is acceptable from the viewpoint of the regulatory framework in Mexico. One was a requirement for Mexico to return to the United States the fuel provided by this country in case Mexico did not comply with certain conditions stipulated in the same Diplomatic Note, or in case the fuel was used in the production of nuclear weapons.



In the nuclear regulatory framework in Mexico the concept of “return” of nuclear fuel has no meaning as the fuel becomes the property of Mexico and loses any “origin” it could have had. Accepting the possibility of relinquishing State owned fuel in an agreement, as explained before, could make the signing officers incur in damage to the Nation’s patrimony. The issue was resolved by stating that in the case the United States considered the conditions specified for a demand to return fuel or to suspend any of its obligations under the agreements were present, a request would be made through the IAEA in which case the “parties should enter into consultations to address the request”. It also states that said consultations would consider the requirements of Mexican Law and whether it was necessary to establish an agreement or other arrangements with the IAEA.

Another concern with the Diplomatic Note involved imposing on Mexico the obligation to inform the United States about the status of nuclear materials related to this project whenever requested by this last country. This is the type of additional commitments or obligations that Mexico tries to avoid when entering bilateral pacts. More so in this case where Mexico has a system of safeguards for the control and reporting of its nuclear and radioactive material already established with the IAEA, making this requirement redundant and unnecessary. The first change required by Mexico and accepted by the United States was to make this requirement reciprocal; that is, to have a similar obligation of reporting regarding the status of the surrendered HEU placed upon the United States at the request of Mexico, as well. But more importantly, the obligation was lifted from the requested party and placed upon the IAEA. In other words, when a party requires information on the status of the material, it will be the IAEA who will respond with the authorisation from the requested party.

For these accords and the Diplomatic Note to be agreed upon it was necessary to hold meetings in Mexico between representatives from the USDOE, the U.S. Department of State and the Embassy of the United States in Mexico with representatives from Mexico’s Ministry of Foreign Affairs and Ministry of Energy.

## **5. Public perception of Mexico’s participation in the fuel conversion program**

In spite of the efforts of the people involved from Mexico’s side to carry out the negotiations for the different activities of the conversion project in a proper fashion, some sectors of public opinion were distrustful of the way said negotiations were being made. The opinions shown below are from an article appearing in the July 2010 issue of *Nuclear*, a periodical publication by the Union of Nuclear Industry Workers of Mexico (SUTIN)<sup>2</sup> and help to explain why the Mexican team of negotiators had to go to extreme lengths not only to comply with the existing regulatory framework, but also to defend certain values held to be important to different sectors of the public in Mexico.

*The establishment of a strategy [for the conversion of HEU fuel to LEU fuel] of this type can only be detrimental to the country and to this Institute (ININ) given that the [Nuclear Law] establishes [...] that “Nuclear Fuel is the property of the Nation; [...] [and that] the [Executive branch] can only authorise its use under the terms of this Law and only under the surveillance of the National Commission for Nuclear Safety and Safeguards”.*



*It has to be considered that the TRIGA reactor's nuclear fuel is the property of all Mexicans, as [is also] demonstrated in the [IAEA original documents attesting to the purchase of the original fuel by Mexico and the formal transfer of ownership of said fuel to Mexico].*

*[...] Therefore, the labourers responsible for the scientific and technological activities in nuclear matters that work at ININ and that belong to our Union of Nuclear Industry Workers (SUTIN), consider of the utmost importance to adhere to and to comply with the Political Constitution of [Mexico], as well as with international agreements signed by our country related to non-proliferation of nuclear weapons and peaceful uses of nuclear energy. We understand the theory of the possibility of catastrophe that could be caused to the planet and specifically to our country by the potential use of nuclear weapons and we agree to protect these nuclear materials to avoid their falling into the hands of terrorists.*

*However, it has to be considered that if Mexico is deprived of the [Institute's] HEU fuel elements, the operation of the TRIGA reactor would be affected and the design power of 1 MW could never be achieved again in manual nor automatic operation modes and would much less be able to achieve power pulses as per the original reactor design. This would have regrettable consequences for the Institute's activities and for the country's development, given that they would be deprived of one of their most important installations, which would therefore also cause:*

- a) a decline in the advancement of research and technological development in the area of nuclear fission;*
- b) total dependency on other countries in the purchase of radioisotopes that presently are produced in the TRIGA reactor for health and industrial applications;*
- c) a reduction in scientific production in areas that are by law the responsibility and objective of the Institute;*  
*[...]*
- f) impossibility to perform services on power reactor research.*

*[...] United States, as is mentioned in DOE's internet page in the framework of the SPP [Security and Prosperity Partnership of North America] considers Mexico capable of producing nuclear weapons that could put that nation at risk. It should be remembered that Mexico was the promoter of the Tlatelolco Treaty to prohibit nuclear weapons in Latin America and the Caribbean. [...] We the workers of the Union consider that the fight against nuclear and/or radioactive material traffic cannot and should not be based on decisions that jeopardise national sovereignty. These are clear signs of the damage and harm that can be caused with proposals like this, designed to encourage the scientific and technological retardation of any country, as well as promoting the technological dependence of our country on others.*

*Regarding the Nuclear Security Summit taking place in April 2010 [where Canada, Mexico and the United States announced their agreement to collaborate in the conversion of Mexico's TRIGA reactor], we consider unadvantageous to substitute, on a one-to-one basis, the LEU fuel elements (of 20% or less enrichment) for HEU fuel elements (of 70%*

*enrichment) as both in terms of cost, as also in terms of energy produced, the transaction would represent a loss [to the nation].*

*[...]*

### ***Union Proposals***

*Given all of the above, and in order to further strengthen the Institute, this Union proposes:*

*Acceptance of the substitution of the LEU nuclear fuel for HEU nuclear fuel if and only if enough budget funds are provided to ININ for the acquisition of a new research reactor of around 10 to 20 MW of power including LEU fuel, the design and construction of which would have the participation of ININ professionals and researchers and the operation of which would be carried out by Mexicans.*

## **6. Conclusions**

All the issues described in this paper and others that could not be included here due to space limitations were solved successfully and in time with the decisive goodwill and resolve from all the people involved from the IAEA and the governments of the United States and Mexico. Compromises had to be made but care was taken by all parties to ensure that regulations in the two countries were observed and the requirements of the IAEA were met.

A recommendation that could be made in order to make all the necessary arrangements in a smooth manner and achieving the proper rate of advance, is that it is important for the involved negotiating governments and organisations to understand that their customary way of doing things might be in contradiction with the regulatory framework or the policy practices of the other countries involved. This state of affairs should be recognised early on to avoid unnecessary roadblocks and to begin efforts as early as possible to contact the appropriate governmental instances and search for the required workable solutions.

The opinion from the Union of Nuclear Industry Workers shows in an interesting way the level of distrust that some sectors of public opinion in Mexico had during the course of this project and are a reminder that sensitivity of the public is an important issue that requires attention, too.

## **7. References**

- [1] Ley Reglamentaria del Artículo 27 Constitucional en Materia Nuclear. Congress of the Union. Mexican United States. February 4, 1985.
- [2] A. Delfin Loya, “Nuclear fuel”, Nuclear, a publication by the Union of Nuclear Industry Workers, Ocoyoacac, Mexico, July 2012.

