NAVAL NUCLEAR PROPULSION AND IAEA SAFEGUARDS

by Laura Rockwood

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ABOUT FAS

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Cover Photo: Captain Ferreira Marques shows replica of future Brazilian nuclear submarine. (Photo by Vladimir Platonow. Caption via Wikimedia Commons.)

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EXECUTIVE SUMMARY

The Federation of American Scientists has initiated a project focused on naval reactor programs and their potential impact on nonproliferation and nuclear disarmament with a view to the 2020 Review Conference of the Treaty on the Non Proliferation of Nuclear Weapons.

From the nonproliferation perspective, the project attempts to address the risk that the withdrawal from safeguards of nuclear material for use in naval reactors could increase the potential for undetected diversion of nuclear material to proscribed nuclear activities and/or the misuse of nuclear facilities by non-nuclear weapon states, and offer recommendations for its mitigation. As the only non-nuclear-armed country that currently has an active nuclear-powered submarine program, Brazil is discussed in the context of its safeguards agreement with the International Atomic Energy Agency.

From the disarmament perspective, the project has explored confidence-building mechanisms that might be used in connection with the naval reactor programs of nuclear armed states with a view to creating a "quid pro quo" that could help alleviate some of the sense of disproportionality of verification obligations and disappointment with the pace of disarmament in time for the 2020 NPT RevCon.

The purpose of this issue brief is to review the legal aspects of safeguards in connection with naval nuclear propulsion programs, in particular as regards the possible withdrawal from safeguards of nuclear material for such programs.

The Summary section provides recommendations about what should be considered in an arrangement that states need to have with the International Atomic Energy Agency for naval nuclear propulsion activities in states with comprehensive safeguards agreements.

I. INFCIRC/153 AND PAST PRACTICE

A. INFCIRC/153 (CORRECTED)

INFCIRC/153 (Corrected)[1] – hereafter referred to as "INFCIRC/153" – serves as the basis for all of the comprehensive safeguards agreements (CSAs) concluded by the International Atomic Energy Agency (IAEA or Agency) with non-nuclear weapon states (NNWS) party to the Treaty on the Non Proliferation of Nuclear Weapons (NPT).

Paragraph 14 of INFCIRC/153 relates to the "Non Application of Safeguards to Nuclear Material to be used in Non Peaceful Activities." It was included to provide a mechanism to accommodate the use of nuclear material in a non-proscribed military nuclear activity –

1 *The Structure and Content of Agreements between the Agency and States Required in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons*, IAEA document INFCIRC/153 (Corrected), 1972. "INFCIRC" refers to an "Information Circular" document of the IAEA and designates a document that has been circulated to all member states. INFCIRCs are publicly available on the IAEA's website http://iaea.org.

specifically, for nuclear propulsion in naval submarines.

As is further clarified in the chapeau to paragraph 14, this provision addresses the situation in which a state "intends to exercise its discretion to use nuclear material which is required to be safeguarded thereunder in a nuclear activity which does not require the application of safeguards under the Agreement."[2]

Paragraph 14 requires that, before the material may be withdrawn from safeguards, the following steps must be taken:

> **a.** The state must inform the IAEA of the activity, making it clear that the use of the material in a non-proscribed military activity will not be in conflict with an undertaking the state may have given, and in respect of which IAEA safeguards apply, that the nuclear material will be used only in a peaceful nuclear activity. This precludes a state from invoking this provision with respect to nuclear material that is subject to a "no military use" undertaking in a project and supply agreement or an item specific safeguards agreement concluded with the IAEA, even if the application of safeguards under that agreement has been suspended.
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> **b.** The state must inform the IAEA that, during the period of non-application of safeguards, the material will not be used for the production of nuclear weapons or other nuclear devices.
>
> **c.** The IAEA and the state concerned must make an "arrangement" so that, only while the nuclear material is in such activity, the safeguards provided for in the agreement will not be applied. The arrangement must identify, to the extent possible, the period or circumstances during which safeguards will not be applied, but that, in any event, safeguards provided for in the Agreement shall again apply as soon as the nuclear material is reintroduced into a peaceful nuclear activity. The IAEA is to be kept informed of the total quantity and composition of such material in the state and of any export of such material.
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> **d.** Each arrangement is to be made in agreement with the IAEA; that agreement is to be given as promptly as possible and "shall only relate to the temporal and procedural provisions, reporting arrangements, etc., but shall not involve any approval or classified knowledge of the military activity or relate to the use of nuclear material therein."

In 1978, Australia wrote to the IAEA's Director General seeking confirmation that paragraph 14 would operate to ensure that the use of nuclear material in a non-explosive military activity would be brought to the Board for its consideration. In his response to Australia, the Director General stated that it was the Secretariat's view that any exercise by a state of the

2 Thus, paragraph 14 does not apply to non-nuclear military uses of nuclear material, such as the use of depleted uranium for armor-piercing projectiles or tank shielding.

discretion referred to in paragraph 14 which comes to the knowledge of the Secretariat, and any notification received by the Secretariat under that paragraph, as well as any arrangement made pursuant to that paragraph, or any breach of the procedures referred to in that paragraph, "must be reported to the Board of Governors, and it would be for the Board in each case to take the appropriate action." The Director General circulated the texts of the two letters to the Board in GOV/INF/347 (3 July 1978).

B. THE CANADIAN SUBMARINE PROGRAM

In the late 1980s, Canada approached the IAEA with a view to concluding an arrangement for the withdrawal of nuclear material for use in nuclear powered submarines. Canada's intention was to export Canadian origin UF6 to a nuclear weapon state (NWS), where the material would be enriched, fabricated into fuel elements and assembled into a reactor and returned to Canada. Any subsequent reprocessing would have taken place in that NWS (or another NWS).

One of the key issues was the point at which the nuclear material would be withdrawn from safeguards. One of the options identified by Canada was an arrangement whereby the UF6 would be withdrawn from safeguards while it was still in Canada (for its subsequent export to a NWS for enrichment, fabrication and later re-import into Canada in submarines).

The Secretariat's preferred approach was to conclude an arrangement providing for the withdrawal of the material in question from safeguards at as late a stage as possible. In its view, such an early withdrawal of the material from safeguards would be inconsistent with the intent to limit the period of time and circumstances in which nuclear material should be excluded from safeguards, and any nuclear material imported into Canada for use in the submarines should be notified to the IAEA prior to the import of the fabricated fuel or reactor (or prior to the assumption of the responsibility therefor by Canada), included on the state's inventory and withdrawn from safeguards thereafter.

However, in light of the fact that Canada was also considering an option of not invoking paragraph 14 at all, but pursuing a direct military-to-military arrangement instead (an approach which the Director General considered undesirable from a policy and legal perspective), it was agreed upon to propose to Canada the Secretariat's preferred approach, along with a less preferable alternative approach which provided for the withdrawal from safeguards of the UF6 before its transfer out of Canada. The IAEA held extensive discussions both internally and bilaterally with Canada. Canada ultimately decided not to pursue the initiative, and therefore no arrangement as foreseen under paragraph 14 of INFCIRC/153 was ever concluded between the IAEA and Canada.[3]

3 An excellent study of Canada's plans to acquire nuclear-powered submarines and the impact on the nonproliferation regime, entitled "Opening Pandora's Box? Nuclear-Powered Submarines and the Spread of Nuclear Weapons," co-authored by Marie-France Desjardins and Tariq Rauf, was published by the Canadian Center for Arms Control and Disarmament (*Aurora Papers* 8) in 1988.

No state has invoked the provisions of paragraph 14 since then.[4]

C. BRAZIL AND THE QUADRIPARTITE AGREEMENT

Brazil has been developing a land-based prototype propulsion reactor at a facility currently referred to as LABGENE, which it has declared to the IAEA and with respect to which it has provided design information. Its commissioning was foreseen for 2014 with full operation in 2015, but the project has been confronted with a number of challenges which have resulted in significant delays in the project. However, it seems to be still in the works.[5] From public accounts, indications point in the direction of a domestic fuel cycle for the conversion and enrichment of nuclear material for the submarine fuel, as well as domestic fabrication of the fuel and its assembly into a reactor core.[6]

Brazil is party to a CSA that it concluded in the early 1990s with the IAEA. Reproduced in IAEA document INFCIRC/435, it is frequently referred to as the Quadripartite Agreement. The genesis of that agreement is useful in analysing the implications for safeguards of Brazil's submarine program.

In November 1990, Argentina and Brazil issued a Declaration on a Common Nuclear Policy.[7] In that declaration, the states, inter alia, decided: to approve a common system of accounting and control (SCCC) applicable to all nuclear activities of both countries; to start negotiations with the IAEA for the conclusion of a joint safeguards agreement; and to adopt, after the conclusion of the safeguards agreement, measures for the full entry into force for both countries of the Treaty on the Prohibition of Nuclear Weapons in Latin America ("Tlatelolco Treaty").

In July 1991, the states concluded an Agreement on the Exclusively Peaceful Utilization of Nuclear Energy (the SCCC Agreement, also referred to as the "Guadalajara Agreement")[8] in which they established the SCCC, as well as the Brazilian Argentine Agency for Accounting

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4 In 2012, Iran announced that it would start building a nuclear submarine (http://cnbc.com/id/48176321). In December 2016, Iran's president is said to have ordered the Atomic Energy Agency of Iran to start developing nuclear propulsion capability for marine transportation in response to asserted violations by the U.S. of the Joint Comprehensive Plan of Action (http://cbsnews.com/news/iran-nuclear-powered-ships-retaliation-nuke-deal-violations-hassan-rouhani).

5 See: "Brazilian navy plans a fleet of 20 subs, six nuclear powered," MERCOPRESS, November 22, 2010, which cited Brazil's navy as planning to build and incorporate in the next decades a fleet of six nuclear powered and 20 conventional submarines, in cooperation with France; and "Brazil's submarines program navigates troubled waters," BERNAMA-NNN-MERCOPRESS, April 11, 2017, which refers to a single nuclear submarine, being built exclusively with Brazilian technology, is five years behind schedule. The article notes that, "although the planning stage for that submarine is completed, construction will not start until 2021, with launching in 2028."

6 This differs from the Canadian approach, which would have involved the transfer of domestic origin material to another State (a NWS) for its enrichment, fabrication and assembly, and its subsequent re import by Canada in the form of a submarine reactor core.

7 *The Iguazu Falls Declaration*, reproduced in IAEA document INFCIRC/388.

8 Reproduced in IAEA document INFCIRC/395.

and Control of Nuclear Materials (ABACC), which would be responsible for the implementation of the SCCC.[9]

In the SCCC Agreement, the states also undertook to use nuclear material and facilities under their jurisdiction or control "exclusively for peaceful purposes," and agreed that "[n]one of the provisions of the … Agreement shall limit the right of the Parties to use nuclear energy for the propulsion of any type of vehicle, including submarines, **since propulsion is a peaceful application of nuclear energy."**[10] (Editor's note: All bold text hereafter is added by the author for emphasis.)

In December 1991, Argentina, Brazil, ABACC, and the IAEA signed the Quadripartite Agreement, which was brought into force in March 1994.[11] While the agreement was based on INFCIRC/153, some of the provisions were modified to take into account the states' undertakings in the SCCC Agreement. The modifications relevant to this issue are reflected in Articles 1 and 13 of the Quadripartite Agreement, as discussed below.

Article 1 of the Quadripartite Agreement provides that Brazil (and Argentina) undertake "to accept safeguards on all nuclear material in **all nuclear activities**." The language, which is different from that contained in the corresponding provision in paragraph 1 of INFCIRC/153 (which requires states to accept safeguards on all source or special fissionable material in "all **peaceful** nuclear activities"), was requested by the states so that it would reflect their bilateral commitment in the Guadalajara Agreement not to use any nuclear material in any nuclear activity for a non-peaceful use.

Article 13 of INFCIRC/435, which corresponds to paragraph 14 of INFCIRC/153, also differs from the standard language in 153, as detailed below. Whereas paragraph 14 of INFCIRC/153

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9 Annexed to the *SCCC Agreement* are "Basic Guidelines for the Common System of Accounting and Control of Nuclear Materials," which address the States' responsibilities vis à vis ABACC. In Article 4 of the Basic Guidelines, the States included a provision related to the application of the SCCC (i.e., their common system of accounting and control) to nuclear material used for nuclear propulsion. These provisions, which are directed toward ABACC, and not the IAEA, provide for: the suspension of inspections, of access to operational accounting records, and of notifications and reports required under the SCCC for the duration of use in such activities; the reapplication of those procedures when the material ceases to be used for such activities; and the recording by ABACC of the total quantity and composition of such material under the jurisdiction or control of the State Party and all transfers of such material outside of that State outside such jurisdiction or control.

10 INFCIRC/395, Article III.

11 At the time of the negotiation of the Quadripartite Agreement, neither Brazil nor Argentina was party to either the NPT or the Tlatelolco Treaty (Argentina became party to the Tlatelolco Treaty in 1994 and to the NPT in 1995; Brazil became party to the Tlatelolco Treaty in 1994 and to the NPT in 1998). Both States subsequently concluded with the IAEA agreements confirming that the Quadripartite Agreement satisfies the requirement of the States parties under the NPT and under the Tlatelolco Treaty to conclude a comprehensive safeguards agreement (INFCIRC/435/Mod.1, 1 August 1997; INFCIRC/435/Mod.2, 15 May 1998; INFCIRC/435/Mod.3, 2 March 2000).

refers to the "non-application of safeguards to nuclear material to be used in non-peaceful activities," Article 13 of the Quadripartite Agreement refers to "special procedures" for the use of nuclear material for nuclear propulsion. These modifications were requested by Brazil and Argentina to reflect: (1) the states' commitment to accept safeguards on **all** nuclear material in **all** nuclear activities (hence, their wish not to refer to "withdrawal"); and (2) their interpretation, referred to above, that the use of nuclear material for propulsion is not "non-peaceful."

The differences between Article 13 of the Quadripartite Agreement and paragraph 14 of INFCIRC/153 may be summarized as follows:

a. Title: Article 13 of the Quadripartite Agreement refers to "Special Procedures"; paragraph 14 of INFCIRC/153 refers to the "Non Application of Safeguards to Nuclear Material to be used in Non Peaceful Activities."

b. Chapeau: While the chapeau of paragraph 14 refers to the use of nuclear material in a "nuclear activity which does not require the application of safeguards under the Agreement," the chapeau of Article 13 refers to the use of nuclear material "which is required to be safeguarded under this Agreement for nuclear propulsion or operation of any vehicle, including submarines and prototypes, or in such other non-proscribed activity as agreed between the state Party and the Agency."

c. Sub-paragraph a.(i): INFCIRC/153 requires the state to make clear that the use of the nuclear material "in a non-proscribed military activity will not be in conflict with an undertaking the state may have given and in respect of which IAEA safeguards apply, that the nuclear material will be used only in a peaceful nuclear activity." The Quadripartite Agreement requires the state to make clear that use of the material in "such an activity" (i.e. an activity as defined in the chapeau) will not be in conflict with any undertaking of that state Party "under agreements concluded with the Agency in connection with Article XI of the Statute of the Agency or any other agreement concluded with the Agency in connection with INFCIRC/26 (and Add.1) or INFCIRC/66 (and Rev. 1 or 2)." The modification was requested to make clear that this restriction only applies to material subject to a previously concluded item specific safeguards agreement concluded with the IAEA and not to bilateral supply arrangements that contain "peaceful use only" undertakings. The substantive effect of the two formulations is similar however.[12]

12 Article 23 of the Quadripartite Agreement reads as follows: "Upon the coming into force of this Agreement for a State Party, the application of safeguards under other safeguards agreements with the Agency not involving third parties will be suspended while this Agreement is in force. The Agency and the State Party concerned shall initiate consultations with the third party concerned with a view to suspending the application of safeguards in that State Party under safeguards agreements involving third parties. The State Party's **undertaking in the agreements referred to above not to use items which are subject thereto in such a way as to further any military purpose shall continue to apply.**" (Editor's note: All bold text hereafter is added by the author for emphasis.) This provision is similar in substance to paragraph 24 of

d. Sub-paragraph a.(ii): INFCIRC/153 refers to the "period of non-application of safeguards," while the Quadripartite Agreement refers to the "period of application of the special procedures."

e. Sub-paragraph b: INFCIRC/153 refers to the non-application of safeguards "only while the nuclear material is in such an activity," while the Quadripartite Agreement refers to the application of the special procedures "only while the nuclear material is used for nuclear propulsion or in the operation of any vehicle, including submarines and prototypes, or in such other non-proscribed nuclear activity as agreed by the state party and the Agency." The sub-paragraph/article contains other differences of an otherwise non-substantive nature that underscore that the Quadripartite Agreement refers to "special procedures" and not to the "non-application of safeguards."

f. Sub-paragraph c: In both INFCIRC/153 and the Quadripartite Agreement, the text provides that the arrangement is to be concluded "as promptly as possible" and that it "shall not involve any approval or classified knowledge of [the military activity][13] [such activity][14] or relate to the use of the nuclear material therein." The substantive difference between the two is that the Quadripartite Agreement limits the scope of the arrangement "**only** to such matters as temporal and procedural provisions and reporting arrangements" whereas INFCIRC/153 adds the word "etc." following that phrase. The actual model for CSAs, reproduced in GOV/INF/276/Annex A, uses slightly different wording ("shall relate only to such matters as, inter alia, temporal and procedural provisions and reporting arrangements"). Thus, the Quadripartite Agreement is somewhat more prescriptive in terms of what may be covered in the arrangement.

To date, Brazil has not approached the IAEA with a request to implement Article 13 of the Quadripartite Agreement or to apply special procedures in connection with its submarine program. Clearly, an essential precondition for the application of the special procedures under INFCIRC/435 is agreement between Brazil and the IAEA on the special procedures provided for in Article 13 of the Quadripartite Agreement. That is to say, Brazil may not unilaterally declare any such material or activities as automatically beyond the reach of the IAEA because they may be related to its submarine program: there is no automatic exclusion of nuclear material or facilities simply by virtue of their use or intended use in support of a military activity. The material and facilities must be declared to the IAEA and, should Brazil wish to limit the IAEA's access to such material and/or facilities, it must first conclude an arrangement with the IAEA in accordance with Article 13 of its Quadripartite Agreement.

INFCIRC/153 and corresponding provisions in other CSAs.

13 In INFCIRC/153.

14 In the Quadripartite Agreement.

II. ARRANGEMENTS FOR WITHDRAWAL/SPECIAL PROCEDURES UNDER CSAs

The implementation of paragraph 14 of INFCIRC/153, if not done carefully, could greatly increase the potential for undetected diversion of nuclear material to proscribed nuclear activities and/or the misuse of nuclear facilities for such purposes. While the general requirements and process for concluding an arrangement for the withdrawal from safeguards of nuclear material for nuclear naval propulsion in a NNWS are broadly set out in INFCIRC/153 (and the corresponding provision of all CSAs), there are many issues that would need to be addressed in the drafting such an arrangement, each of which will have technical, policy and legal implications, as discussed below.

A. MILITARY-TO-MILITARY TRANSFERS

The basic undertaking of a state party to a CSA is "to accept safeguards, in accordance with the terms of the Agreement, on all source and special fissionable material in all peaceful nuclear activities within its territory, under its jurisdiction or carried out under its control anywhere, for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices."[15] For its part, the IAEA has a corresponding "right and obligation to ensure that safeguards will be applied, in accordance with the terms of the Agreement, on all source and special fissionable material in all peaceful nuclear activities within its territory, under its jurisdiction or carried out under its control anywhere, for the exclusive purpose of verifying that such material is not diverted to nuclear weapons or other nuclear explosive devices."[16]

A state party to a CSA is required, pursuant to paragraph 34(a) and (b) of INFCIRC/153, to inform the IAEA when it imports from any state, or directly or indirectly exports to a NNWS, material containing uranium or thorium which has not reached the stage of the nuclear fuel cycle described in sub-paragraph 34(c) ("of a composition and purity suitable for fuel fabrication or for being isotopically enriched"), unless such import or export is for "specifically non-nuclear purposes." Thus, shipments of yellowcake by the state concerned to a NWS or a NNWS for the production of fuel for a submarine reactor would not be excluded from such an obligation, since that is not a non-nuclear purpose.

Paragraph 34(c) of INFCIRC/153 provides that any nuclear material of the requisite composition and purity referred to above becomes subject to "the other safeguards procedures specified in the Agreement" upon its production within the state or upon import into the state. Paragraph 34(c) does not limit this obligation to the production of such material for use in a peaceful activity. Nor is it limited to imports of such material for peaceful purposes. It may be argued, therefore, that a state party to a CSA has obliged itself to the principle that the production or import of 34(c) nuclear material, regardless of the ultimate intended use, becomes subject to safeguards upon its production or entry into the state and, should

15 INFCIRC/153, para. 1.
16 INFCIRC/153, para. 2.

the state wish to withdraw such material from safeguards, it could thereafter invoke the provisions of paragraph 14.

This view is reinforced by the negotiating history wherein it is stated that "the Agency should be consulted and satisfactory administrative arrangements reached concerning the use of any nuclear material for a military purpose permitted under [the] NPT, whether or not the material was initially under safeguards."[17] "The provision should thus be applied to all material which was either actually under safeguards and to be withdrawn or which had never been placed under safeguards and which was intended to be used in a permitted nuclear activity."[18] In fact, a change to the Secretariat's proposed draft of paragraph 14 was made by the negotiators to avoid any ambiguity that might suggest that nuclear material would not be subject to safeguards under the agreement with the IAEA if it were assigned at the moment of production to a non-explosive military nuclear activity.[19]

From this line of reasoning it may be concluded that, notwithstanding Article III.1 of the NPT, which requires the application of safeguards to nuclear material in **peaceful nuclear activities**, the parties to INFCIRC/153 agreements have bound themselves to notify the IAEA of the production and import of nuclear material, even if it is intended for use in a non-proscribed military nuclear activity, and to resort to the provisions of paragraph 14 should it wish to exercise its discretion "to use nuclear material which is required to be safeguarded ... in a nuclear activity which does not require the application of safeguards."

B. POINT OF WITHDRAWAL /APPLICATION OF SPECIAL PROCEDURES

Paragraph 14(b) specifically requires that an arrangement under paragraph 14 is to provide for the non-application of safeguards under an agreement only while the material is in a nuclear activity that does not require the application of safeguards under the agreement. It was agreed by the drafters, although not included in the text of INFCIRC/153, that such peaceful nuclear activities as transport and storage, and activities or processes which merely change the chemical or isotopic composition of nuclear material, such as enrichment and reprocessing, are not intrinsically military and not, therefore, entitled to exclusion from safeguards under paragraph 14.[20]

However, the IAEA's lack of access to classified information, as explicitly precluded under paragraph 14, will create difficulties in determining, as a practical matter, the specific point later in the fuel cycle at which the withdrawal from safeguards nuclear material intended for use in a submarine reactor may take place.

C. INFORMATION REQUIREMENTS AND LIMITATIONS

Under paragraph 14, the IAEA has no right to classified information. However, paragraph 14 explicitly requires that the Agency is to be "kept informed of" the total quantity and compo-

17 GOV/COM.22/OR.11, para. 40.
18 Id; see also GOV/COM.22/OR.13, para. 11.
19 GOV/COM.22/OR.13, paras 7, 19.
20 GOV/COM.22/53/Mod.1.; GOV/COM.22/OR.76, paras. 47-53.

sition of such unsafeguarded nuclear material in the state and of any exports of such material. Clearly, the IAEA is entitled to know the quantity and composition prior to withdrawal from safeguards. With respect to exports of such material, it is reasonable to conclude that such notification should include the identity of the recipient state. That the IAEA must be "kept informed" suggests some form of reporting during the period of withdrawal, although it is not specified whether this should be on a periodic basis or only at such times as the quantity and/or composition change.

The detail required for such reporting is not specified in paragraph 14, but should be set forth in the agreed arrangement. One factor to be taken into account by the IAEA in determining the detail necessary should be whether the IAEA will be able to maintain a material balance which, upon re-introduction of the nuclear material into a peaceful nuclear activity, could ultimately be verified.

As noted above, the IAEA's lack of access to classified information, as determined by the state concerned, will create difficulties in determining what information can be required by a state.

D. REAPPLICATION OF ROUTINE SAFEGUARDS/EXPORTS

Paragraph 14 requires the reapplication of safeguards under the agreement as soon as the nuclear material is reintroduced into a peaceful nuclear activity. Although the term "peaceful nuclear activity" is not defined in INFCIRC/153, the drafters agreed that transportation, storage and reprocessing are all considered peaceful nuclear activities even if they involve previously withdrawn nuclear material (see above).

A CSA speaks to the reapplication of safeguards under the agreement upon reintroduction into a peaceful nuclear activity and to notification of exports. This suggests that the drafters contemplated the reintroduction into a peaceful nuclear activity of the nuclear material within the state, or alternatively, the export of the material to another state for storage or reprocessing which would result in reducing by that amount the inventory of nuclear material withdrawn from safeguards under paragraph 14.

The arrangement should include provisions that would limit the possibilities for withdrawn material to be effectively "lost to safeguards" through export. If the material is to be removed from the submarine and exported for reprocessing or storage to an NPT NWS, the arrangement should require that the exporting state make safeguards in the recipient state a condition of supply. The arrangement should also provide that, should the export be to an NPT NNWS while the material is still in the non-proscribed activity, the importing state would at the least be required to notify the IAEA and enter into an arrangement of its own with the IAEA for the non-application of safeguards.

In accordance with Article III.2 of the NPT, all parties to the NPT undertake not to provide: source or special fissionable material, or equipment or material especially designed or prepared for the processing, use or production of special fissionable material, to any NNWS for peaceful purposes, unless the source or special fissionable material will be subject to the safeguards required under the NPT. Thus, unless the NPT withdrawing state wished to vio-

late its obligation under Article III.2, it could not export the withdrawn nuclear material to a non-NPT NNWS for a peaceful nuclear activity (e.g. reprocessing or storage) in the absence of an appropriate safeguards agreement. Whether the material could be "lost to safeguards" by shipment to a non-NPT NNWS of nuclear material while it is still in the non-proscribed activity (e.g. a "military-to-military" export of a naval submarine with a core made from material withdrawn from safeguards) may be open to debate. However, whether or not Article III.2 of the NPT prohibits such a transfer without safeguards, the IAEA would have no way of verifying compliance with such a prohibition. This could be precluded through the inclusion in the paragraph 14 arrangement of an undertaking by the withdrawing state not to make transfers of the withdrawn material except subject to safeguards.

E. THE ARRANGEMENT WITH THE IAEA

A state wishing to invoke paragraph 14 is required to make an arrangement in agreement with the IAEA, the purpose of which is to ensure that only while the nuclear material is in the nuclear activity not requiring the application of safeguards will the safeguards provided for under the particular CSA not be applied. The arrangement is to include, inter alia, temporal and procedural provisions and reporting arrangements. However, it may not involve approval of the military activity or classified knowledge thereof, or relate to the use of the nuclear material within that activity. Neither INFCIRC/153 nor the Quadripartite Agreement indicates whether Board approval of such an arrangement would be required.

It may be argued that a particular paragraph 14 arrangement does not legally require the Board's approval. Such an arrangement conceivably could be equated with the status of Subsidiary Arrangements, which are also required to be agreed to between the state and the IAEA,[21] but which are not approved by the Board and are normally protected as safeguards confidential. Alternatively, it may be argued that a paragraph 14 arrangement is distinguishable from Subsidiary Arrangements as the latter relate to the implementation of safeguards agreements within parameters specifically laid down in agreements that have been approved by the Board.

These arguments may be somewhat moot, however, in light of the Director General's 1978 confirmation that any such arrangement must be reported to the Board of Governors, and that it would be for the Board in each case to take the appropriate action (see reference above).

As a practical matter, while a paragraph 14 arrangement could be drafted in such a way as to avoid reference to safeguards confidential material, it might be necessary to draft an ancillary document or documents containing information required under paragraph 14, but that the state considers confidential, which could be protected from distribution (e.g., as is the case with Facility Attachments).

III. RELEVANCE OF THE MODEL ADDITIONAL PROTOCOL

21 INFCIRC/153, para. 39.

The Model Protocol Additional to the Agreement(s) between State(s) and the IAEA for the Application of Safeguards (Model Protocol), reproduced in IAEA document INFCIRC/540 (Corrected), serves as the model for Additional Protocols (APs) concluded by all states with CSAs. Such APs are, by decision of the Board of Governors, required to include all of the measures in the Model Protocol. Thus, the CSA APs are substantively identical in terms of the IAEA's right of access to information and locations.

The IAEA has also concluded APs in connection with the voluntary offer agreements (VOAs) of the five NPT NWSs,[22] as well an AP in connection with an item specific safeguards agreement concluded with India.[23] Although also based on the Model Protocol, these six APs vary significantly in scope and content.

Although the Model Protocol was not drafted with an eye to nuclear naval propulsion, there are a number of provisions in these APS that may be relevant to such programs.

A. CSA ADDITIONAL PROTOCOLS

In terms of information, the most relevant provisions would be:

- Article 2.a.(i) requires the state to submit information about nuclear fuel cycle related research and development (R&D) activities not involving nuclear material that are funded, specifically authorized or controlled by, or carried out on behalf of the state (defined in Article 18.a. as activities which are specifically related to any process or system development aspect of: conversion, enrichment, fuel fabrication, reactors, critical facilities, reprocessing and processing of intermediate or high level waste containing plutonium, high enriched uranium or uranium-233). Any nuclear fuel cycle-related R&D activities in connection with a nuclear naval propulsion program that involve nuclear material would be required to be reported under the CSA; any such R&D activities that did not involve nuclear material would have to be declared under a CSA state's AP.

- Article 2.a.(iii) requires a general description of each building on the sites of nuclear facilities and of locations outside facilities where nuclear material is customarily used (LOFs) and, if not apparent from that description, its contents. Since a reactor is defined as a nuclear facility, and is required to be declared under a CSA, information about the buildings on the site of that reactor is required to be declared under an AP, even if the reactor is a land-based prototype for a naval reactor. If the state wished to exclude a prototype reactor from such an obligation, that would have to be part of whatever arrangement/special procedures to be

22 The VOA APs are reproduced in IAEA documents: INFCIRC/263/Add.1 (2005) (U.K.); INFCIRC/288/Add.1 (2009) (US); INFCIRC/290/Add.1 (2005) (France); INFCIRC/327/Add.1 (2008) (Russia); and INFCIRC/369/Add.1 (2002) (China).

23 Protocol Additional to the Agreement between the Government of India and the International Atomic Energy Agency for the Application of Safeguards to Civilian Nuclear Facilities, reproduced in IAEA document INFCIRC/754/Add.6. (2014).

agreed with the IAEA. A state has no right to treat it as automatically exempt from reporting simply because it may be a prototype for a submarine reactor.

- Article 2.a.(iv) requires a description of operations engaged in activities specified in Annex I of the AP (including the manufacture of specified equipment related to enrichment, reactor operation and reprocessing). As for Article 2.a.(iii), there is no distinction drawn between the manufacture of such equipment intended for use in a civilian activity or a non-proscribed nuclear activity.

- Article 2.a.(ix) requires the submission of certain information in connection with exports/imports of equipment and material specified in Annex II of the AP. In the context of this issue brief, of particular relevance would be the requirement of a CSA state to declare any export of a reactor (e.g. if the state were to export a reactor for naval propulsion) to any other state.

- Article 2.a.(x), which requires the state to provide general plans for the succeeding ten-year period relevant to the development of the nuclear fuel cycle (including nuclear fuel cycle-related research and development activities) when approved by the appropriate authorities in the state.

- In addition, Article 2.a.(viii), on further processing of intermediate and high-level waste containing plutonium, HEU or U-233 on which safeguards have been terminated, could become relevant in the event that the state were to reprocess spent naval reactor fuel.

In terms of access under a CSA AP, the IAEA has broad rights to carry out complementary access to 2.a.(iii) locations to determine whether there is any nuclear material or activities on the site of a facility or a LOF that should be declared by a state but are not being declared through the use of complementary access under the AP. As regards access to the other locations identified. The IAEA would also have a right to request access to any location identified in Article 2.a.(viii) to assure the absence of undeclared nuclear material and activities.

To trigger access to the other locations identified above, there would have to be a question or inconsistency relating to the correctness and/or completeness of the information provided. However, the bar for what constitutes a question or inconsistency is low, and need amount to suspicions about the possible conduct of proliferation-related activities.

B. OTHER ADDITIONAL PROTOCOLS

The five NPT NWSs each have in place what is referred to as a "voluntary offer safeguards agreement" or "VOA." While the format of each of the NWS VOAs is based largely on INFCIRC/153, the scope differs among the agreements. All of them, however, permit the NWS to withdraw nuclear material from safeguards at the state's discretion. For example, in the case of the U.K., the state offers for safeguards "all source or special fissionable material

in facilities or parts thereof … subject to exclusions for national security reasons only."[24] The U.S. VOA is similarly broad in scope, excluding "only those facilities associated with activities with direct national security significance in the United States."[25] From the proffered material, the IAEA has the discretion to select all, some or none for the application of safeguards. France's VOA is not as broad as the U.K.'s, and simply offers to place under safeguards source or special fissionable material that is designated by it.[26] The VOAs of Russia and China are similarly circumscribed.[27] As a matter of practice, very few facilities are offered for safeguards under these VOAs, and the IAEA implements safeguards in the NWSs in limited circumstances.

Not surprisingly, particularly given the "national security" exclusions from their scope of application, there are no provisions in any of the VOAs that correspond to paragraph 14 of INFCIRC/153 or otherwise require the submission of information or the granting of access in connection with domestic naval nuclear propulsion programs.

Where the VOAs might have some relevance is in connection with exports of nuclear naval fuel to NNWSs. All five of the VOAs cite the undertakings in INFCIRC/207, pursuant to which each has undertaken to provide information to the IAEA with respect to "the anticipated export of nuclear material (excluding exports of source material for non-nuclear purposes), in an amount exceeding one effective kilogram, for peaceful purposes to any non-nuclear weapon state."[28] If one were to adopt the Brazilian/Argentine position that the use of nuclear material for propulsion is a peaceful application of nuclear energy, the undertaking in INFCIRC/207 would seem to cover exports of fuel for or in naval reactors. However, with the exception of the U.S. VOA, the undertakings in the VOAs limit the reporting to transfers from (or to) facilities or parts of facilities that are either "on the Facilities List" (U.K., France) or from (or to) "a facility selected [for the application of safeguards by the IAEA]" (Russia, China). That would likely rule out any facility involved in the production of fuel for submarines as such facilities are unlikely to be offered for safeguards by those states.

As noted above, Article III.2 of the NPT prohibits the transfer of source or special fissionable material, and equipment or material especially designed or prepared for the processing, use or production of special fissionable material, to any NNWS for peaceful purposes, unless the source or special fissionable material shall be subject to the safeguards required by this Article. Notwithstanding, it could be argued, in line with the contention that "the use of nuclear material for propulsion is a peaceful application of nuclear energy," that the NWSs should require that a recipient NNWS declare the import of nuclear material and negotiate an arrangement pursuant to paragraph 14 of INFCIRC/153 for its withdrawal from safeguards.

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24 IAEA document INFCIRC/263 (1978).
25 IAEA document INFCIRC/288 (1980).
26 IAEA document INFCIRC/290 (1981).
27 IAEA document INFCIRC/327 (1985); IAEA document INFCIRC/369 (1989).
28 Notification to the Agency of Exports and Imports of Nuclear Material, reproduced in IAEA documents INFCIRC/207 (1974), INFCIRC/207/Add.1 (1984) and INFCIRC/207/Add.2 (1991).

Each of the NPT NWSs has also concluded with the IAEA an AP to its respective VOA which, as noted above, although broadly based on the Model Protocol, vary significantly in scope. All of those APs, with the exception of the U.S. AP, circumscribe the state's commitments to provide information to activities that have some connection with NNWS.

Of particular relevance to NWS activities in relation to NNWS are the following provisions:

- Article 2.a.(i) of the Model Protocol: Three of the VOA APs require the state to submit information about nuclear fuel cycle related research and development (R&D) activities not involving nuclear material that are funded, specifically authorized or controlled by, or carried out on behalf of the state, jointly or in cooperation with a NNWS (U.K., France, Russia). The U.S. AP contains a similar commitment, but it is not limited to activities carried out with or for a NNWS. China's AP has no corresponding commitment.

- Article 2.a.(iii) of the Model Protocol: Only the U.S. AP requires information with respect to sites of facilities and LOFs. The commitment is not limited to activities in connection with a NNWS.

- Article 2.a.(iv) of the Model Protocol finds its way into corresponding provisions in the five VOAs, with four of the five limiting to the information to Annex I activities carried out in cooperation, for or jointly with a NNWS (or, in the case of the U.K., "involve links with fuel cycle operations in a NNWS").

- Article 2.a.(ix) of the Model Protocol, related information in connection with exports/imports of Annex II material and equipment, is reflected in the VOAs of China and Russia (exports to NNWS), of France and the U.K. (exports to NNWS outside the European Community), and of the U.S. (any export of Annex II material or equipment).

- Article 2.a.(x) of the Model Protocol: The APs of the U.S. and the U.K. both require the state to submit information on its ten-year plan for the development of their nuclear fuel cycles, limited to the civil fuel cycle in the U.K. and excluding activities with direct national security significance in the US. The corresponding commitment in the APs of China and France is limited to plans for cooperation with a NNWS. The Russian AP contains no corresponding commitment.

In terms of access, the U.S. AP follows the language of the Model Protocol (excluding only instances where its application would result in access by the IAEA to activities with direct national security significance to the U.S. or to locations or information associated with such activities), as does that of the U.K. The French commitment is more limited, offering access only to resolve questions or inconsistencies. Access to locations corresponding to Article 2.a.(i) and (iv) locations are authorized, whereas access to any other location specified by the IAEA are limited to the carrying out of location-specific environmental sampling with the objective of enhancing the IAEA's ability to detect undeclared nuclear activities in a NNWS. Neither the Russian nor the Chinese AP contains any provision for access under their respective APs.

The 2009 Agreement between the Government of India and the IAEA for the Application of Civilian Nuclear Facilities[29] in practical effect supersedes the other safeguards agreements India had previously concluded with the IAEA. The Indian agreement is an item specific safeguards agreement, and applies only to those materials, equipment and facilities placed under safeguards by India. The safeguards agreement was concluded following the India U.S. Joint Statement of 18 July 2005, in which India, inter alia, stated its willingness: to identify and separate its civilian and military nuclear facilities and programs in a phased manner; to file with the Agency a declaration regarding its civilian nuclear facilities; and to take a decision to place voluntarily its civilian nuclear facilities under Agency safeguards. The agreement contains no provision corresponding to paragraph 14 of INFCIRC/153. The AP to India's 2009 safeguards agreement, the only AP concluded to date in connection with an item specific agreement, is quite limited in scope. However, in its AP, India has undertaken to provide information on exports out of India of equipment and material listed in its Annex (which corresponds to Annex II of the Model Protocol). It is worth noting that the undertaking is not expressly limited to exports of items that are already under safeguards in India; nor is it on its face limited to exports of such items for peaceful or non-military purposes. India's AP makes no provision for complementary access.

IV. POTENTIAL MECHANISMS FOR VOLUNTARY SAFEGUARDS MONITORING, AND/OR VERIFICATION

Currently, the only states with nuclear powered submarine programs are the five NPT NWS and India – all nuclear-armed states. Acceptance by the nuclear-armed states of voluntary confidence-building measures in connection with their respective programs could contribute to achieving two goals:

1. Providing transparency and assurance that their nuclear navies do not create either horizontal or vertical proliferation challenges and improve their credibility among NNWS as serious partners in both nonproliferation and disarmament. In so doing, the nuclear-armed states also confirm their commitment to disarmament, by demonstrating that their nuclear naval activities do not and will not contribute toward an increase of their weapons stockpiles.[30]

2. Encouraging any NNWS wishing to pursue a naval propulsion program to accept the most effective measures possible to ensure that its program is not misused for prohibited purposes.

In separate publications of the Federation of American Scientists, this "quid pro quo" has been explored, and some mechanisms for achieving these goals have been proposed.[31] These

29 Reproduced in IAEA document INFCIRC/754 (2009).

30 N. Egel, B. Goldblum, and E. Suzuki, "A Novel Framework for Safeguarding Naval Nuclear Material, *The Nonproliferation Review* 22 (2), (February 3, 2016): 239-251.

31 T. Shea (August 2017), *The Nonproliferation and Disarmament Challenges of Naval Nuclear*

proposals range from unilateral action by a NWS to the conclusion of new legal instruments based on a model supplementing existing IAEA safeguards agreements. They also include a proposal for achieving consensus on a series of recommendations with respect to naval propulsion at the 2020 NPT Review Conference, as a contribution to nonproliferation and disarmament.

While the current state of international affairs suggests that achieving agreement among the nuclear-armed states on significant enhancements in the area of verification is unlikely, agreement at least among the five NPT NWSs on confidence-building measures in connection with their respective programs could help alleviate among the NPT NNWS some of the sense of disproportionality of verification obligations, and disappointment with the pace of disarmament in time for the 2020 NPT RevCon.

V. SUMMARY

The CSAs concluded by the NNWS party to the NPT contemplate the possibility of a state "[exercising] its discretion to use nuclear material which is required to be safeguarded thereunder in a nuclear activity which does not require the application of safeguards under the Agreement." Each of these agreements contains a provision, corresponding to paragraph 14 of INFCIRC/153, which addresses, in general terms, the requirements for withdrawal of nuclear material from safeguards, including that the state concerned agree with the IAEA on an arrangement so that, only while the nuclear material is in such an activity, the safeguards provided for in the Agreement will not be applied.

Apart from an initial approach by Canada in the late 1980s to conclude such an arrangement with the IAEA in connection with its plans for a nuclear submarine program, which Canada terminated in 1990, the IAEA has not been called upon to address the legal and technical aspects of such arrangements.

Brazil, which is also party to a CSA and which does have an ongoing – if somewhat delayed – nuclear submarine program, has not yet approached the IAEA with a view to agreeing on "special procedures" in connection with its program.

Notwithstanding, there are certain aspects of the implementation of the provisions of paragraph 14, and the corresponding provision in Article 13 of Brazil's Quadripartite Agreement, which could benefit from clarification and confirmation. First and foremost would be the understanding that, notwithstanding Article III.1 of the NPT, which requires the application of safeguards to nuclear material in **peaceful nuclear activities**, the parties to INFCIRC/153 agreements have bound themselves to notify the IAEA of the production and import of all nuclear material, even if it is intended for use in a non-proscribed military nuclear activity, and only then would be able to withdraw nuclear material from safeguards for use in a nuclear submarine program.

Propulsion: A Quid Pro Quo for Nuclear-Armed States and NPT Non-Nuclear Weapon States, Special Report, Federation of American Scientists.

As regards the arrangement itself:

- The arrangement to be prepared for the Board should be drafted in such a way as to protect confidential information. An ancillary document could be developed to accommodate such information if necessary.

- Such peaceful nuclear activities as transport and storage, and activities or processes which merely change the chemical or isotopic composition of nuclear material, such as enrichment and reprocessing, are not intrinsically military and should not, therefore, automatically be entitled to exclusion from safeguards under paragraph 14.

- The arrangement should provide for the non-application of safeguards only while the material is used for propulsion, including explicit provisions with respect to reporting, record keeping and verification, and require the reapplication of safeguards at the earliest point in time as possible, and in any case no later than upon its reintroduction into a peaceful nuclear activity (including transportation, storage and reprocessing) or upon export.

- The arrangement should include provisions that would limit the possibilities for withdrawn material to be effectively "lost to safeguards" through export to an NPT NWS or any other nuclear-armed state.

- Any arrangement for the withdrawal of nuclear material from safeguards, or the application of special procedures, in connection with a NNWS's nuclear submarine program would require approval by the IAEA's Board of Governors.

In developing the arrangements for verification in connection with a state's nuclear naval program, whether for a NNWS or a NWS or other nuclear armed state, consideration also needs to be given to the implications of the AP measures (including CSA or VOA APs), some of which could offer a degree of compensation for the lack of transparency attendant to the withdrawal of nuclear material from safeguards.

Opportunities for achieving progress through a "quid pro quo" have been explored in another FAS project publication. Even if achieving agreement among the nuclear-armed states on significant enhancements in the area of verification is unlikely, agreement among at least the five NPT NWSs on confidence-building measures with respect to their nuclear submarine programs could help alleviate some of the sense of disproportionality of NWS verification obligations among the NPT NNWS and disappointment with the pace of disarmament in time for the 2020 NPT RevCon.

Given the state of delayed development of Brazil's nuclear submarine program, and little interest expressed by other states in such programs, the matter of nuclear submarine programs in NNWS is not one of urgency. However, it is precisely because it is not urgent that considered thought and research should and could be dedicated now to achieving progress in appropriate political and technical solutions.

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