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Issues Associated with IAEA Involvement in Assured Nuclear Fuel Supply Arrangements

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Executive Summary

Assured nuclear fuel supply has been discussed at various times as a mechanism to help limit expansion of enrichment and reprocessing (ENR) capability beyond current technology holders. Given the events in the last few years in North Korea and Iran, concern over weapons capabilities gained from acquisition of ENR capabilities has heightened and brought assured nuclear fuel supply (AFS) again to the international agenda. Successful AFS programs can be valuable contributions to strengthening the nonproliferation regime and helping to build public support for expanding nuclear energy.

In 2007, the International Atomic Energy Agency issued a report summarizing thirteen AFS proposals. Most envision a role for the IAEA, ranging from owning and managing nuclear material or facilities, to brokering arrangements between suppliers and clients. This paper discusses the issues arising from the IAEA role envisioned in eight proposals.

The IAEA Statute provides for nearly all of the IAEA roles, including owning material and/or operating a nuclear material reserve. The authors conclude, however, that implementation of some of the new roles would likely impose a burden on the Agency's ability to meet its existing responsibilities or costs that do not outweigh the gains in assurance of supply that might result. Such roles include predictions on reliability of the international uranium market and management of a nuclear facility where the Agency does not have the skills to undertake the task. Additionally, even though provided for in the IAEA Statute, it is not clear that IAEA ownership of nuclear material is advantageous due to possible concerns about safeguarding itself.

The simplest and most direct roles for the Agency to assume with respect to these proposals are the following:

- Safeguard the material in question.
- Establish nonproliferation criteria for releasing material from a fuel reserve or bank.
- If virtual reserves of LEU or uranium are envisioned, establish arrangements with the supplier states (or private entities) to commit material for release by the IAEA upon its request for states eligible to receive such material in the event they suffer a supply interruption for reasons unrelated to compliance with their nonproliferation commitments. This would include agreement made in advance to facilitate the export license of the material that the Agency requests.
- If IAEA owns the material, establishment of an agreement with the host state concerning the respective responsibilities of the Agency and host

state concerning various matters such physical protection, safety and liability, export of the Agency-owned material.

One other potential role of the Agency – to certify that a given recipient/customer is in full compliance with its nonproliferation obligations – may not be straightforward. First, it may be difficult to get the BOG to agree on exactly what constitute "nonproliferation obligations". Second, the BOG or Agency Secretariat will need to define what constitutes compliance, or full compliance? Is there a materiality standard -- for example, is some minor violation of a safeguards agreement considered noncompliance? If the noncompliance has to be major or significant, how is that criterion defined and compliance measured? Third, the IAEA may not want to get in the business of certifying compliance. The Agency is usually quite guarded in its conclusions with respect to its core mission of safeguards verification. This issue may require considerable IAEA and BOG efforts to resolve.

It is our recommendation that the Agency avoid assuming new responsibilities that add very little to fuel supply assurances and would be inappropriate, burdensome, costly, and/or require the Agency to acquire major new skills or capabilities.

Introduction

Assured nuclear fuel supply has been discussed at various times as a mechanism to help limit the spread of enrichment and reprocessing (ENR) capability beyond current technology holders. Given the events in the last few years in North Korea and Iran, concern over weapons capabilities gained from the acquisition of ENR capabilities has heightened and brought assured nuclear fuel supply (AFS) again to the international agenda. President Bush raised AFS in his speech at the U.S. National Defense University in February 2004. He called on all countries to work towards stemming further development of ENR in return for assured, economic nuclear fuel supplies.[1] Successful AFS programs can be valuable contributions to strengthening the nonproliferation regime and helping to build public support for expanding nuclear energy.

The success of any assured fuel supply scheme in achieving this objective rests in its ability to provide a country (or utility) with sufficient incentive to participate, accepting the conditions, including voluntarily refraining from ENR, for the duration of the arrangement. AFS effectively addresses the threat of the spread of enrichment technology. Further arrangements may be needed to manage spent nuclear fuel at the back end of the nuclear fuel cycle to remove an incentive to reprocess. However, assuming responsibility for back end services is not yet feasible for any country, and requires speculation decades into the future, so the international community has focused on the front end of the fuel cycle.

The International Atomic Energy Agency (IAEA) secretariat issued an information paper to the Board of Governors (BOG) on 13 June 2007 describing thirteen proposals for assured nuclear fuel supply that have been prepared by a number of countries and the Nuclear Threat Initiative (NTI). Many of the thirteen proposals envisions a role for the IAEA – including the application of safeguards to nuclear material in accordance with nonproliferation requirements (nothing new), to assuming rights to release material assigned to a "fuel bank", and managing and possibly operating nuclear fuel cycle facilities which it also must safeguard.

Assigning the IAEA a role in ensuring fuel supplies can have certain advantages. For example, potential candidates for nuclear fuel assurances are likely to view the IAEA as a politically neutral intermediary compared to traditional suppliers. This perception may help to increase the confidence of recipients that they will obtain alternative fuel supplies when cutoff by a traditional supplier for political motives other than noncompliance with nonproliferation commitments. The IAEA may not, according to its Statute (Article III.C), make its assistance subject to any political conditions. Also, the Agency's involvement has the potential to assure the international community that a recipient/customer is in compliance with its nonproliferation obligations if a means of Agency verification can be agreed on.

[1] President Bush's actual words were: "The world's leading nuclear exporters should ensure that states have reliable access at reasonable cost to fuel for civilian reactors, so long as those states renounce enrichment and reprocessing. Enrichment and reprocessing are not necessary for nations seeking to harness nuclear energy for peaceful purposes."

On the other hand, some of these assured fuel supply (AFS) proposals may impose responsibilities on the IAEA that it does not have the skill set for, or that may raise conflict of interest issues. This paper will examine the advantages and disadvantages of the anticipated role of the IAEA in each of eight proposals which include a substantive IAEA role and discuss the issues associated with implementing that role. The analysis will cover twelve issues. Which of these issues is triggered by each proposal is summarized in Table 1. Ratings are given as positive for the IAEA, negative for the IAEA, neutral, and not clear if the proposal's implementation path is unclear.

IAEA Authorization – The IAEA Statute

The IAEA Statute (see relevant provisions of Statute in Annex 1) provides for the IAEA to carry out the major functions described in the AFS proposals. The IAEA can receive, store and send special fissionable and source material (Article III.A, IX.A&B). The Agency is required to verify receipt of this material and report on the amounts delivered periodically to its Board of Governors (Article IX.G). It is obligated to protect and safeguard this material from diversion, sabotage, forcible seizure and damage (Article IX.H). It can hire guards to protect the material (Article VII.G). It can request a Member State to provide materials it made available to the Agency without delay to another Member State or to the Agency (Article IX.D). The IAEA can "establish or acquire a plant, equipment or facilities for the receipt, storage and issue of materials" (Article IX.I). The Agency can require internationally acceptable safety and security standards be met at a facility (Article IX.I). Member States can also make available to the Agency services, equipment, and facilities that assist the Agency in fulfilling its objectives and functions (Article X). It may be that some of these proposals would be implemented as an Agency project, at which point the Agency can enter into agreements with Member States for implementation of the project. If the BOG approves, this may include the ability of the IAEA to charge for any services, materials, equipment or facilities it, or a Member State, provides (Article XI.F.3). This can be important if there is no budget provision for the Agency's functions in assured fuel supply. These project agreements can include provisions for undertakings on peaceful use, for safeguards, for dispute settlements, and, there is a catchall clause for whatever other provisions might be needed (Article XI). Therefore, uunder the Statute, the IAEA could act to establish a virtual or actual fuel reserve and, if so desired, serve as a supplier of last resort for fuel customers.[2]

Although the IAEA was granted these authorities, to date it has had little opportunity to exercise many of them. As David Fischer describes in his history of the IAEA, several of the provisions in the IAEA Statute were never implemented. For example, President Eisenhower's idea that the IAEA's principal aim "be to reduce stockpiles of fissile materials in the hands of nuclear weapons State" by creating a pool or bank of material to be available to all nations for peaceful purposes did not materialize. Thus, the Agency did not create the depot identified in the Statute.[3] Additionally, IAEA project agreements

[2] IAEA Statute, IAEA Publication, first in force 29 July, 1957.
[3] Fischer, David, History of the International Atomic Energy Agency The First Forty Years, Division of Publications, IAEA, 1997, p.23.

did not become the "normal mechanism for giving assistance to a developing country or for triggering safeguards."[4] The IAEA has, however, served as a reliable intermediary in the supply of nuclear material and equipment from one Member State to another, e.g., through project and supply agreements, e.g., INFCIRC 526 – The Text of the Agreement of 29 August among the International Atomic Energy Agency and the Governments of the Republic of Nigeria and the People's Republic of China concerning the Transfer of a Miniature Neutron Research Reactor and Enriched Uranium.

Although considerable thought has been given to assured fuel supply proposals in the last two years, there is little information indicating how they would be implemented by the IAEA and Member States.[5] This paper will focus on how the IAEA might play a role in implementing some of these proposals. Any proposal would, of course, have to entail specific arrangements for the Agency that are acceptable to the Board of Governors (BOG) and the General Conference. The paper will conclude with some recommendations on issues that should be addressed by the U.S and other Member States if these proposals are implemented.

[4] Op. Cit., p.41.
[5] One exception is a report done for the Nuclear Threat Initiative by Harold Bengelsdorf and Frederick McGoldrick that focused on the implementation of the NTI fuel reserve and the application of export controls and related nonproliferation obligations.

Assured Nuclear Fuel Supply Options

1) World Nuclear Association - Ensuring Security of Supply in the International Nuclear Fuel Cycle

The WNA proposal involves a three-tier mechanism to assure the provision of enrichment services to countries or utilities that have suffered an interruption of their supplies. The first tier is the international fuel market. The second is an emergency or backup collective guarantee by enrichers, supported by governmental and IAEA commitments. It would be triggered only in the event of a political disruption between the supplier and recipient. The third tier is a backup of highly enriched uranium (HEU) excess to defense needs in nuclear weapons states, held as an HEU stockpile, which "would need to be controlled by a widely accepted international body, presumably the IAEA."[6] WNA recommends that the three tier mechanism be "transparent and market neutral."[7]

In this proposal, the IAEA would have two roles. In tier two, the Agency would be responsible for determining the eligibility of fuel customers for assured supplies and thus trigger implementation of the supplier's guarantee."[8] WNA suggests that IAEA should determine that a customer's fuel cutoff is due to a political disruption of the market for a reason other than noncompliance with nonproliferation obligations of the applicant.[9] To further guarantee fuel supply in Tier two, WNA suggests establishment of an international agreement between enrichers and the IAEA that would obligate the enrichers to "supply the contracted enrichment in equal shares"[10] when the Agency has determined that a customer is eligible. The IAEA is authorized to require supply of the material under Statute Article IX.D, wherein IAEA can request that States which have committed material to it provide this without delay to the appointed recipient. The IAEA has been an intermediary in assuring the transfer of some material, equipment or facility when a Member State desired to distance itself from the supplier or to strengthen the reliability of supply from a supplier. In order to better ensure supply, the IAEA would have agreements with multiple suppliers.

WNA also suggests that the enrichers be "compensated for the costs associated with providing the supply assurance."[11] Such compensation would need to be paid by the recipient. A back-up supply clause in the agreement between the supplier and recipient is suggested by WNA to provide an agreed method for calculating the price.

Tier three would be the reserve of material derived from former weapons HEU, held as a stockpile in a weapons state. It is suggested that this reserve be "under IAEA control" to add to security of its supply. Control of the IAEA appears to refer to the fact that the supplier State has committed the material to the IAEA for assured fuel supply, as in

[6] WNA Report Ensuring Security of Supply in the International Nuclear Fuel Cycle, April 2006, p. 2.
[7] Ibid, p. 9.
[8] Ibid. p. 11.
[9] Ibid. p. 9.
[10] Op. Cit., p. 11.
[11] Ibid. p. 11.

Article IX of the IAEA Statute and the material is under IAEA safeguards. It does not appear to suggest that the IAEA would own this nuclear material. The Agency role would be to determine if the customer is eligible for receipt of material from Tier three. The WNA suggests that the supplier retain management responsibility for the reserves, but voluntarily commit them for AFS, and/or transfer rights regarding their use "to the IAEA, if so desired."[12] Thus, the IAEA could request release of reserve material for a customer if it has determined that the customer has met the nonproliferation criteria and is otherwise eligible. In its paper on assured fuel supply approaches, the Agency suggests that the criteria for material release be approved by the BOG. The Agency paper also notes that these criteria would need to be the same for all states and applied "in a consistent manner without prejudice to any State's future options regarding its fuel cycle in the context of multilateral approaches."[13]

One issue which must be addressed for this and other proposals is the role of the Agency in certifying or determining the recipient/customer's compliance with its nonproliferation obligation. Several questions must be resolved. First, it may be difficult for the BOG to agree on exactly what constitute "nonproliferation obligations" once one gets beyond NPT Articles I, II, and III? For example, do they include compliance with NSG guidelines or bilateral obligations such as consent rights? Second, either the BOG or the Agency Secretariat will need to define what constitutes compliance, or full compliance. Is there a materiality standard -- for example, is some minor violation of a safeguards agreement considered noncompliance? If the noncompliance has to be major or significant, how is that criterion defined and compliance measured? Third, the IAEA may not want to get in the business of certifying compliance. The Agency is usually quite guarded in its conclusions with respect to its core mission of safeguards verification. In the 2006 Safeguards Statement, for example, the Agency was able to conclude for only 32 states that all nuclear material remained in peaceful activities. For 121 other states with comprehensive safeguards agreements the Statement could only conclude that all declared nuclear material remained in peaceful activities. Would the latter constitute full compliance? How definitive would or could the Agency be about other obligations, absent significant new verification activities? And would the Agency really be willing to "certify" compliance, an undertaking that could raise issues of credibility and liability if such a certification proved inaccurate. These issues are not raised to say the IAEA should not take on this role, but that it could be a more difficult task than appears at first look.

A further complication could arise in implementation because of the nonproliferation obligations that enrichment states would normally impose on the recipient. First, even if the Agency makes a positive nonproliferation commitment judgment, the supplier state may still require such assurances from the customer before shipping. All the major nuclear suppliers are members of the Nuclear Suppliers Group and would presumably insist that any recipient of the enriched material from this arrangement abide by the Nuclear Suppliers Guidelines. In addition, the United States, Canada and Australia routinely require that the nuclear material they export be subject to so-called consent

[12] Ibid, p. 4.
[13] GOV/INF/2007/11, p.12.

rights over reprocessing and other sensitive nuclear activities. This may also raise the issue of whether a recipient might receive enriched material with multiple country consent rights attached to it because WNA suggests that all enrichers contribute equal shares to the enriched material provided to an eligible recipient. Some recipient states may therefore prefer to obtain their emergency supply from states other than the Australia, Canada and the US. The Agency's paper suggests that supplier states would enter into agreements with the IAEA in advance to guarantee export and transfer licenses to solve these problems.[14] In fact, in the next proposal from the six enricher states proposes that implementation of this mechanism be "consistent with their national legal and regulatory requirements". On the other hand, the six supplier States proposal recommends that suppliers "should endeavor to allow export from their territories of enriched uranium and commit, in principle, to avoid opposing such exports from other States."[15] So there is clearly some disposition to accommodate AFS because of its importance to nonproliferation.

2) Concept for a Multilateral Mechanism for Reliable Access to Nuclear Fuel by France, Germany, the Netherlands, the Russian Federation, the United Kingdom and the United States

This proposal includes provision for the above enrichment states to create a mutual back-up system should one supplier not be able or willing to supply the customer as well as backup reserves of enriched uranium so that customers will not need "to hedge with large financial investment in indigenous enrichment ... capabilities"[16] in event of a future supply problem. The proposal states that if "commercial supply arrangements are interrupted for reasons other than [noncompliance with] nonproliferation obligations and cannot be restored through normal commercial processes"[17], this mechanism could be triggered. IAEA would have the responsibility to judge whether the customer met the requirements for triggering the mechanism. Under this proposal, the customer must meet the following conditions for supply: a Comprehensive Safeguards Agreement (INFCIRC153) and its Additional Protocol in force; "no exceptional safeguards implementation issues outstanding with the Agency;"[18] adherence to accepted international safety standards; adherence to the Convention on the Physical Protection of Nuclear Material and Nuclear Facilities; use of the international market to obtain fuel supplies; and commitment to forgo pursuing sensitive fuel cycle facilities. Again, as above, this proposal raises questions concerning the Agency's potential role in determining compliance with these obligations.

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[14] Op. Cit. p. 12.
[15] Communication dated 31 May 2006 received from the Permanent Missions of France, Germany, the Netherlands, the Russian Federation, the United Kingdom of Great Britain and Northern Ireland, and the United States of America, p.3.
[16] Communication dated 31 May 2006 received from the Permanent Missions of France, Germany, the Netherlands, the Russian Federation, the United Kingdom of Great Britain and Northern Ireland, and the United States of America, p.1.
[17] Communication dated 31 May 2006 received from the Permanent Missions of France, Germany, the Netherlands, the Russian Federation, the United Kingdom of Great Britain and Northern Ireland, and the United States of America, p. 3.
[18] Ibid. p. 3.

If triggered, the backup system would be initiated and an alternative supplier found. Compensation of the supplier is expected to be handled bilaterally. Suppliers and their customers might add a backup supply clause to their agreements and if desired deposit the agreements with the IAEA.[19] If the backup system does not work for any reason, this mechanism provides for a supplier to supply from its reserves of LEU that it has committed to AFS. The other major IAEA role would be to apply safeguards to the nuclear material involved in accordance with the relevant safeguards agreements.

The costs of implementing this proposal have not been estimated and no funds have been identified to cover the Agency's time and other costs in implementing the proposal, though these costs are not expected to be large.

3) IAEA Standby Arrangements System for the Assurance of Nuclear Fuel Supply

Japan proposed a mechanism to provide assurance of supply as contemplated in the above six nation proposal but with expanded assurance to cover all key activities of the front end of the fuel cycle: uranium mining and milling, storage, conversion, enrichment and fuel fabrication. Japan proposed that the multilateral arrangements not only focus on "remedial responses to market failures…but also prevent the occurrence of such failure by reporting to the IAEA up-to-date information about the market." Japan proposed its "Standby Arrangements System" be placed under "the auspices of the IAEA." The information system would require Member States to notify the Agency annually of their capacities in the five stages of the front end of the nuclear fuel cycle mentioned above according to three levels of readiness to supply: 1) possesses a commercial capability, but not yet exporting; 2) exports on a commercial basis and willing to cooperate to the extent that it is able in response to emergency supply requests, and 3) maintains reserves that can be exported on short notice. It suggests that membership in this scheme be open to any Member State that is in compliance with its nonproliferation obligations.[20]

The IAEA role is to conclude bilateral standby arrangements with States, administer the database, collect information annually from suppliers, keep track of potential demand from recipients including projections of future needs, and monitor the situation in the international uranium market. The IAEA is expected to prepare an annual report on the adequacy of the fuel supply market based on this data. The IAEA would not possess or store any nuclear materials. This proposal would create a virtual nuclear fuel reserve of the IAEA. The IAEA would act as an intermediary between the supplier and recipient to ensure supply in the event of disruption of fuel supply for reasons other than nonproliferation concerns. Arrangements would presumably be negotiated directly between the supplier and customer for compensation for the material transferred. The Agency would also apply safeguards to the nuclear material in accordance with relevant safeguards agreements.

[19] GOV/INF/2007/11, p.9.
[20] Communication received on 12 September 2006 from the Permanent Mission of Japan to the Agency concerning arrangements for the assurance of nuclear fuel supply, p. 2.

For those States that own and operate the front end of the fuel cycle facilities, the Japanese proposal would require a bilateral arrangement between the Supplier State and the IAEA to commit the material for the reserve and establish release criteria as above. However, the agreement would also need to cover release of requested data on enrichment and other nuclear fuel cycle capacity if the plant is State-owned. For States where the nuclear suppliers are private, the IAEA would need to request the data be provided on a voluntary basis from the facility owners. Depending on the level of detail, some of the data envisaged by the Japanese proposal may be regarded as commercially sensitive. Owners may be reluctant to provide such information to the Agency or may do so only pursuant to a confidentiality agreement. The effort required to analyze, process and integrate the data to create a reliable market forecast and evaluation tool should not be underestimated. This capability does not currently exist at the IAEA, nor does it appear appropriate for the IAEA. The IAEA should not be in the business of predicting the successful operation of the international market in which it does not participate. There are other organizations such as the World Nuclear Association that can provide such market analyses. Alternatively, the IAEA could hire an organization to collect and analyze the data and charge Member States for the organization's services.

4) Nuclear Threat Initiative Fuel Bank

NTI proposes to create a new low enriched uranium (LEU) stockpile to improve the reliability of assured nuclear fuel supply by providing customer states "reliable access to a nuclear fuel reserve "under impartial IAEA control should their supply arrangements be disrupted." NTI's proposal envisions that the LEU stockpile would be "owned and managed by the IAEA" and that material from it would be made "available as a last resort"… for nations that "have no indigenous enrichment facilities" and "are in full compliance with their nonproliferation obligations." The NTI suggests that the reserve be sized so that it does not interfere with the nuclear fuel market¸ but is large enough to provide the needed assurance. NTI volunteered $50 million if others would contribute an additional $100 million or an equivalent value of low enriched uranium to jump start the reserve. [21]

The NTI proposal follows the concept introduced in the IAEA Statute paragraph IX of an IAEA "depot". Storage and transfer of nuclear material is one area where the Agency was expected to have a large role historically[22], but it has not materialized, so this would be a new activity for the Agency. The details for implementing this fuel depot or reserve are under discussion among the IAEA staff. The issues under discussion are numerous:
1) the location of the reserve - an extraterritorial location has been ruled out;
2) whether the IAEA owns the LEU and manages the facility or just owns the material and a country hosts the facility, or Agency owns the material and a company manages the facility under contract to it;
3) how export controls are applied to the movement of the LEU from a country to the fuel reserve and then from the reserve through the fuel fabrication facility, to the customer;

[21] Nuclear Threat Initiative letter to International Atomic Energy Agency, 6 September 2007, p.2.
[22] Fischer, p.41.

4) how suppliers meet national export control and nonproliferation requirements if the recipient's nonproliferation bona fides are determined by the Agency rather than the government of the country in which the supplier is located.

The arrangement that the IAEA and NTI appear to be leaning toward is an Agency contract with a company to rent a portion of an existing facility for the LEU reserve. IAEA would own the nuclear material, but the contractor would manage it for the IAEA. The facility would remain subject to the laws and regulations of the host state. IAEA's ownership raises a question. Since the IAEA owns part of the material, it would need to apply safeguards to material it owns. While this is allowed for in the IAEA Statute, there may be a perceived conflict of interest if the Agency is checking on itself, or concern that the IAEA could be tempted to cut costs and skip regular safeguards on this facility. But in fact, would the Agency ever need to visit the facility except to apply safeguards and thereby account for the LEU? Could the facility host accept receipt of the reserve materials and account for it for the Agency?

An agreement would be needed between the Agency and the facility host and its government to cover management of the material, rent, etc. An agreement would also be needed among the suppliers, customers and the IAEA to set a pricing mechanism, pay Agency costs, assure customers of receipt of LEU when eligible, among other issues. The Agency suggests that $150 million would cover the cost of LEU for one reactor core load, the recommended minimum size for a reserve.[23] Thus other costs for rent, safeguards and possibly management of the reserve material receipt and shipping would then require additional funds unless some of the LEU is donated.

The simplest approach may be for the IAEA to rent space for its fuel reserve. Alternatively, the host country/facility might donate the space. The host country/company could apply its national laws and policies on safety and security, and the company might be willing to provide such protection for the IAEA-owned material since it may represent a small additional cost. The IAEA would apply safeguards to the LEU.

Another significant issue with the NTI fuel reserve could be application of national nonproliferation controls on the uranium or LEU provided to the reserve. Supplier countries are unlikely to be prepared to give up their national controls on the material once it has gone to the IAEA. However, if the IAEA adopts the Nuclear Supplier Guidelines as the criteria for release of the material, this should not be a problem for most suppliers. In the case of Australia, Canada and the U.S., additional controls in the form of consent rights would be required. As mentioned in the six nation proposal, the suppliers could enter into agreements in advance with the IAEA providing for the timely export and transfers of the LEU they contribute to the fuel bank.

Another possibility for the NTI reserve might be a virtual arrangement in which the Agency never takes custody of the LEU. In this case, the IAEA would enter into an agreement with supplier states to access LEU whenever needed. It would not own the nuclear material. Access to the material through this agreement could be managed as in

[23] GOV/INF/2007/11, p.10.

the six supplier proposal and materials be released to customers if the Agency has verified the supply disruption is not related to the customer's failure to comply with its nonproliferation commitments. The supplier and the customer would enter into an agreement or add an additional clause to an existing agreement to handle things such as the price for the LEU.

5) International Uranium Enrichment Centre (IUEC) at Angarsk

In January 2007, the Russian Federation established an IUEC at Angarsk, Russia. The Angarsk IUEC would provide LEU and enrichment services to all its contributing members subject to the conditions outlined in the government-to-government founding agreement. There will be two types of contributors – those such as Kazakhstan that provide uranium and those who contribute funds to get enrichment services. Each would be entering into a government-to-government agreement. Russia is considering how to set aside 1-2 reactor loads of LEU to contribute to a broader assurance of supply mechanism. The IUEC will remain under Russian national laws and regulations, and enrichment technology will not be shared with the contributors. Russia is offering the facility up for selection by the IAEA for safeguards, under its voluntary offer safeguards agreement. Russia has also stated that "a regulatory basis will be developed in the sphere of export control such that the shipment of material out of the country at the request of the Agency is guaranteed.''[24]

The Angarsk IUEC would provide guaranteed access to uranium enrichment to the Centre's participating organizations, which are anticipated to be "chiefly from States not developing uranium enrichment capabilities on their territory" according to the Russian announcement.[25] The first intergovernmental agreement for the IUEC was signed on 10 May 2007 between Russia and Kazakhstan. States participating in the Angarsk IUEC would have the opportunity to purchase enriched uranium (or enrichment services) from a company that they partly own. In addition they would get dividends from the commercial sales of uranium. In this way, the Russians intend that their initiative would "provide an economic incentive for potential IUEC participants to refrain from developing their own enrichment capabilities."[26]

The Russian IUEC will operate under a joint advisory committee to resolve issues. The IAEA is expected to be a member of this committee.

The role of the IAEA is advisory in IUEC operations, to safeguard the facility (or maybe just the LEU?) if it is selected for safeguards, and to identify eligible customers for access to the LEU reserve material if the reserve is established. The terms of "eligibility" for

[24] Communication from the Resident Representative of the Russian Federation to the IAEA on the Establishment, Structure and Operation of an International Uranium Enrichment Centre, INFCIRC 708, 7 June, 2007

[25] Communication from the Resident Representative of the Russian Federation to the IAEA on the Establishment, Structure and Operation of an International Uranium Enrichment Centre, INFCIRC 708, 7 June, 2007

[26] Ibid. p.4.

release of the LEU will, as with other proposals, be presented to the BOG for approval. The IAEA is considering preparation of a set of criteria that could be used in many of these proposals so that the BOG would only need to review these once.[27] But as noted above, determining these criteria and getting BOG agreement may be difficult. Some questions are unanswered about the Russian proposal, including how the Advisory Committee will work, what the IAEA will apply safeguards to, and even whether the Russians will create an LEU store for broader assured supply purposes. So it is more difficult to define the IAEA's role for Angarsk in detail.

6) Germany's proposal for Multilateralizing the Nuclear Fuel Cycle

Germany proposes construction and operation of a new multilateral commercial enrichment plant with **extraterritorial status** that would operate as a new supplier in the market. The German concept appears to be that the enrichment plant would operate in the market, but have as its first or as a supply priority to supply customers who have been cutoff and who the IAEA determines meet the criteria established for eligibility. As with earlier proposals, these criteria will be approved by the BOG to help the Agency enforce supply. In order to supply enriched uranium when a customer is identified by the IAEA as eligible, the facility could either put aside product or alter the flow of orders to meet such a request. The latter is possible because enrichment plants often operate at less than full capacity so their capacity could be increased to meet the need.[28]

As conceived, "one or more commercial enrichment plants could be constructed on the basis of arrangements that would not involve any transfer of technology to the Agency. The enrichment plant would be built as a "black box" and would be accessed and maintained solely by the technology supplier. The IIEC would not be owned or subsidized by the Agency, but financed on a commercial basis or, alternatively, by interested Member States. Operation of the centre would be on a commercial basis by management independent of the Agency, and under the control and responsibility of its owners."[29]

"The criteria for siting the centre would include: reliable infrastructure, good accessibility, and a politically stable host country that does not operate an enrichment capacity. The host country would have to be willing to cede administration and sovereign rights over a certain area on its territory where such the IIEC would be located."[30] IAEA Legal Affairs Officer, Wolfram Tonhauser, explained it this way - The multilateral contributors to such an enrichment facility could choose to locate the plant in a country such as Finland which is considered neutral. Such a facility would be on extraterritorial land in that country, but still subject to the laws of Finland beyond the border of the UN land, just as the IAEA is subject to the laws of Austria. It was not possible to clarify, but it appears this means exports would be subject to Finnish law. He suggested that a more neutral country location could be considered advantageous to

[27] Conversation with Wolfram Tonhauser, IAEA Legal Affairs 01/22/08
[28] Conversation with Tom Wood, PNNL, 1/21/08
[29] GOV/INF/2007/11, Annex 4 p. 2.
[30] Ibid., p.2.

customers seeking high assurance of supply. He called this "Angarsk plus 1", one more level of assurance than Angarsk because the plant is not in Russia. [31]

Some complications could arise, for example, will the plant operator be willing to accept full liability for this plant or will it require liability protection from the multilateral contributors? If an accident occurs with transboundary consequences, what is Finland's liability? Also, the economic risk associated with unpredictable assured supply requests may be acceptable to a governmental company that desires to support the international nonproliferation community by reducing the prospect of a new enrichment or reprocessing plant being built by a new technology holder. A private company might want additional incentives to cooperate.

7) The UK - Enrichment Bonds

The United Kingdom introduced the concept of enrichment bonds as a mechanism for what it calls a voluntary scheme for reliable access to nuclear fuel. A bond would involve an agreement among a group of supplier states, the customer state and the IAEA in which the supplier government(s) would guarantee that, subject to international law and to meeting nonproliferation commitments as assessed by the IAEA, national enrichment providers would not be prevented from supplying the customer. The bonds address one of the key features of nuclear supply that can interfere with rapid delivery of fuel at request of the IAEA on behalf of a customer – national export approval. The idea of a supplier state guarantee of export approval could increase a customer's confidence in reliable and timely supply.

To provide sufficiently strong confidence that supply needs will be fulfilled, the Supplier States are asked to arrange for advance assurance that export approvals will be given if the IAEA identifies an eligible customer. The UK proposal suggests that an agreement be established between a group of suppliers, a recipient and the IAEA. This agreement would include the "prior consent for export" assurances, the conditions for the export to take place and the commitments of the customer.[32] Depending on how this advance assurance provision is anticipated to be implemented, it may not be possible for all supplier states to provide such assurances without Congressional or Parliamentary approval.

The activities suggested for the IAEA are consistent with the IAEA's current capabilities, but there is implementation risk in that the supplier governments may not be able to provide the export guarantee under existing national laws.

8) Austria's Multilateralization of the Nuclear Fuel Cycle

[31] Conversation with Wolfram Tonhauser 1/21/08.

[32] Communication dated 30 May 2007 from the Permanent Mission of the United Kingdom of Great Britain and Northern Ireland to the IAEA concerning Enrichment Bonds - A Voluntary Scheme for Reliable Access to Nuclear Fuel, p. 4.

The Austrian proposal, based around the concept used for European Union states to improve their security, suggests that all states declare to the IAEA and to all other states all of their existing nuclear programs and future plans. This information would then be updated when transfers of nuclear material, equipment and technology as well as any other changes in nuclear activities take place. The IAEA would be obliged to provide for the security and confidentiality of the exchange of information. Second, all transactions involving nuclear fuel would be gradually, but eventually all be, placed under the auspices of a Nuclear Fuel Bank that would "ensure, monitor and verify safe, secure and fair distribution" of the fuel. Once the Nuclear Fuel Bank subsumes all enrichment facilities, nuclear fuel would be supplied exclusively by fully multilateral facilities. This international Nuclear Fuel Bank would "ensure that the nuclear fuel cycle was operated and controlled by all interested States in an equal and fair manner." The Austrians note that working out the details will require looking at, among other things, the existing safeguards system, rights and obligations on the nuclear weapons states, avoidance of market distortions, safety and confidentiality. They anticipate the IAEA would draft the concept paper for this.

Implementation of the Austrian proposal assumes a level of confidence among States in information supply that is currently not achievable. It is unlikely that all States would be comfortable providing such information to the IAEA. For some time now, the IAEA has requested information from suppliers on nuclear transfers, and many states have been reluctant to provide the information. Additionally, this proposal will add new responsibilities to the IAEA, such as being the confidential clearinghouse for all data to be shared among countries. It is not clear what the cost of such an effort would be, nor how it would be staffed.

Conclusions

Based upon the above review, we offer the following preliminary conclusions.

The IAEA has the authority under its Statute to carry out the various fuel assurance roles that the AFS proposals have suggested for the Agency. Some of these functions are ones the IAEA is already performing such as the application of safeguards to nuclear material. Applying safeguards to material the Agency owns should not present any problems of a conflict of interest since this is provided for in the Statute which has been endorsed by all Member States. Nonetheless, the Agency's safeguarding itself may be sensitive and the locale for the fuel reserve should be selected with this in mind. The fuel reserve would best be located in a host country with excellent nonproliferation credentials.

Some other roles may appear similarly straightforward such as confirming that a potential recipient state is in compliance with its nonproliferation obligations. Yet, as noted above, it may be challenging for the BOG to agree on exactly what constitutes "nonproliferation obligations", to define compliance and specify how compliance is measured, and to establish a workable mechanism for the Agency to reach and report on such conclusions. This issue may require considerable Secretariat and BOG efforts to resolve.

Other roles for the IAEA would be new. Some would similar with functions already carried out by the Agency, e.g., a Board of Governors' determination of criteria for releasing material under IAEA auspices to potential recipients. It should be remembered that the same criteria must be applied to all recipient countries/utilities. Use of the Nuclear Suppliers Guidelines may provide assurance that no new requirements will be levied by suppliers for AFS. Yet, since the content of these guidelines cannot be affected by countries beyond those invited into the Nuclear Suppliers Group, use of the guidelines may be sensitive to some countries which perceive that the suppliers can change these guidelines without their input. Taking ownership of nuclear material may be new for the IAEA as mentioned above, but the acquisition of title to material should not place undue burdens on the Agency. It may also have the advantage of increasing confidence with some recipients in AFS because they could access Agency-owned material instead of having to obtain the material from a traditional supplier.

In other cases the Agency would be ill-suited to carry out certain proposed functions or the assumptions of certain responsibilities that would require a major expenditure of funds. These would include building and managing an LEU reserve or providing an assessment of the international fuel market for its Member states.

The simplest and most direct roles for the Agency to assume with respect to these proposals are the following:

- Safeguard the material in question.
- Establish nonproliferation criteria for releasing material from a fuel reserve or bank.
- If virtual reserves of LEU or uranium are envisioned, establish arrangements with the supplier states (or private entities) to commit material for release by the IAEA upon its request for states eligible to receive such material in the event they suffer a supply interruption for reasons unrelated to compliance with their nonproliferation commitments. This would include agreement made in advance to facilitate the export license of the material that the Agency requests.
- If IAEA owns the material, establishment of an agreement with the host state concerning the respective responsibilities of the Agency and host state concerning various matters such physical protection, safety and liability, export of the Agency-owned material.

One last role of the Agency – to certify that the applicant consumer is in full compliance with its nonproliferation obligations – may or may not be straightforward as mentioned above.

It is our recommendation that the IAEA avoid assuming new responsibilities that add very little to fuel supply assurances and would be inappropriate, burdensome, costly, and/or require the Agency to acquire major new skills or capabilities.

ANNEX I

ARTICLE III: Functions

A. The Agency is authorized:

1. To encourage and assist research on, and development and practical application of, atomic energy for peaceful uses throughout the world; and, if requested to do so, to act as an intermediary for the purposes of securing the performance of services or the supplying of materials, equipment, or facilities by one member of the Agency for another; and to perform any operation or service useful in research on, or development or practical application of, atomic energy for peaceful purposes;

2. To make provision, in accordance with this Statute, for materials, services, equipment, and facilities to meet the needs of research on, and development and practical application of, atomic energy for peaceful purposes, including the production of electric power, with due consideration for the needs of the under-developed areas of the world;

3. To foster the exchange of scientific and technical information on peaceful uses of atomic energy;

4. To encourage the exchange of training of scientists and experts in the field of peaceful uses of atomic energy;

5. To establish and administer safeguards designed to ensure that special fissionable and other materials, services, equipment, facilities, and information made available by the Agency or at its request or under its supervision or control are not used in such a way as to further any military purpose; and to apply safeguards, at the request of the parties, to any bilateral or multilateral arrangement, or at the request of a State, to any of that State's activities in the field of atomic energy;

6. To establish or adopt, in consultation and, where appropriate, in collaboration with the competent organs of the United Nations and with the specialized agencies concerned, standards of safety for protection of health and minimization of danger to life and property (including such standards for labour conditions), and to provide for the application of these standards to its own operation as well as to the operations making use of materials, services, equipment, facilities, and information made available by the Agency or at its request or under its control or supervision; and to provide for the application of these standards, at the request of the parties, to operations under any bilateral or multilateral arrangements, or, at the request of a State, to any of that State's activities in the field of atomic energy;

7. To acquire or establish any facilities, plant and equipment useful in carrying out its authorized functions, whenever the facilities, plant, and equipment otherwise available to it in the area concerned are inadequate or available only on terms it deems unsatisfactory.

ARTICLE VII: Staff

G. In this article the term "staff" includes guards.

ARTICLE IX: Supplying of materials

A. Members may make available to the Agency such quantities of special fissionable materials as they deem advisable and on such terms as shall be agreed with the Agency. The materials made available to the Agency may, at the discretion of the member making them available, be stored either by the member concerned or, with the agreement of the Agency, in the Agency's depots.

B. Members may also make available to the Agency source materials as defined in article XX and other materials. The Board of Governors shall determine the quantities of such materials which the Agency will accept under agreements provided for in article XIII…

D. On request of the Agency a member shall, from the materials which it has made available, without delay deliver to another member or group of members such quantities of such materials as the Agency may specify, and shall without delay deliver to the Agency itself such quantities of such materials as are really necessary for operations and scientific research in the facilities of the Agency.

G. The Agency shall specify the place and method of delivery and, where appropriate, the form and composition, of materials which it has requested a member to deliver from the amounts which that member has notified the Agency it is prepared to make available. The Agency shall also verify the quantities of materials delivered and shall report those quantities periodically to the members.

H. The Agency shall be responsible for storing and protecting materials in its possession. The Agency shall ensure that these materials shall be safeguarded against

1. hazards of the weather,
2. unauthorized removal or diversion,
3. damage or destruction, including sabotage, and
4. forcible seizure. In storing special fissionable materials in its possession, the Agency shall ensure the geographical distribution of these materials in such a way as not to allow concentration of large amounts of such materials in any one country or region of the world.

I. The Agency shall as soon as practicable establish or acquire such of the following as may be necessary:

1. Plant, equipment, and facilities for the receipt, storage, and issue of materials;
2. Physical safeguards;
3. Adequate health and safety measures;
4. Control laboratories for the analysis and verification of materials received;

5. Housing and administrative facilities for any staff required for the foregoing.

J. The materials made available pursuant to this article shall be used as determined by the Board of Governors in accordance with the provisions of this Statute. No member shall have the right to require that the materials it makes available to the Agency be kept separately by the Agency or to designate the specific project in which they must be used.

ARTICLE X: Services, equipment, and facilities

Members may make available to the Agency services, equipment, and facilities which may be of assistance in fulfilling the Agency's objectives and functions.

ARTICLE Xl: Agency projects

A. Any member or group of members of the Agency desiring to set up any project for research on, or development or practical application of, atomic energy for peaceful purposes may request the assistance of the Agency in securing special fissionable and other materials, services, equipment, and facilities necessary for this purpose. Any such request shall be accompanied by an explanation of the purpose and extent of the project and shall be considered by the Board of Governors .

B. Upon request, the Agency may also assist any member or group of members to make arrangements to secure necessary financing from outside sources to carry out such projects. In extending this assistance, the Agency will not be required to provide any guarantees or to assume any financial responsibility for the project.

C. The Agency may arrange for the supplying of any materials, services, equipment, and facilities necessary for the project by one or more members or may itself undertake to provide any or all of these directly, taking into consideration the wishes of the member or members making the request.

D. For the purpose of considering the request, the Agency may send into the territory of the member or group of members making the request a person or persons qualified to examine the project. For this purpose the Agency may, with the approval of the member or group of members making the request, use members of its own staff or employ suitably qualified nationals of any member.

E. Before approving a project under this article, the Board of Governors shall give due consideration to:

1. The usefulness of the project, including its scientific and technical feasibility;

2. The adequacy of plans, funds, and technical personnel to assure the effective execution of the project;

3. The adequacy of proposed health and safety standards for handling and storing materials and for operating facilities;

4. The inability of the member or group of members making the request to secure the necessary finances, materials, facilities, equipment, and services;

5. The equitable distribution of materials and other resources available to the Agency;

6. The special needs of the under- developed areas of the world; and

7. Such other matters as may be relevant.

F. Upon approving a project, the Agency shall enter into an agreement with the member or group of members submitting the project, which agreement shall:

1. Provide for allocation to the project of any required special fissionable or other materials;

2. Provide for transfer of special fissionable materials from their then place of custody, whether the materials be in the custody of the Agency or of the member making them available for use in Agency projects, to the member or group of members submitting the project, under conditions which ensure the safety of any shipment required and meet applicable health and safety standards;

3. Set forth the terms and conditions, including charges, on which any materials, services, equipment, and facilities are to be provided by the Agency itself, and, if any such materials, services, equipment, and facilities are to be provided by a member, the terms and conditions as arranged for by the member or group of members submitting the project and the supplying member;

4. Include undertakings by the member or group of members submitting the project: (a) that the assistance provided shall not be used in such a way as to further any military purpose; and (b) that the project shall be subject to the safeguards provided for in article XII, the relevant safeguards being specified in the agreement;

5. Make appropriate provision regarding the rights and interests of the Agency and the member or members concerned in any inventions or discoveries, or any patents therein, arising from the project;

6. Make appropriate provision regarding settlement of disputes;

7. Include such other provisions as may be appropriate.

G. The provisions of this article shall also apply where appropriate to a request for materials, services, facilities, or equipment in connection with an existing project.

ARTICLE XII: Agency safeguards

A. With respect to any Agency project, or other arrangement where the Agency is requested by the parties concerned to apply safeguards, the Agency shall have the following rights and responsibilities to the extent relevant to the project or arrangement:

1. To examine the design of specialized equipment and facilities, including nuclear reactors, and to approve it only from the view- point of assuring that it will not further any military purpose, that it complies with applicable health and safety standards, and that it will permit effective application of the safeguards provided for in this article;

2. To require the observance of any health and safety measures prescribed by the Agency;

3. To require the maintenance and production of operating records to assist in ensuring accountability for source and special fissionable materials used or produced in the project or arrangement;

4. To call for and receive progress reports;

5. To approve the means to be used for the chemical processing of irradiated materials solely to ensure that this chemical processing will not lend itself to diversion of materials for military purposes and will comply with applicable health and safety standards; to require that special fissionable materials recovered or produced as a by-product be used for peaceful purposes under continuing Agency safeguards for research or in reactors, existing or under construction, specified by the member or members concerned; and to require deposit with the Agency of any excess of any special fissionable materials recovered or produced as a by-product over what is needed for the above- stated uses in order to prevent stockpiling of these materials, provided that thereafter at the request of the member or members concerned special fissionable materials so deposited with the Agency shall be returned promptly to the member or members concerned for use under the same provisions as stated above.

6. To send into the territory of the recipient State or States inspectors, designated by the Agency after consultation with the State or States concerned, who shall have access at all times to all places and data and to any person who by reason of his occupation deals with materials, equipment, or facilities which are required by this Statute to be safeguarded, as necessary to account for source and special fissionable materials supplied and fissionable products and to determine whether there is compliance with the undertaking against use in furtherance of any military purpose referred to in sub- paragraph F-4 of article Xl, with the health and safety measures referred to in sub- paragraph A-2 of this article, and with any other conditions prescribed in the agreement between the Agency and the State or States concerned. Inspectors designated by the Agency shall be accompanied by representatives of the authorities of the State concerned, if that State so requests, provided that the inspectors shall not thereby be delayed or otherwise impeded in the exercise of their functions;

7. In the event of non- compliance and failure by the recipient State or States to take requested corrective steps within a reasonable time, to suspend or terminate assistance and withdraw any materials and equipment made available by the Agency or a member in furtherance of the project.

B. The Agency shall, as necessary, establish a staff of inspectors. The Staff of inspectors shall have the responsibility of examining all operations conducted by the Agency itself to determine whether the Agency is complying with the health and safety measures prescribed by it for application to projects subject to its approval, supervision or control, and whether the Agency is taking adequate measures to prevent the source and special fissionable materials in its custody or used or produced in its own operations from being used in furtherance of any military purpose. The Agency shall take remedial action forthwith to correct any non- compliance or failure to take adequate measures.

C. The staff of inspectors shall also have the responsibility of obtaining and verifying the accounting referred to in sub paragraph A-6 of this article and of determining whether there is compliance with the undertaking referred to in sub paragraph F-4 of article XI, with the measures referred to in sub- paragraph A-2 of this article, and with all other conditions of the project prescribed in the agreement between the Agency and the State or States concerned. The inspectors shall report any non-compliance to the Director General who shall thereupon transmit the report to the Board of Governors. The Board shall call upon the recipient State or States to remedy forthwith any non-compliance which it finds to have occurred. The Board shall report the non-compliance to all members and to the Security Council and General Assembly of the United Nations. In the event of failure of the recipient State or States to take fully corrective action within a reasonable time, the Board may take one or both of the following measures: direct curtailment or suspension of assistance being provided by the Agency or by a member, and call for the return of materials and equipment made available to the recipient member or group of members. The Agency may also, in accordance with article XIX, suspend any non- complying member from the exercise of the privileges and rights of membership.

ARTICLE XIII: Reimbursement of members

Unless otherwise agreed upon between the Board of Governors and the member furnishing to the Agency materials, services, equipment, or facilities, the Board shall enter into an agreement with such member providing for reimbursement for the items furnished.