

Crashing Nuclear Submarines Through IAEA Safeguards

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Bottom Line

Let me start with giving the “bottom line” of this assessment. While many well-meaning experts have written [legal, policy](#) and technical tomes on how to [verify](#) naval nuclear fuel and to [convert](#) such fuel from weapon-grade highly-enriched uranium (HEU) to [low enriched uranium](#) (LEU); the unfortunate reality remains that none of the [nuclear navies](#) using HEU are interested in converting to LEU fuel or to allow International Atomic Energy Agency (IAEA) or any other inspectors within a Scandinavian mile of their nuclear fleets – that is a generous 10 kilometres. The IAEA Board of Governors had a [fractious discussion](#) on this matter in late November 2021 and missed an opportunity to set up a consultation process with its member states and experts to define what is needed to safeguard naval nuclear fuel; and whether the “[loop hole](#)” should be closed in the Agency’s [comprehensive safeguards agreements](#) that allows for “non-application of safeguards” on “non-proscribed” military activities such as nuclear-powered submarines. Despite the objections of states involved in the contemplated sharing of naval nuclear propulsion technology, it is now clear that this matter will be controversial at the much postponed [Tenth Non-Proliferation Treaty \(NPT\) Review Conference](#), now scheduled to be held in August this year in discussions in [Main Committee II on IAEA safeguards](#). In this regard, it is mystifying that the IAEA in its [Background Paper](#) on safeguards submitted to the forthcoming NPT Review Conference does not mention safeguards on naval nuclear fuel or the non-application of safeguards on non-proscribed military activities as among the challenges facing the Agency. In my view, the NPT Review Conference must consider this matter of exemption from comprehensive safeguards of naval nuclear fuel and find ways to close off this “loop hole”.

An informative online discussion on nuclear submarine operations, safeguards and related matters can be found [here](#).

Introduction

The United States Navy pioneered naval nuclear ship propulsion reactors and their fuel based on HEU, starting with the [Nautilus](#) nuclear-powered attack submarine (SSN). On 17 January 1955, under the command of Captain Eugene Wilkinson, [USS Nautilus \(SSN-571\)](#) made the first voyage of a nuclear vessel, powered by a 70 MWth (S2W) pressurised water reactor (PWR) built by the Westinghouse Electric Company. Wilkinson flashed the historic message “Underway on Nuclear Power” to Commander Submarine Forces Atlantic. This revolution in marine propulsion and naval technology continues to this day.

The chronology of naval nuclear propulsion after the launch of the *Nautilus* was: 4th June 1958, *K-3* Soviet Navy SSN; 10 January 1963, HMS *Dreadnought*, Royal Navy ballistic missile submarine (SSBN); 23 August 1971, People’s Liberation Army Navy *Han* SSN; 1 December 1971, *Le Redoubtable* French Navy SSBN; 1988 Soviet SSN leased to the Indian Navy and on 14 December 2014 INS *Arihant*, Indian Navy SSBN was launched (nuclear power unit copied from Soviet design).

On the civilian side, in addition to Soviet/Russian nuclear-powered ice breakers and a new floating nuclear power plant, there have been four commercial nuclear-powered ships. On 21 July 1958, the US nuclear-powered passenger-cargo ship, the [Savannah](#), was launched and its first voyage under nuclear power was in 1962. Between 1962 and its withdrawal from service in 1970, the *Savannah* cruised for nearly half-a-million nautical miles under power drawn from a 74MWth pressurised water reactor fuelled by a total of 74 kilograms (163 pounds) of 4% enriched Uranium-235 uranium oxide fuel – the cost of the reactor and fuel was US\$28.3 million.

Germany had the [Otto Hahn](#) launched on 11 October 1969, Japan had the *Mutsu* launched in 1991; the Soviets launched the [Sevmorput](#) on 20 February 1986 – after a refit in 2016, the *Sevmorput* remains in service today. It is powered by a KLT-40 pressurised water reactor (for ice breakers) rated at 135 MWth, with a core of 150 kilograms (332 lb) of highly enriched uranium. The 150 MWth KLT-40S variant is currently used in the Russian floating nuclear power station [Akademik Lomonosov](#). The KLT-40S small medium reactor (SMR) uses 14% low-enriched uranium (LEU) fuel on a three-year refuelling cycle.

It is a credit to the United States Navy that various generations of its nuclear propulsion reactors have been in operation for 65 years, and its nuclear-powered ships and submarines have traversed more than 160 million nautical miles through the world’s oceans without any nuclear safety or security incident – this is to be differentiated from nuclear-powered ship and submarine collisions and groundings.

The inheritance passed down by Admiral Hyman Rickover, the father of the US nuclear navy, is the US Navy’s crown jewel—not to be shared with allied or client states—the only exception being the transfer of naval nuclear reactor technology to the Royal Navy under the UK-US [Mutual Defence Agreement \(MDA\) of 1958](#). The MDA is the true manifestation of the “special relationship” besides the “five eyes network” (soon to be “nine eyes”) – that also includes the US sharing nuclear submarine technology, naval strategic ballistic missiles,

nuclear warhead design and associated firing mechanism and aeroshell design information with the UK.

There were unconfirmed reports that the secretive small team headed by Jake Sullivan, the Biden administration's national security advisor, did not consult the US Navy in advance of making the announcement to provide fast-attack nuclear-powered guided missile submarines (SSGNs) to the RAN – the Royal Australian Navy.

I doubt that in the end this deal likely will ever materialise – the US Navy may well scuttle it after the Biden administration becomes a mere footnote in history in three or more years from now.

Non-Proscribed Non-Peaceful Uses

In 1988, along with my then colleague Marie-France Desjardins, I published a seminal study that, for the first time in a substantive manner, warned against the dangers of the proliferation of fast attack nuclear-powered submarines (SSNs) to non-nuclear-weapon states (NNWS) party to the nuclear [Non-Proliferation Treaty \(NPT\)](#).

Aurora Papers 8, [Opening Pandora's Box? Nuclear-Powered Submarines and the Spread of Nuclear Weapons](#), published in February 1988 by the then Canadian Centre for Arms Control and Disarmament (CCACD), examined the then Canadian government's plan to acquire a fleet of 10 to 12 SSNs and assessed the impact on the safeguards or verification system of the NPT administered by the International Atomic Energy Agency (IAEA).

The IAEA's NPT safeguards system for NNWS is specified in *The Structure and Content of Agreements between the Agency and States required in connection with the Treaty on the Non-Proliferation of Nuclear Weapons* ([INFCIRC/153 \(Corrected\)](#)) of 1971/1972. The basic undertaking of an NPT NNWS such as Australia or Canada is “to accept safeguards, in accordance with the terms of the Agreement, on all source or 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” (emphasis added).

However, [INFCIRC/153 \(Corr.\)](#) in its paragraph 14 provides for the “Non-Application of Safeguards to Nuclear Material to be used in Non-Peaceful Activities”, generally interpreted to refer to nuclear-powered ships and submarines, military space vehicles, and nuclear reactors and radio-thermal generators (RTGs) for military bases or isolated radar stations, etc. However, there is no definition or concept of “non-peaceful or non-proscribed nuclear military activities” as this has never been tested at NPT review conferences or by the IAEA Board of Governors. In the current context of the ([Australia, UK and US](#)) [AUKUS agreement](#) and the [proposed supply of SSNs to Australia](#), the IAEA Board of Governors discussed this matter [at the request of China on 26 November 2021](#), but the Board punted the matter into the indefinite future, preferring to rely on the [AUKUS participating states](#) to present their views in about eighteen months.

To exercise this provision of [INFCIRC/153 \(Corr.\)](#) paragraph 14 on the “Non-Application of Safeguards to Nuclear Material to be used in Non-Peaceful Activities”, the state concerned would have to give an assurance to the IAEA to not use the nuclear material taken out of safeguards for the production of nuclear weapons or other nuclear explosive devices.

Furthermore, IAEA safeguards “shall again apply as soon as the nuclear material is reintroduced into a peaceful nuclear activity [such as a spent nuclear fuel storage or disposition facility]. The Agency shall be kept informed of the total quantity and composition of such unsafeguarded nuclear material ... but shall not involve any approval or classified knowledge of the military activity or relate to the use of the nuclear material therein”.

This exception or “grey area” in the safeguards system was introduced into INFCIRC/153 (Corr.) as, at that time in the 1960s-1970s, nuclear ship propulsion for commercial uses looked promising and several NATO states’ navies had ambitions to sail under nuclear power.

At that time and continuing into later years, Germany, Japan, the Soviet Union and the United States had [nuclear-powered commercial \(merchant\) ships](#), the *Otto Hahn*, the *Mutsu*, the *Sevmorput* and the *Savannah*, respectively, three of which were decommissioned after successful operating histories but the concept never took off internationally for a variety of environmental and commercial reasons. These nuclear-powered merchant vessels are to be differentiated from nuclear-powered ice-breakers and nuclear-powered naval ships and submarines. I have confirmed from reliable sources in Japan that the *Mutsu* was under Agency safeguards and that the IAEA carried out an annual inspection of the nuclear ship propulsion reactor and an inspection was carried out when the spent fuel was removed from the ship.

It is interesting in the context of the current backroom discussions on how to address safeguards modalities under the AUKUS plan, to recall that on 30 March 1978, Australia sent a letter to the IAEA Director General, seeking “*clarification of certain of the provisions and procedures involved in paragraph 14*” of INFCIRC/153 (Corr.). In the letter, Australia *inter alia* stated that to implement paragraph 14 provisions, “*a State would have to seek the approval of the IAEA Board of Governors for using nuclear material outside of safeguards for non-proscribed “non-peaceful activities”*”. And further that, “*In the event of a State not following the prescribed procedures, this would constitute a breach of the safeguards agreement with the Agency and any such breach would be reported to the Board of Governors*”.

In his reply of 17 April 1978, the IAEA Director General Sigvaard Eklund stated that “*No State Party to NPT has so far exercised the discretion referred to in paragraph 14. Accordingly, the Board of Governors has not had occasion to interpret that paragraph, nor has it elaborated in further detail the procedures to be followed pursuant to that paragraph ... [and] any breach of the procedures referred to in that paragraph, must be reported to the Board of Governors*”.

Fast forward to 20 August 1987, [the IAEA in response to my enquiry stated](#) that, “*To the Secretariat’s knowledge there is no formal definition of “non-proscribed military activity”*”. We understand that at the time of preparing INFCIRC/153 naval propulsion was considered as the

most likely use ... [and that the drafters of INFCIRC/153] favoured a narrow construction of the term "non-proscribed military activity", and that processes such as enrichment or reprocessing to produce materials for use in such an activity would not themselves be considered as non-proscribed military uses and would therefore be subject to safeguards in the NNWS concerned" (reproduced from [Aurora Papers 8](#)).

The Problem

The problem the IAEA is facing concerns what has been discussed above: the exemption from safeguards of naval nuclear fuel regardless of whether it is Australia or any other non-nuclear-weapon state with an INFCIRC/153 (Corr.) type safeguards agreement in force. Not only is there not any definition or interpretation of the paragraph 14 exemptions, nor of what is meant by "non-peaceful" and "non-proscribed" military activities, there is also no understanding of, or procedures to, implement paragraph 14 provisions.

For the three AUKUS partner states to take it upon themselves to interpret and to define paragraph 14 exemptions, with or without the IAEA Secretariat's involvement, cannot command confidence without adequate consultations involving interested member states and experts. All IAEA member states are equal under the Agency's Statute, and all states with INFCIRC/153 (Corr.) type safeguards agreements in force have an equal stake in how the structure and content of comprehensive safeguards agreements are concluded and implemented even taking into account the differing levels and extent of their respective nuclear fuel cycles.

Drafting and subsequent changes and amendments, interpretations and practices of Agency safeguards agreements traditionally have been considered in consultations involving all interested IAEA member states. Such consultations involving all interested Agency member states were carried out for the development of [INFCIRC/66](#), [INFCIRC/153 \(Corr.\)](#) and [INFCIRC/540 \(Additional Protocol\)](#) safeguards measures and for the rescission of and modifications to [Small Quantities Protocols \(SQPs\)](#) for states with comprehensive safeguards agreements, before they were brought before the Board for approval. At the [2005 IAEA General Conference](#), Director General Mohamed ElBaradei stated that, "*Since February [2005], the Secretariat has been consulting with Member States on this issue [SQPs], with a view to identifying possible remedies*".

To further reinforce this point, it should be recalled that in 2005 the IAEA Board [established a special committee \(Committee 25\)](#) to consider further strengthening measures for safeguards (as proposed by the US). The [Director General's report to the IAEA General Conference in 2006](#) stated that, "*In June 2005, the Board of Governors established the Advisory Committee on Safeguards and Verification within the Framework of the IAEA Statute, otherwise known as Committee 25. Committee 25 was established, with an initial two-year mandate, to consider ways and means to strengthen the safeguards system and to make relevant recommendations to the Board*".

In the annual Resolution on safeguards adopted on [22 September 2006](#), the General Conference in the resolution's operational paragraphs:

“8. Acknowledges the work of the Advisory Committee on Safeguards and Verification within the Framework of the Agency’s Statute in accordance with the Board’s decision in June 2005, in whose work all Member States may participate, to consider ways and means to strengthen the safeguards system, and to report thereon, with recommendations, to the Board, and appreciates the Secretariat’s efforts in supporting that work;

9. Attaches great importance to the Committee’s making every effort to take any decisions or make any recommendations by consensus within the Agency’s statutory responsibilities”.

Thus, it is abundantly clear that it has been the IAEA’s established practice to consult with member states and to seek their approval for any and all substantive matters concerning the Agency’s safeguards system, as regards amendments, changes or interpretations. Such good practice enables buy-in from all Agency member states and leads to uniform acceptance of procedures and obligations, and thus provides a common agreed foundation for the Board to approve individual safeguards agreements as well as changes or interpretations drawn up on the basis of the agreed standardised texts.

Thus, past practice clearly establishes that no Agency member state or group of such states can unilaterally take up discussing significant aspects of safeguards implementation, with or without Secretariat involvement that will lead to critical alterations or limitations that have implications for the Agency’s safeguards system.

Hence, the point here is that implementation of paragraph 14 derived safeguards exemptions necessarily must first be discussed in consultations or negotiations involving all interested Agency member states to arrive at common understandings that can be put before the Board for its consideration and approval. Australia or AUKUS is not being singled out; the matter is bigger and broader than them and concerns all Agency member states and the Secretariat.

IAEA Board Meeting November 2021

The matter of AUKUS and SSNs for Australia has become a politically charged matter at the Agency, especially given the criticisms voiced by China and the Russian Federation with the Secretariat uncomfortably caught in between.

[China filed its objections](#) with the Secretariat on 29 October 2021, *inter alia* stating that, *“The trilateral cooperation on nuclear-powered submarines undermines regional peace and stability, and constitutes serious risks of nuclear proliferation in contravention of the objective and purpose of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). China expresses its deep concern with and strong opposition to such cooperation. The naval nuclear propulsion reactors and their associated nuclear material to be transferred by the US and the UK to Australia cannot be effectively safeguarded under the current IAEA safeguards system. And therefore there is no guarantee that such nuclear material will not be diverted by Australia to the production of nuclear weapons or other nuclear explosive devices”.*

China went on to note that, *“The issue of safeguards on the naval nuclear propulsion reactors and their associated nuclear material of a non-nuclear-weapon State has a direct bearing on*

the integrity and effectiveness of the NPT, and thus is closely related to the interests of all IAEA member States. It stands to reason that all IAEA member States should participate in the discussion of this issue, in order to seek a solution that is acceptable to all sides. For that purpose, China proposes that a Special Committee open to all IAEA member States be established, to deliberate on the political, legal and technical issues related to the safeguards on naval nuclear propulsion reactors and their associated nuclear material of a non-nuclear-weapon State, and submit a report with recommendations to the Board of Governors and the General Conference of the IAEA. Pending the adoption of the above-mentioned report, the US, the UK and Australia should not commence their cooperation on the nuclear-powered submarines, and the IAEA Secretariat should not engage with the three countries on the safeguards arrangements for the cooperation in question”.

The Agency convened its last regular meeting for the year on 24-26 November 2021. The Secretariat informed the Board that, “On 20 November 2021, the Director General received a Note Verbale from the Permanent Mission of China, requesting the inclusion in the provisional agenda of an item entitled “Transfer of the nuclear materials in the context of AUKUS and its safeguards in all aspects under the NPT”. The letter and the explanatory memorandum related to the inclusion of this item are attached hereto. Accordingly, this item is added to the provisional agenda as: “5. Transfer of the nuclear materials in the context of AUKUS and its safeguards in all aspects under the NPT”.

At the Board meeting, [China](#) took the floor on 26 November and *inter alia* fired off a long list of pertinent questions including, “Whether the AUKUS deal involves nuclear materials? Whether the nuclear material transferred under AUKUS involves nuclear-weapon materials? Are the AUKUS-related nuclear materials under the jurisdiction or control of Australia manufactured or to be manufactured by Australia on its own and indigenously? Or are such nuclear materials to be transferred from the United States and the United Kingdom as Nuclear-Weapon States to Australia as a Non-Nuclear-Weapon State under the NPT? Whether the nuclear materials to be used in the naval reactors for propulsion of submarines under AUKUS are 93% HEU, based on the nuclear-weapon materials currently used by the US in its nuclear submarines, as widely believed by the international community and international experts? If Australia is a country with such exemplary non-proliferation credentials, why did it terminate the relevant agreement with France by shifting from uses of low-enriched uranium to other countries’ highly-enriched uranium with high non-proliferation risks, in its nuclear submarine under AUKUS? As per Article 14 of the CSA template, even if applied, it is generally construed as a provision on nuclear materials, in a context of naval propulsion reactor, developed and manufactured indigenously by the relevant countries, instead of involving nuclear materials transferred. What legal problem may ensue should Article 14 be extended to cover the nuclear materials transferred by providing the relevant safeguards? In what way can the nuclear materials in Australia’s naval propulsion reactors be subjected to IAEA’s effective safeguards? What is the relevance of the IAEA’s comprehensive and full-scope safeguards if they cannot provide safeguards to nuclear submarines under the sea? Whether and how should new formulas be explored to address the above lacuna? China wishes to establish a body in a nature of a special committee, open to all Member States of the Agency, as early as possible, so as to continue in-depth discussions and submit a report with recommendations to the Board of Governors and the General Conference of the Agency. China maintains that, pending a proper formula worked out by Member States of the Agency through

consensus, the United States, the United Kingdom and Australia should not go ahead with their nuclear submarine cooperation under AUKUS, whereas the secretariat of the IAEA, for its part, should not proceed on its own to negotiate the relevant safeguards arrangement with the three countries”.

The Russian Federation, despite being the first country to actually transfer nuclear-powered submarines to another country as far back as 1986, as discussed later, also filed its objections at the Board meeting. In its “Non-Paper” entitled “Approach of the Russian Federation to AUKUS Trilateral Security Partnership and its implications” of 18 November, Russia *inter alia* stated that, “Plans to use the framework of AUKUS to build nuclear-powered submarines for the Australian Navy by the United States and the United Kingdom have a destabilizing effect on the NPT regime. Australia will receive nuclear materials and facilities that, in the NPT non-nuclear-weapon states, should be placed under the IAEA safeguards. Full control and continuity of knowledge should be ensured with regard to nuclear materials and facilities that will be supplied to Australia, including by providing all the necessary access for the Agency’s inspectors. Uncertainties in such a sensitive area are fraught with risks for the entire system of the IAEA safeguards”.

Russia claimed that, “It is of serious concern how this correlates with Australia’s obligations under the Modified Code 3.1 [on early provision of information] that requires countries to inform the Agency about construction of new nuclear facilities no later than when the relevant decision has been made. As far as we understand from the AUKUS Joint Leaders Statement of September 15, such decision has been taken already. If so, we are dealing with a serious violation of the Modified Code 3.1 obligations by Australia”.

Russia also stated that, “It remains unclear what kind of nuclear fuel will be used in these submarines’ reactors. Should it be highly enriched uranium (HEU), that is currently more commonly used for nuclear naval propulsion, the question is how this correlates with the idea of HEU minimization that has been aggressively promoted by the US and Australia on the international arena. We have no doubt that while implementing the intentions indicated under AUKUS, Australia and the US will simply turn the blind eye to this inconsistency for the sake of straightening their own military capabilities. ... We assume that any verification arrangement to be made between the IAEA and AUKUS must be subject to the approval of the IAEA Board of Governors”.

At the Board meeting, the “[Trilateral Statement on Behalf of Australia, the United Kingdom, and the United States](#), on 26 November 2021, *inter alia* reassuringly asserted that, “We emphasize today our willingness and intent to proceed in an open and consultative manner, especially regarding issues of nuclear material, facilities, and activities relevant to the IAEA. We also reiterate our assurance that the trilateral cooperation between Australia, the US and the UK will be fully consistent with the three parties’ respective non-proliferation obligations – and that this cooperation will be pursued in a manner that preserves the integrity of the non-proliferation regime”.

However, the Trilateral Statement worryingly went on to claim that, “Many of the program[me] specifics have yet to be determined. There are aspects that may be relevant to the implementation of respective safeguards and other obligations, but the full implications of

these aspects are not clear at this stage. There are also a number of factors beyond the purview and scope of this Board that would be inappropriate for discussion in this body. A Board agenda item addressing safeguards related to an Australian nuclear-powered submarine program is premature. Australia, the United Kingdom and the United States are strongly opposed to the establishment of a 'special committee' into this issue. Such a proposal is nothing more than an attempt to introduce issues that are extraneous to the IAEA's technical and legal mandate and appears intended to politicise this issue. I underline again that we are in the early stages of an 18 month consultative period".

The Trilateral Statement continued, *"We are also deeply concerned by calls for the Director General to avoid engaging with us on these issues. Not only is it proper and appropriate, but there is a firm legal basis for the Director General and the Secretariat to engage Australia, with the support of relevant partners, on issues relevant to the prospective use of nuclear material by Australia for naval nuclear propulsion. The IAEA has a legal obligation to engage Australia on these issues under Australia's Comprehensive Safeguards Agreement and Additional Protocol. Any suggestion otherwise risks undermining the role of the Agency. ... We will continue to approach this discussion in an open and transparent manner. We welcome the interest and questions of fellow Member States and will continue to engage with them through the appropriate channels and mechanisms".*

The above noted assertion in the Trilateral Statement on engaging with the Agency "in an open and transparent manner" is welcome. However, the AUKUS partner states need to demonstrate their openness and transparency through broad based consultations with interested IAEA member states on the definitions and modalities of implementing INFCIRC/153 (Corr.) paragraph 14 exemptions from safeguards.

Australia, the UK and the US challenged and rejected both China's and Russia's objections, and dismissed China's requests to set up a committee of the Board and for the Secretariat not to engage on the matter. Reportedly, several Western states sided with the AUKUS partners and were successful in having the Secretariat continue its engagement with the AUKUS states and in not establishing a committee. Also, it is reported that unusually the Board Chair did not provide a "Chair's Summary" on this agenda item.

In my view, the AUKUS states and their other allies are misguided in objecting to discussing the generic matter of the "non-proscribed" uses of nuclear material and related "non-application" of safeguards pursuant to paragraph 14 of INFCIRC/153 (Corr.), in a special committee of the Board, as noted earlier in this paper.

This recommendation of mine to discuss INFCIRC/153 (Corr.) paragraph 14 safeguards exemptions in a special committee of the IAEA Board of Governors is independent of the views of China, Russia or other states. In fact, it was first enunciated on 3 November 2021 at an in-person discussion session in Vienna attended by several representatives of the Agency's Member States, including Argentina, Australia, China, Egypt, Finland, Germany, Iran, the Republic of Korea, New Zealand, Russia, Switzerland, the UK and the US among others.

Canadian Episode

Nuclear-powered submarines of the United States and the United Kingdom reportedly are fuelled with highly-enriched uranium (HEU) of [93% to 97% enrichment level](#) that can last for the life of the submarines of up to 33 or more years – this is the same enrichment level as for use in nuclear weapons. In contrast, French nuclear-powered submarines run on low-enriched uranium of 5% to 7.5% enrichment level and need to be refuelled on average after about 7 to 10 years but do not need weapon-grade enriched uranium.

From its very inception, the US nuclear navy has placed its ship propulsion nuclear reactors and the isotopic composition and quantity of their nuclear fuel at the [highest level of classification](#). To the best of my knowledge, one cannot find any official US Navy data on these parameters. References in the open-source literature are speculative and unconfirmed, though there are some technical studies from the US' nuclear laboratories that discuss some data in a very general way.

When [Canada](#) was considering acquiring a fleet of SSNs in 1987, the two potential suppliers were France (*Rubis/Améthyste*-class) and the United Kingdom (*Trafalgar*-class).

In the case of the United Kingdom as supplier, Canada was informed that US Congressional approval would be required for the UK to construct and supply SSNs (with US design reactors and nuclear fuel) to Canada. The nuclear ship propulsion reactor design and nuclear fuel information would be subject to the highest level of classification and could not be shared in any form with any third party, including the IAEA. The US authorised the UK to share some technical data on the UK's US-derived (S5W) nuclear propulsion system for the *Trafalgar*-class – the UK's PWR2 naval reactor based on the US' S5W naval reactor design.

For Canada to exercise paragraph 14 provisions, given this US' requirement for absolute secrecy and classification, Canada would have been contractually prohibited to provide any detailed information to the IAEA under its NPT safeguards agreement ([INFCIRC/164](#)) on the submarine reactors and their fuel whether fresh or spent, or on the operational burnup of the fuel, thereby creating a permanent loophole or gap in IAEA safeguards coverage in Canada. A certain large quantity, up to 200kg or more, of 93%--97% HEU for naval nuclear fuel per submarine would either be taken out of, or never placed under, Agency safeguards; and the spent fuel coming out the boats after thirty years or more also would be subject to secrecy, and thus the IAEA would not be able to measure the quantity or isotopic composition or to verify the HEU in naval use.

One proposal was to send Canadian-origin natural uranium to the US, additional to Canada's normal exports, for enrichment and fabrication into naval fuel by the US for use in the UK-manufactured and supplied *Trafalgar*-class SSNs. Since Canada would import fully constructed and fuelled SSNs, Canada reportedly proposed to exclude the imports under the terms of paragraph 14 of its CSA as non-proscribed (non-explosive) military activity and not provide any safeguards relevant information to the IAEA from beginning to end.

Safeguards experts from the foreign affairs and defence departments and from the Atomic Energy Control Board of Canada (AECB), the official point of contact for Canada with the

Agency, held several rounds of closed consultations with the IAEA but did not reach any final agreement or arrangement. One challenge faced by the Canadian team was the Agency's then safeguards culture reliant on what the Agency itself later termed a "mechanistic" bureaucratic approach that led to some difficulties for the Secretariat's team in grasping the details and intricacies of naval nuclear propulsion and related military secrecy requirements.

This was not surprising as in those days Agency safeguards were applied in a narrow "mechanistic" manner and as a result, for example, missed Iraq's clandestine nuclear activities at the Tuwaitha nuclear complex. These deficiencies were resolved with the "93+2" safeguards strengthening measures implemented during 1993-1996 and with the Additional Protocol approved by the IAEA Board in 1997. The Canadian SSN acquisition programme was cancelled by 1989 on cost grounds and the Royal Canadian Navy bought four used *Upholder*-class diesel electric boats from the UK in 1995 that never could be operated to their full potential due to design and other faults and are now due for replacement.

Australian SSNs

The AUKUS proposal seems bold and ambitious, given considerations such as limited available naval ship building capacity in the UK and the US, limited stocks of HEU for naval fuel, and transfer of sensitive military-industrial and nuclear technology, were the SSNs to be constructed in Adelaide as indicated by Canberra.

It remains in doubt that in the end the AUKUS proposal to provide Australia with US design SSNs will ever materialise. It is in the public domain in the specialised naval community that the projected delivery timeline is long and the US Navy's top brass may well scuttle the SSN element of AUKUS after the Biden administration is relegated to a mere footnote in history three or more years from now.

The US Navy does not have the spare industrial capacity to build eight boats for Australia, when it is struggling to meet its own requirements of launching two *Virginia*-class SSGNs and one *Ohio*-class SSBN (ballistic missile submarine) per year. And, as was reported by the US National Nuclear Security Administration (NNSA) some years back, its stock of 93% and 97.3% HEU designated for naval use is limited (about 160 MT) and will be exhausted in 50-60 years as the US Navy ramps up its global operations especially in the Pacific Ocean.

The alternative to the *Virginia*-class for Australia is the UK's *Astute*-class attack submarine, which costs less to manufacture and operate as it has a smaller crew. The UK's naval construction capacity also is limited and its submarines have come off the production line behind schedule. BAE Systems, the UK's naval constructor, has little, if any, spare capacity as it is occupied with manufacturing the Royal Navy's *Dreadnought*-class SSBNs. The Royal Navy's naval nuclear propulsion reactor type PWR2 "Core H", reportedly, is a lifetime core lasting 25-30 years. The Royal Navy is phasing out its PWR2 naval nuclear reactors that are in use in the *Astute*-class and older *Trafalgar*-class SSNs, to be replaced by the PWR3 units.

In 2011, it was reported that in 2009 the [Defence Board](#) of the UK Ministry of Defence found that the PWR2 naval reactors fall “[significantly short](#)” of the UK’s current nuclear safety standards as they have a vulnerable type of cooling system and could be potentially vulnerable to a structural failure of the primary cooling circuit. The PWR2/2b-type naval reactor presently is powering four *Trident*-class SBBNs, six *Trafalgar*-class SSNs and seven *Astute*-class submarines.

The Rolls Royce [PWR3](#) naval reactor under development is designed to rely on “passive” cooling, is less reliant on back-up power and can inject coolant into the reactor using other methods in an emergency. The PWR3 apparently is based on the S8G/S9G design widely used in modern US nuclear submarines (reactors designed for natural circulation core cooling and capable of operating at a significant fraction of full power without reactor coolant pumps). The *Astute*-class SSN is designed for [PWR2/PWR2b](#) naval nuclear reactor units and cannot accommodate the larger next-generation PWR3 reactor.

In addition to these limitations, the UK has a very small stock of HEU for naval propulsion (estimated at 7.2 MT) and not enough to supply eight *Astute*-class SSNs for Australia.

Now that under [AUKUS](#), the US has agreed to provide SSNs and SSN technology to Australia, it is very likely that not only would Congressional approval be required but also Australia very assuredly would be prevented by the US from sharing any technical information on the naval nuclear reactors and declaring the quantity or isotopic composition of the HEU naval fuel to the IAEA under its NPT safeguards agreement ([INFCIRC/217](#)) and under its additional protocol ([INFCIRC/217/Add.1](#)).

For NPT NNWS, such as Australia for example, there could be four possible avenues for the acquisition of nuclear fuel for ships or submarines outside of Agency safeguards:

- 1) acquisition/importation of the nuclear material at an enrichment level suitable for the fuelling of naval nuclear ship propulsion reactors;
- 2) setting up an enrichment facility and production of highly-enriched uranium indigenously;
- 3) sending own natural or refined uranium to another country for enrichment; or
- 4) acquisition of naval nuclear ship propulsion reactors fully fuelled either for installation in the naval vessels’ hulls being assembled/constructed in Australia; or installed in fully operational vessels transferred into Australian Navy’s ownership and control.

Should Australia choose to import submarine nuclear fuel, it would become the first non-nuclear weapon state party to the NPT to acquire weapon-grade fissionable material outside of safeguards for a military purpose – albeit non-explosive. This might be done controversially by exploiting the weakness of Article III.1 of the NPT which does not require the imposition of safeguards on nuclear material transferred for a non-peaceful nuclear activity and triggering paragraph 14 of INFCIRC/217 Australia’s safeguards agreement. The IAEA Board of Governors would need to approve any such action and such an exemption should adversely affect the Agency’s safeguards conclusion for Australia given the exemption of large quantities of HEU-based naval reactor fuel.

Alternatively, should Australia decide to enrich its own nuclear material, it would be the first NNWS party to the NPT to invoke the INFCIRC/153 paragraph 14 exemption clause for the cut-off of safeguards even though one interpretation of paragraph 14 provisions is that the enrichment process for naval nuclear fuel should not be exempted from safeguards. This might well be a moot point if Australia is contractually prohibited to provide design information on naval nuclear fuel, as in that case the quantities, enrichment level and isotopic composition would be classified behind a wall of military secrecy. Reportedly, at present, Australian national legislation does not allow enrichment in the country, but the legislation could easily be amended by Canberra.

Australia is a leading pioneer in developing third-generation uranium enrichment technology based on lasers. Separation of Isotopes by Laser Excitation (SILEX) classified proprietary technology was developed by Australian scientists Michael Goldsworthy and Horst Struve who formed a public company, [SILEX Systems Ltd. \(SSL\)](#). A review of the SILEX process was done for the IAEA in February 2005 to assess the potential for the SILEX Company (SSL) to produce significant quantities of highly enriched uranium (HEU). The report remains classified, "Safeguards-in-Confidence" by the IAEA and is not available for distribution beyond the confines of the Agency. In the current context of the AUKUS arrangements, it would be helpful were the IAEA Board of Governors to request the Secretariat to issue the report as a GOV/INF for consideration by member states.

Were Australia to have its own uranium enriched elsewhere, the precedent created would be determined by the composition of the material sent abroad for enrichment. If natural uranium was transformed in Australia before being sent abroad, it would automatically become subject to IAEA safeguards. In this instance, Australia would have no option but to invoke paragraph 14 of INFCIRC/217 regarding non-proscribed military activities and withdraw the nuclear material from safeguards probably at the point where it leaves the conversion facility.

On the other hand, were Australia to send natural uranium or yellowcake for enrichment abroad, there would not be a requirement to invoke INFCIRC/217 paragraph 14, because safeguards are not mandatory when nuclear material in this composition is being sent to a nuclear-weapon state (NWS). The highly-enriched weapon-grade uranium-based naval nuclear fuel would be sent to Australia for a non-peaceful or "non-proscribed" military as opposed to a "peaceful nuclear activity" outside of safeguards. Again, IAEA Board approval should be required.

Import of fuelled naval reactors or operational SSNs could only be outside of Agency safeguards but reported to the Agency, but this would need the consent of the Board.

By creating *within* the NPT/IAEA regime a new system of pre- or non-NPT types of arrangements under which a state can operate two parallel nuclear programmes, one under and one outside IAEA safeguards, Australia would be weakening the uniformity of the structure and implementation of comprehensive Agency safeguards in NPT NNWS and in practice emulating India, a state not party to the NPT, having one part of its nuclear activities under safeguards and another outside. Obviously, it must be recognised that Australia and India have very differentiated safeguards obligations but, in their implementation, there

would be similarity or parallelism. By becoming the first NNWS party to the NPT to militarise the atom, Australia would also risk sacrificing its long time claim to strong nuclear non-proliferation credentials.

Thus, Australia when exercising paragraph 14 provisions would be creating a black hole as regards significant quantities of HEU in naval nuclear propulsion use – 200 to 250 kg of up to 97.3% HEU per boat for a total of 1.6 to 2.0 metric tonnes, that is 1600 to 2000 kg. Recall, that for safeguards purposes, the IAEA calculates a Significant Quantity (SQ) as 25kg of HEU even though with modern designs a nuclear warhead can be fabricated with as little as 5 kg.

That Australia, or any other NPT NNWS, could be able to exercise INFCIRC/153 (Corr.) paragraph 14 exemptions from NPT/IAEA comprehensive safeguards without prior understanding of, and agreement on, the modalities involved and prior approval of the Agency's Board of Governors, beggars belief. The only practical and rational way forward is for the Board of Governors and interested member states to arrive at a clear and common understanding on how to interpret and implement paragraph 14 exemptions on a non-discriminatory and uniform basis; and further, to consider whether to close off the paragraph 14 "loop hole" for good.

Safeguards Conclusions and Nuclear-powered Submarines

INFCIRC/153 (Corr.) was approved in 1972 by the IAEA Board of Governors and [INFCIRC/540](#), *The Model Protocol Additional to the Agreement(s) between State(s) and the International Atomic Energy Agency for the Application of Safeguards*, was approved in 1997. The Additional Protocol provides for the "broader conclusion" regarding the absence of undeclared nuclear material or activities.

For "drawing [safeguards conclusions](#)", the Agency specifies that, "For States with a Comprehensive Safeguards Agreement (CSA) and an Additional Protocol in force [such as, for example, Australia]: If the IAEA's Secretariat has completed all evaluations and found no indication of the diversion of declared nuclear material from peaceful activities and no indication of undeclared nuclear material or activities for the State as a whole, the Secretariat concludes that *all nuclear material remained in peaceful nuclear activities*".

Without getting into an unnecessary "legal discussion" in light of the above, in my view, were Australia or any other NPT NNWS to withhold from the IAEA information and safeguards application on naval nuclear fuel pursuant to paragraph 14, then they should not be able to qualify for the IAEA's safeguards conclusions of: (a) "no indication of the diversion of declared nuclear material from peaceful nuclear activities; and, (b) no indication of *undeclared* nuclear material or activities. Thus, the IAEA Secretariat would not be able to conclude that, [for Australia], "all nuclear material remained in peaceful activities".

Implementing paragraph 14 safeguards exemptions would set a really bad precedent. There is an old saying, "what's sauce for the goose, is also sauce for the gander". Should Australia be able to exempt weapon-grade highly-enriched uranium-based naval fuel from Agency safeguards, then why not others such as, for example, Argentina, Brazil, Canada, Iran, Japan and South Korea? For many years Brazil has been avoiding concluding an additional

protocol with the IAEA citing its naval nuclear propulsion research and development programme. Both Brazil and Iran have claimed that one requirement for their uranium enrichment activities is the possibility of acquiring nuclear-powered submarines.

Reportedly, the AUKUS states have [communicated to the IAEA Director General](#) their intention to provide a fleet of SSGNs to the Royal Australian Navy. This means that at some future time Australia could be invoking paragraph 14 of its NPT safeguards agreement to exclude significant quantities of highly-enriched uranium for naval nuclear fuel – up to 1600 to 2000 kg or more of weapon-grade HEU. The claim by the AUKUS states “that a critical objective of this cooperation will be to maintain the strength of both the nuclear non-proliferation regime and Australia’s exemplary non-proliferation credentials” and that they will be “engaging with the IAEA throughout the coming months” likely may end up as an oxymoron.

It should be matter of serious concern for the IAEA Board of Governors that the “IAEA will engage with them [AUKUS] on this matter in line with its statutory mandate, and in accordance with their *respective* safeguards agreements with the Agency” – as this does not make much sense in that the paragraph 14 provisions apply only to Australia and not to the UK and the US “voluntary offer safeguards agreements” ([VOAs](#)) that do not contain paragraph 14 exemptions (which apply exclusively to NNWS).

After some encouraging statements in September, the Agency’s Director General is now correctly sounding more cautious. During his recent trip to Washington in October 2021, [The Guardian newspaper quoted him as saying](#), “*The procedures by which the Agency would ensure that the fuel, removed from agency oversight, is not diverted to making nuclear weapons have yet to be worked out. We have to have specific agreements to make sure that whatever they receive technology-wise or material-wise is under safeguards. There has to be a specific arrangement with the IAEA. Now we have to dot the Is and cross the Ts, which has never been done before, and it’s a very, very demanding process. It cannot be excluded that other countries would use the AUKUS precedent to pursue their own nuclear submarine plans*”.

The Director General was also [reported](#) as saying, “*I already set up a taskforce within the inspectorate, composed of very experienced safeguards inspectors and legal experts to look into this.*”

This is more of a policy matter than a legal or technical one, dotting the “Is” and crossing the “Ts”, in my view is way too optimistic – this will not happen, though I would be pleased to be proved wrong! Again, as noted above, the Board needs to grapple with the intricacies of the practical exercise of paragraph 14 exemptions and in this effort could benefit from consultations with member states and experts on this matter.

Define Non-Proscribed Military Activities

In my view, it is neither responsible nor practical for the Agency’s Secretariat to engage in secret with the AUKUS states to work out how to deal with highly enriched uranium fuel for Australia’s nuclear-powered submarines, especially when there is neither any agreed definition of nor modalities for how to exempt such nuclear material from safeguards. It

should be unacceptable for member states that three AUKUS states (and the Secretariat) prepare the modalities (in secret) and then present them as a *fait accompli* to the Board of Governors (and member states) for approval – thus putting the proverbial cart before the horse!

There are precedents at the Agency, as already discussed above, on how to address and deal with evolving safeguards issues and new challenges. After the shock of missing Iraq's clandestine nuclear weapon development activities at the Tuwaitha nuclear complex which was under Agency safeguards and inspections, the Board of Governors set up an open-ended committee to strengthen safeguards. Thus, the Agency's "93+2" safeguards strengthening measures and the protocol additional to safeguards agreements (Additional Protocol) were both developed in extensive and complex discussions and negotiations involving the Secretariat and member states. As already noted above, in 2005, a US proposal to further strengthen safeguards was also discussed in a committee of the Board in open-ended consultations involving all member states. Furthermore, also in 2005, the issue of modifications to the Small Quantities Protocol was considered by the Board by engaging in consultations with interested member states. This shows that the usual and standard practice at the IAEA is to discuss safeguards matters that affect all member states in transparent consultations involving all interested member states – not in secretive behind-the-scene discussions.

The exceptions of devising monitoring and verification, not safeguards, measures for specific political cases such as the US-North Korea "Agreed Framework"; the Six Party agreement with North Korea on "dismantlement and disablement"; the EU/E3+3 (EU/France, Germany and UK + China, Russia, US) and Iran "Joint Plan of Action" and the "Joint Comprehensive Plan of Action", were negotiated between and among the states involved with the Agency providing technical inputs as requested. Importantly, the IAEA is *not* a party to any of these agreements/arrangements; rather it is requested to implement the measures agreed by the states involved, as approved by the Board. The JCPOA is not a safeguards agreement along the lines of INFCIRC/153 (Corr.); it is an *ad hoc* "monitoring and verification" arrangement that is not a precedent for any other state as confirmed by the Board of Governors and UN [Security Council resolution 2231 \(2015\)](#). Thus, as these arrangements were special *ad hoc* measures, they could be negotiated among the concerned states without consulting or seeking the approval of IAEA member states and Board of Governors in advance.

Another important consideration is that the Agency's Statute prohibits it being involved to "[further any military purpose](#)". Now, it could be argued that in exempting significant quantities of highly-enriched uranium naval fuel from comprehensive safeguards for a state's navy, the Agency is furthering a military purpose – that of facilitating military operations by nuclear-powered ships or submarines. Thus, there is an inherent tension or contradiction between the Agency's statutory obligations and the provisions of paragraph 14 of INFCIRC/153-type comprehensive safeguards agreements. The negotiating record on INFCIRC/153 shows that the drafters and negotiators of the text were blissfully unaware of this tension with the Statute when they were drafting the provisions of paragraph 14.

The Agency's involvement in working with the Russian Federation and the US to work out the "monitoring and verification" arrangements of their bilateral "[Trilateral Initiative](#)" and the "[Plutonium Management and Disposition Agreement](#)", was to ensure at the request of the two states that specified quantities of plutonium released from military use were [dispositioned](#) by each of the two states through agreed technical procedures to render the ex-weapons plutonium unusable for nuclear weapons. In this case, the Agency's involvement and activities were to monitor the removal or withdrawal of weapon-usable plutonium from military to non-military purposes. Thus, this Agency experience was *not* to "further any military purpose" but was completely different in its objectives from facilitating military use of weapon-usable and other nuclear material for naval use – hence was not relevant for matters concerning paragraph 14 implementation.

In contrast, for Australia or any other NPT non-nuclear-weapon state to negotiate any exemption from safeguards of nuclear items under paragraph 14 of its safeguards agreement, concerns *all* Agency member states as all NPT/IAEA safeguards agreements are pursuant to the NPT and are based on the common model of INFCIRC/153 (Corr.) and approved by the Board for implementation under common and uniform modalities. This might be too subtle a point for some to grasp, but it is clear that any substantive modification to any INFCIRC/153 (Corr.) type safeguards implementation, even such as paragraph 14 exemptions, affects the integrity of the Agency's "safeguards system" and is of direct concern to all IAEA member states not only to the state(s) involved; therefore, it should be considered in wider consultations conducted by the Board of Governors.

The only responsible options for the IAEA Board of Governors are two:

- 1) to consider in detail in an open and transparent manner the matter of the interpretation of INFCIRC/153 paragraph 14 provisions and clarification and definition of "non-peaceful" or "non-proscribed" nuclear military activities, and in this context also to request the Standing Advisory Group on Safeguards Implementation (SAGSI) to provide technical inputs and assessments for consideration by the Board and in consultations with all interested member states; and
- 2) to caution Australia, and other member states, regarding the deleterious effects on the Agency's "safeguards system" should they persist in seeking to exercise paragraph 14 provisions and consequently to keep large quantities of HEU and other nuclear material for naval activities outside of IAEA safeguards.

Given the Agency's and member states' continuing efforts to [strengthen the effectiveness and improve the efficiency of Agency safeguards](#), it would be totally counterproductive and illogical to then weaken the safeguards system by permitting and facilitating exemption from safeguards of large quantities of weapon-usable nuclear material, even if conceivable under what I would assert is an outdated provision of comprehensive safeguards agreements which has been superseded by the additional protocol (INFCIRC/540). Rather, the Board should consider the responsible decision to revoke paragraph 14 of all INFCIRC/153 (Corr.) based safeguards agreements, much like the Board [rescinded](#) the original provisions of the Small Quantities Protocol in 2005.

The NPT and Nuclear-Powered Submarines

At the Tenth NPT Review Conference, postponed from 2020 to January 2022 and now further delayed to [August](#) this year due to the continuing corona virus pandemic, states parties also could seriously consider recommending that the INFCIRC/153 (Corr.), paragraph 14 exclusion is undesirable and defeats the objectives and purposes of NPT safeguards, and adds another layer of discrimination to that between nuclear-weapon and non-nuclear-weapon states by creating a new category of NNWS with significant quantities of weapon-grade nuclear material out of NPT safeguards.

There is an indirect precedent in that, at the 2000 NPT Review Conference, states parties decided that NPT Article V on peaceful nuclear explosions should no longer be availed of and that the 1996 Comprehensive Nuclear-Test-Ban Treaty (CTBT) prohibits all types of nuclear explosions.

China already has submitted a [working paper](#) to the upcoming review conference which *inter alia* states that, “*The issue of safeguards on the naval nuclear propulsion reactors and their associated nuclear material of a non-nuclear-weapon State has a direct bearing on the integrity and effectiveness of the Non-Proliferation Treaty, and thus is closely related to the interests of all IAEA member States*”.

It is virtually certain that China, Russia and other states will raise this matter in Main Committee II (on non-proliferation) at the review conference and that this promises to be a contentious affair that will impact on the adoption of its report.

Other Implications

Transfer of SSNs/SSGNs equipped with conventional land attack cruise missiles could pose issues for the credibility of the Nuclear Suppliers Group and the Missile Technology Control Regime. Furthermore, should Australia amend its legislation and establish a uranium enrichment facility to produce highly-enriched uranium for naval reactors, there could be implications for the “[Hexapartite Safeguards](#)” arrangement involving Australia, Japan, the so-called “troika” states, i.e. Germany, the Netherlands and the United Kingdom, EURATOM, the United States and the [IAEA](#), for applying effective and efficient safeguards to commercial centrifuge enrichment plants..

Nuclear Submarine Proliferation

Unfortunately, proliferation of nuclear-powered and nuclear-armed submarines already has taken place. As indicated above, it was the Soviet Union that in 1986 became the first state to “lease” a ([Charlie](#)-class) nuclear cruise missile submarine to India. Then, in February 2004, Russia “leased” an *Akula*-class fast nuclear attack submarine to India. And, in 2019, India “leased” yet another *Akula*-class fast attack nuclear submarine from Russia to be transferred by 2025. Indian Navy [Commodore Kumar](#) said in September 2021, that the “*Charlie I class boat was an SSGN and did not have any nuclear missiles. The boat was completely manned and operated by the Indian crew and there were no restrictions on access*”

to any compartment or weapon load. The number of Russian sailors onboard never exceeded seven during sea sorties”.

Reportedly, India copied design information from the *Akula*-class SSN for building its own nuclear submarines, whose [reactors are of Russian design provenance](#) and reportedly built with substantial Russian help. As an aside, it might be recalled that all 22 of India's pressurised heavy water reactors (PHWRs), operational or under construction, are unauthorised copies or derivatives of the Canadian-supplied CANDU PHWR. As India, is *not* a state party to the NPT, it does not have an INFCIRC/153-type comprehensive safeguards agreement with the IAEA; rather it has an “item specific” INFCIRC/66/Rev.2-type safeguards agreement and hence India can have civilian nuclear activities under safeguards and parallel nuclear weapon activities obviously outside safeguards. Nonetheless, Russia already has set a bad precedent and this weakens the credibility of its case against Australia's acquisition of a fleet of SSNs.

The Way Forward

Australia's acquisition of SSGNs under AUKUS could well open up a [Pandora's Box](#) of proliferation as other non-nuclear-weapon states such as Argentina, Brazil, Canada, Iran, Japan, Saudi Arabia and South Korea among others, and even Taiwan (China), may feel emboldened to develop or acquire nuclear-powered ships or submarines and keep nuclear fuel (both low- and highly-enriched uranium) outside the scope of IAEA comprehensive safeguards. As discussed above, this would weaken the IAEA safeguards (verification) system already facing challenges from new technologies, open up possibilities of diversion of nuclear material for nuclear weapons, create an additional level of discrimination under the NPT, and imply differentiated safeguards obligations under comprehensive safeguards agreements (INFCIRC/153 (Corr.)).

In my view, Australia would be well advised to revert to acquiring a fleet of diesel-electric submarines (SSKs) with advanced [air-independent-propulsion \(AIP\) systems](#) supplemented by fuel cells. There are several options available. France's DNCS SMX [Ocean-class](#) submarine shares its basic design with the [Barracuda-class](#) SSN. It carries advanced AIP technology that gives it a patrol range of more than 18,000 nautical miles, patrol deployment of 90 days, and underwater endurance of 21 days. Alternatively, Australia could revert to conventionally powered adapted *Barracuda*-class boats equipped with advanced AIP technology. Another option could be the German [Type 216](#) submarines, built by Howaldtswerke-Deutsche Werft (HDW) equipped with an AIP systems supplemented with lithium ion batteries as a supplementary energy sources. The *Type 216* has an endurance up to 120 days including a fully submerged AIP capability of more than 18 days, and a range in excess of 10,000 nautical miles. By all accounts SSKs are quieter and harder to track than SSNs – there have been war game exercises in which reportedly US Navy's capital ships have been “sunk” by conventionally powered submarines of [Canada](#) and [Sweden](#).

Concluding Comments

This discussion has focused on important relevant issues and questions pertaining to the AUKUS plan to equip the Royal Australian Navy with nuclear-powered attack submarines (SSNs). The AUKUS states apparently have initiated non-transparent and secret discussions with the IAEA on how best to take advantage of a “grey area” or “loophole” in IAEA comprehensive safeguards to exclude weapon-grade highly-enriched uranium from Agency safeguards. There is a rumour that the AUKUS states may have approached France to discuss the possibility of equipping the SSNs to be supplied by the UK/US to Australia with France’s naval nuclear reactor fuelled with low enriched uranium. Either way, there is no clear and agreed understanding and interpretation of the technical and policy modalities on the interpretation and implementation of this “grey area” and related exemption of nuclear material from safeguards.

As already noted above, [China](#) and the Russian Federation have launched diplomatic fusillades across the bow of the Agency’s Board of Governors criticising the AUKUS plan for providing nuclear-powered submarines to Australia. Many Western Group states intimidated by the pressure and influence by the AUKUS alliance seem to be taking a back seat and waiting to see the colour of any agreement cooked up by the AUKUS states and the Agency, thus giving Australia the benefit of the doubt and showing sympathy for the US’ confrontation with China. The Non-Aligned States (NAM) have not yet shown their hand, but many are caught in a Catch-22 situation, fearful of both antagonising China and antagonising the US and its Asia Pacific partners.

In any case, AUKUS and the safeguards exemption for nuclear-powered submarines will bedevil future Agency Board meetings, as already was the case in November. The IAEA Secretariat needs to be neutral and limit itself to its technical mandate, not favour any side, exercise maximum restraint, transparency and inclusivity with all interested member states through open and transparent consultations that ought to be mandated by the Board of Governors.

The Board could decide to mandate one of the two Vice Chairs to consult with interested member states and experts on the generic technical matter of INFCIRC/153 (Corr.) paragraph 14 provisions with the objective to develop possible understandings and interpretations from policy, technical and legal perspectives for the consideration of the Board. Secrecy, favouritism and sleight of hand on this important and sensitive matter shall surely backfire to the detriment of the Agency and its safeguards system and all necessary steps should be taken to avoid such an outcome. Finally, at the Tenth NPT Review Conference in [August 2022](#), Main Committee II on non-proliferation (and safeguards) also logically must take up this matter and recommend restraint leading to possibly nullifying paragraph 14 exemptions. Now is the time to further strengthen the effectiveness and improve the efficiency of the IAEA safeguards system, not to weaken it and not drive a fleet of nuclear-powered submarines through it.

The Author

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