US-China Civilian Nuclear Cooperative (123) Agreement: What's at Issue; What Might Congress Do?

The proposed US-China nuclear cooperative agreement presents a clear challenge to Congress. Not only has China violated its pledge not to divert US nuclear technology to its military sector (in this case to its naval submarine reactor program see p. 2 of the attached brief below), but it continues to proliferate nuclear weapons related technology through "private" entities and directly to Pakistan in violation of its obligations as a Nuclear Supplier Group member (see p. 4). Recently, the Justice Department indicted several overseas Chinese for hacking into Westinghouse computer servers and stealing nuclear design information (see p. 5). Also, the proposed agreement, unlike that the US cut for Russia in 2008, gives China advanced consent to chemically strip out nuclear weapons usable plutonium from spent fuel produced by US-designed reactors (see pp. 5 ff). This could allow China to produce and stockpile tens of thousands of bombs worth of plutonium over the next three decades without having to ask US permission in each instance it reprocesses.

The nuclear industry and Administration officials downplay these concerns. We are talking to China about nuclear proliferation in other forms. They are likely to proliferate anyway. We should not cut ourselves off from the business and possible influence it might afford. The French and other nuclear vendors will only take up the business the US would otherwise ply. The Chinese, moreover, will never want or need more than the 450 additional nuclear weapons they could fashion out of the military surplus they already have. In any case, nuclear weapons-grade material is best made in dedicated military reactors (see pp. 8 and 9).

Although handy, much of this argumentation is misleading. Only a few members of Congress are considering voting to disapprove the nuclear deal. Most, instead, are focused on how to condition its approval, as Congress did with the original PRC nuclear agreement back in 1985 (see p. 13).

Nor is losing manufacturing jobs to other nuclear exporters all that likely. In fact, the only major US-based nuclear reactor exporter, Westinghouse, is entirely owned by Japan (Toshiba 87% and IHI 3%) and Kazakhstan (Kazakatom 10%). All of the proceeds from any Westinghouse export to China go entirely to these overseas stockholders (see p. 9). In addition, almost no US manufactured nuclear good that requires a Nuclear Regulatory Commission export license is any longer being made in the US. US firms are making canned coolant pumps (Curtiss-Wright and Enertech) and special valves (SPX Corporation) for the AP 1000 but because China would like to make these components domestically, it is unlikely that these US manufacturing efforts will grow (see pp. 9-10).

Also, the only French reactor exporter, AREVA, is so bedevilled by financial and technical setbacks it is expected to get out of the reactor export business. As for the Japanese and Koreans, their nuclear efforts are technically tied to continued technology transfers from the US (see pp. 11-12). Finally, in the long run, the Chinese have a multitude of reasons to avoid relying on the Russians, who they are more likely to have to compete with in the next three decades diplomatically, economically and militarily. For all these reasons, most industry experts see the Chinese relying most on the AP 1000 and cloning their own version the CAP 1400 (see p. 12).

This, then, brings us to the worry about China's nuclear weapons future. China may well keep its nuclear weapons arsenal small. However, there is good reason to worry that they might not especially if China's relations with its neighbours – India, Russia, Japan, Korea, and the US – continue to worsen. If they do, it actually is easy to imagine Russia deploying more tactical nuclear weapons systems in Central Asia and Siberia; India deploying more sea and land based nuclear missiles; the US and its allies deploying more

missile defences and forward-based military assets. All or any of this could prompt China to build up. Over the next three decades, it is not inconceivable that Beijing might want at least to be able to threaten to ramp up its nuclear weapons arsenal not by hundreds but by several thousands of warheads (see pp. 5-8). In this regard, being able to exploit their civilian nuclear infrastructure as a possible military nuclear mobilization base cannot be discounted. China, after all, has already done this with US civilian nuclear technology in support of its naval reactor program.

More generally, if no effort is made to qualify the green light this deal gives China to separate as much nuclear weapons usable plutonium from US-origin spent reactor fuel as it would like, Japan will be attracted to do likewise. South Korea, in tun, will have no choice but to demand that the current nuclear cooperative agreement with Washington be modified to allow it to follow suit to hedge against both China and Japan. Within the lifetime of the PRC 123, this could result in the stockpiling of tens of thousands of bombs worth of nuclear weapons usable plutonium in the region. This will only make management of security there that much harder.

All of this matters as Congress considers what, if any, conditions they would like to place on the implementation of the proposed US-PRC nuclear deal. Among the most important of these would not block proceeding with the agreement but would prevent the reprocessing of spent fuel generated in US-designed reactors until and unless the President could certify that he had secured Chinese agreement to grant America case-by-case consent rights, like those it secured with Russia (see pp. 13-14).

Beyond this, Congress must consider the wisdom of fast tracking US nuclear technology and component transfers as envisioned under the deal. After the PRC 123 comes into force, the deal calls for the creation of lists of nuclear technologies, components and end uses for which licensing and authorization approvals will be expedited. Given the likelihood that China has or is now attempting to divert US civilian nuclear technology to its submarine reactor program, though, pushing such streamlining hardly makes sense. Making the President certify that this listing making will not interfere or supersede the existing licensing and authorization review processes would be useful. It also would be appropriate to ask that Congress and the intelligence community be able to participate in these reviews.

In support of each of these conditions, Congress also will want to get the Executive Branch to define what "US-designed" means regarding reactors and other controlled nuclear components. Currently, this task is largely left to industry to decide. Given that US nuclear exporters sometimes include the transfer of US technology to help seal their deals, though, this his hardly prudent.

Finally, it would be wise for Congress to require the intelligence community to routinely assess what the drivers of future Chinese nuclear military requirements might be and how the Chinese might exploit US civilian nuclear technology and China's own civilian nuclear infrastructure to meet these requirements. Had this been done when the original nuclear cooperation agreement was struck, there is a good chance greater protections would have been in place to prevent China from trying to divert the nuclear technology they now are suspected of having diverted to upgrade their submarine reactors.

These, of course, are only suggestions. What, if anything, Congress ultimately does remains to be seen. The nuclear deal automatically will come into force either this summer or fall, depending upon how many days Congress remains in continuous session. There is no legislative deadline, however, on Congress conditioning nuclear cooperative agreements. On this Congress can act any time.

1. *Is China in compliance with its existing 123 agreement?*

A. No.

i. On May 12, 2015 the Senate Foreign Relations Committee (SFRC) testimony suggests (http://www.foreign.senate.gov/hearings/the-civil-nuclear-agreement-with-china_balancing-the-potential-risks-and-rewards) that the PRC had violated the peaceful end-use pledge it made when it signed the 1985 US nuclear cooperative agreement it currently is operating under. As reported in *The Washington Beacon* (see http://freebeacon.com/national-security/senators-say-china-diverted-u-s-nuclear-technology-to-submarines-in-violation-of-85-accord/) Sen. Robert Menendez (D-NJ) asked leading questions that more than suggested that the Chinese had diverted AP 1000 reactor cooling pumps technology produced by the Curtiss-Wright Corp., which also makes a scaled down version of the pumps for US nuclear-powered submarines.

ii. Although this revelation caused a stir, it was not unanticipated. On May 18, 2007, Congressmen Ed Royce, Jeff Fortenberry, Christopher Smith, and Diane Watson wrote Secretary of Defense Robert Gates voicing concerns about the possibility that the Chinese might divert US civilian nuclear technology to make its submarines stealthier and to produce more nuclear weapons materials (see http://www.csmonitor.com/2007/0530/p03s01-usfp.html). At the time, Bush Administration officials downplayed these risks. Subsequently, in March of 2008, NPEC commissioned two naval nuclear reactor experts (one now is the president of the Federation of American Scientists and the other works with the national labs) to assess the risks of China reverse engineering certain advanced reactor components that could help silence PRC submarines. They also examined how the PRC's naval reactor program would require enriched uranium produced from China's "peaceful" uranium enrichment plants. These enrichment plants could use uranium from the US as feed material. They also could be used to make more weapons-grade uranium. The general conclusion of these experts' discussion was that a military diversion risk existed (see http://npolicy.org/article.php?aid=235&rtid=2). Finally, in August of 2008, the US-China Economic and Security Review Commission held a hearing that established that advanced US power reactor technology might enhance PRC submarine reactors. A key concern was the canned coolant technology that Curtiss-Wright had first developed for the US Navy's submarines on a proprietary basis and subsequently scaled up for use in the AP1000 series reactors. These pumps help reduce noises and other disturbances that otherwise would make a submarine easier to detect (see p. 185 ff. of http://origin.www.uscc.gov/sites/default/files/transcripts/8.13.08HearingTranscript.pdf).

iii. It is unclear how much more AP1000 civilian technology China might be able to divert under a new US- PRC 123 to upgrade its submarine reactors. Peter Dutton and Andrew Erickson, US Navy War College experts on the Chinese Navy, recently wrote that China still lags significantly behind the US in its mastery of naval propulsion and quieting techniques (see http://www.andrewerickson.com/2015/05/quick-look-report-on-cmsi-conference-chinas-naval-shipbuilding-progress-and-challenges/). More important, even if China has secured all the data it wants, it may still seek advice and insights on how to work with this data.

That said, it also is clear that whatever nuclear technology China has been unable to buy from the US, it has been stealing. In May of 2014, the Justice Department indicted five members of the People's Liberation Army for hacking into Westinghouse Nuclear Division computers and stealing an estimated $100 billion in trade secrets (see http://www.beyondnuclear.org/security/2014/5/22/chinese-military-cyber-attack-hacks-westinghouse-nuclear-sec.html and http://mobile.nytimes.com/2014/05/20/us/us-to-charge-chinese-workers-with-cyberspying.html?referrer=&_r=0. Note well: This theft was a major concern that Senator Markey raised at the Senate Foreign Relations Committee hearing on May 12th). With such theft, China should be able to manufacture more and more of whatever is left of US design.

iv. It is unclear when the US officials first learned of the diversion to China's naval reactors; what corrective action, if any, was taken within the US government (USG); or how secure US civilian nuclear technology is from further Chinese military diversions. No one was fired or nor is there any evidence that any procedural review processes were changed.

v. Partly out this concern, the House Armed Services Committee recently included a provision in the 2016 National Defense Authorization Act (NDAA) that would require the Chief of Naval Operations and the Director of National Intelligence to give an assessment of the military implications of any US nuclear technology export to a country that has a nuclear navy before the export can be approved by the Department of Energy (DoE). (See section 3119 of the act, available at http://docs.house.gov/billsthisweek/20150511/Rules_Print_HR1735_xml.pdf . Also see http://www.theenergydaily.com/publications/ed/House-defense-bill-toughens-nuclear-export-reviews_12466.html). It should be noted that over the last decade China has been the only country with a naval reactor program to have received significant amounts of advanced US civilian nuclear technology.

B. How badly might China have proliferated to other states (e.g., Iran, Pakistan, North Korea) in violation of its current 123 pledges not to do so?

i. State Department officials briefing warned staffers in early March that the code-word version of the Nuclear Proliferation Assessment Statement (NPAS), which was sent to the Hill with the PRC 123, would be "controversial."

ii. The unclassified Congressional Research Service's review of China's proliferation record (available at http://fas.org/sgp/crs/nuke/RL31555.pdf) is both lengthy and worrisome. It spotlights extensive Chinese proliferation activities related to Pakistan, N. Korea, and Iran, all of which occurred since the current 123 agreement came into force in 1998, and relies heavily on official sources.

iii. Yet another issue that came up in the Senate Foreign Relations Committee Hearing May 12th was China's past transfers of nuclear weapons-related technology to Pakistan and Iran. As reported in the *Washington Beacon* (http://freebeacon.com/national-security/senators-say-china-diverted-u-s-nuclear-technology-to-submarines-in-violation-of-85-accord/) Senators Cardin and Markey both were disturbed by continuing reports "that Chinese

government and private entities have proliferated technologies concerning and related to nuclear weapons to countries of concern." Senator Markey spotlighted the arms proliferator Karl Lee, a Chinese national, who has facilitated illicit nuclear and missile transfers to Iran. He noted that China's government has done nothing to shut down the Karl Lee arms network.

2. *How well might China live up to its pledges under a new 123 agreement?*

A. Senators at the May 12th hearing voiced concerns that the Chinese might re-export US nuclear goods to states, such as Pakistan, Iran, or North Korea without prior US consent

i. Senate Foreign Relations Committee members voiced concerns that China was currently exporting reactors to Pakistan in clear violation of its Nuclear Supplier obligations not to export to non-NPT states that have not been exempted. The administration witnesses agreed this was a concern but noted that this was not a violation China's pledge not to retransfer US-designed reactor technology or goods to other nations without first securing US consent. China, however, is planning to build and export its own version of the AP1000, the CAP1400, which utilizes US-reactor design information. China believes it may export the CAP1400 where ever it wants without US consent (including to Pakistan) claiming it is 100% of Chinese design (see http://www.neimagazine.com/features/featurechinese-reactor-design-evolution-4272370/). If it did, though, it arguably could violate its 123 pledge against re-exporting US technology.

ii. To date, just what constitutes a major reactor component or reactor of "US design" is a matter of considerable dispute within the US government. There is no official USG definition. The DoE witness at the May 12th Senate Foreign Relations Committee hearing explained that what is "of US-design" is largely left up to US-headquartered nuclear firms to decide (see http://www.foreign.senate.gov/hearings/the-civil-nuclear-agreement-with-china_balancing-the-potential-risks-and-rewards). Unfortunately, this presents a major conflict of interest for major foreign-owned US-based nuclear exporters, such as Westinghouse, that willingly transfer considerable reactor design information in order to secure reactor exports (In 2007, Westinghouse immediately handed over 75,000 technical documents as a part of its original AP1000 sale, see http://www.bloomberg.com/news/articles/2010-11-25/westinghouse-expects-more-reactor-orders-from-china-on-clean-energy-demand). This is important for yet another reason: The Iranians and Chinese have been considering exporting power reactors to Iran (see http://m.voanews.com/a/iran-seeks-china-help-to-build-new-nuclear-plants/2730146.html).

iii. In this regard, it is worth nothing that the proposed nuclear hardly tightens existing US controls over the transfer of US-design information or goods. Instead, under an annex provision of the 123 agreement entitled "Technology and Information Exchange," current controls would be loosened by creating "pre-approval" lists of

technologies, goods and end users. Such streamlining would make it more difficult to review each proposed transfer.

B. Yet another concern raised May 12th was the possible diversion of "peaceful" nuclear weapons-usable plutonium generated in US-designed reactors to make bombs

i. A question raised May 12th was if China reprocesses nuclear weapons-usable plutonium from spent fuel generated in US-designed reactors or enriches uranium made with US-origin uranium, can it be trusted not to divert it to make bombs or to fuel its navy's reactors?

ii. Despite China's worsening relations with the US, the current renegotiated US-PRC agreement (see http://www.gpo.gov/fdsys/pkg/CDOC-114hdoc28/pdf/CDOC-114hdoc28.pdf) is actually looser on reprocessing of nuclear weapons-usable plutonium than the 1985 agreement (compare Annex A, page 352 of http://digitalcommons.law.umaryland.edu/cgi/viewcontent.cgi?article=1286&context=mjil with http://www.gpo.gov/fdsys/pkg/CDOC-114hdoc28/pdf/CDOC-114hdoc28.pdf, Article 2, para. 2). In fact, it lacks any clear requirement that the PRC seek the explicit case-by-case permission of the US before it reprocesses nuclear weapons-usable plutonium from US reactors (i.e., reactors of US design or that have major components of US design). On this point, the proposed PRC 123's terms are certainly much looser than those contained in the 123 agreement the US reached with Russia in 2008 (see http://nnsa.energy.gov/sites/default/files/nnsa/05-13-inlinefiles/2013-05-24%20Russia%20123%20Agreement.pdf).

iii. Nuclear materials produced in US-designed reactors are subject to IAEA safeguards under the existing PRC-IAEA safeguards agreement. This agreement, however, allows the PRC to remove facilities from their designated safeguards list at any time and to veto inspectors from states China considers unfriendly (See https://www.iaea.org/publications/documents/infcircs/agreement-20-september-1988-between-peoples-republic-china-and). As such, China could notify the IAEA it wanted to delist its reprocessing plant from safeguards, use the plutonium reprocessed there for military purposes, and still technically be in compliance with its IAEA safeguards agreement.

iv. The more important point, however, is that no inspections or safeguards system will be able to provide timely warning of a gradual or abrupt military diversion since once a state has separated plutonium and has stockpiled it, it is days or hours from making bombs (See http://www.npolicy.org/books/Falling_Behind/Ch6_Cochran.pdf and http://www.npolicy.org/books/Falling_Behind/Ch5_Lyman.pdf).

v. Defenders of the PRC 123 dismiss the idea that China would ever want to reprocess plutonium from its civilian reactors to make bombs since it already has bombs and could make another 450 additional weapons from stockpiled materials (see http://thehill.com/blogs/congress-blog/homeland-security/239479-addressing-risk-in-chinese-nuclear-cooperation). The assumption here is that China would never want or need to threaten to make more than roughly 1,000 weapons.

vi. Over the 30-year lifetime of the PRC 123, though, China may face a hostile US (allied with Japan and South Korea) and a hostile Russia given differences over Siberia and other East

and Central Asian interests (see, e.g., http://thediplomat.com/2015/05/can-the-china-russia-warmth-last/?utm_content=buffer896bf&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer ; http://thediplomat.com/2015/05/chinas-growing-presence-in-georgia/ and http://thediplomat.com/2015/02/mackinder-revisited-will-china-establish-eurasian-empire-3-0/).

vii. Russian military writers note that Russia is outgunned conventionally by China, stretched thin demographically, and must travel much further to project force in Asia. So it may rely heavily on deploying tactical nuclear weapons systems to check Chinese military capabilities in East Asia (see http://www.npolicy.org/books/Next_Arms_Race/Ch2_Kipp.pdf).

viii. China knows this. That is why China developed and tested an enhanced radiation warhead for possible future tactical deployment against the Russians or against the US or its allies in naval engagements (see e.g., http://nationalinterest.org/feature/unlocking-the-puzzle-china%E2%80%99s-neutron-bomb-12124 and http://thediplomat.com/2014/10/could-chinas-nuclear-strategy-evolve/).

ix. But any nuclear competition, particularly one that might involve the deployment of tactical nuclear systems along the Chinese-Russian border or possible surface naval engagements against the US and Japan (e.g., nuclear mines and anti-submarine operations), could easily drive Chinese nuclear weapons requirements past hundreds to several thousand or more (during the Cold War, the US tactical weapons requirements to defend NATO drove the US Army's nuclear warhead requirements as high as 151,000. Today, the same dynamics are at play for tactical weapons requirements in theaters such as S. West Asia. See http://www.brookings.edu/about/projects/archive/nucweapons/50 and http://www.stimson.org/summaries/pakistans-tactical-nuclear-weapons-operational-myths-and-realities/).

x. Also, with the US and Russia having amassed so much surplus highly enriched uranium (HEU) and plutonium (as in scores of thousands of bombs' worth, see http://fissilematerials.org/library/gfmr13.pdf) during the decades of the Cold War, any attempt by China to ramp up militarily would risk antagonizing the two super powers possibly into remilitarizing their vast military surplus fissile inventories. Assuming China could convert all of its current surplus of plutonium and HEU into nuclear weapons overnight, it would give China no more than temporary rough nuclear parity with the US and Russia (i.e., about 1,000 nuclear weapons); China would then have to contend with the very real prospect of either the US or Russia remilitarizing their massive military fissile surpluses, which could allow either to remilitarize scores of thousands of additional nuclear weapons.

xi. Nor would it be easy for China to ramp up its military nuclear material production efforts. China has and is planning on building more than enough uranium enrichment capacity. The optimal material for nuclear weapons primaries in an advanced thermonuclear warhead, though, is plutonium. Unfortunately, China has not operated either of its mothballed production reactors for more than two decades and is dismantling one (See http://belfercenter.ksg.harvard.edu/files/Hui-Zhang-China-Chapter-Global-Fissile-Materials-Report.pdf. Also on China's potential need for more warheads to put multiple warheads on

its missiles, see http://thebulletin.org/what-if-china-develops-mirvs8133). The one that might be reopened could make no more than roughly 300 kilograms of plutonium a year (enough for roughly 75 primaries a year, assuming DoE's published figure of 4 kgs. of weapons-grade plutonium is needed per weapon).

xii. All of these points should be kept in mind when thinking about the security risks of granting China advanced consent to reprocess spent fuel from US-designed reactors:

(1) China asked US officials to allow it to reprocess US-origin spent fuel because arguing it is interested doing so in either a demonstration commercial reprocessing plant (it now has one) or a much larger commercial-sized plant that it is negotiating with the AREVA to buy.

(a) This French AREVA plant would produce 8,000 kilograms of weapons-usable plutonium—i.e., conservatively enough to make ~1,500 to 2,000 primaries a year (this range reflects how much of the plutonium might be reactor or weapons-grade. According to a well-known US nuclear weapons designer, Richard Garwin, see http://fas.org/rlg/980826-pu.htm , it takes 30% more plutonium metal to make a nuclear weapon from reactor-grade plutonium than it does if one is working with weapons-grade plutonium. Using DoE's figure of 4 kgs. of weapons-grade plutonium for a first-generation nuclear weapon, this means 5.2 kgs. of reactor-grade plutonium would be needed to produce a similar device). French negotiations to sell China this large reprocessing plant have until recently been held up over the question of price.

(b) Given AREVA's most recent financial and technical troubles (see below), France may be willing to sell this plant for far less than before (see below in section 3).

(c) Recently, July 15, 2015, AREVA announced it had reached an agreement with the Chinese to move to the final stage of negotiations over financing and price for the reprocessing plant. http://english.cri.cn/12394/2015/07/01/3742s885300.htm

(2) Although, the Chinese have not yet put reprocessing or commercial fast reactors in their 5-Year Plan, officials say this is where they would like to go. China, they argued, wants to reprocess and stockpile plutonium in advance of deploying large, commercial fast reactors in the 2030-50 time frame producing enough plutonium (80-160 tons) for roughly 15,380 to 40,000 plutonium primaries (again, depending on the grade of the plutonium) http://thebulletin.org/reprocessing-poised-growth-or-deaths-door/reprocessing-china-long-risky-journey).

(a) China could plead its case using reasons similar (albeit not identical) to that of Japan. Since the US has yet to voice concern about Japan, a non-nuclear weapons state, proceeding with large-scale reprocessing, China could argue that Chinese commercial reprocessing should be of no US concern since China is a nuclear weapons state (What is interesting, however, is that Chinese authorities last year did voice nuclear weapons proliferation objections to Japan proceeding with large-scale reprocessing but the US dismissed its concerns. See,

http://www.bloomberg.com/news/articles/2014-03-23/japan-s-plutonium-potential-stokes-china-tensions-on-a-bomb-risk; http://thebulletin.org/china-worries-about-japanese-plutonium-stocks7248; and http://m.scmp.com/comment/insight-opinion/article/1459831/japan-must-clear-doubts-over-its-huge-stock-plutonium).

(b) It is worth noting that Westinghouse has told the World Nuclear Association (see the China country profile, AP1000 heading at http://www.world-nuclear.org/info/Country-Profiles/Countries-A-F/China--Nuclear-Power/) that it will have 10 to 40 AP1000 reactors operating within the lifetime of the proposed US-PRC 123. Using conservative estimates based on Lawrence Livermore calculations, each of these reactors can generate enough weapons-grade plutonium to make more than 37 Nagasaki-yield weapons and enough reactor-grade plutonium to make 48 first-generation warheads per year, per reactor. For 40 AP1000 reactors, that would equate to nearly 1,500 weapons' worth of weapons-grade plutonium or roughly 1,900 weapons' worth of reactor-grade plutonium per year (again, this assumes DoE's figure of 4 kgs of weapons grade plutonium/device and about 5.2 kgs of reactor–grade plutonium). These figures do not factor in the plutonium that might be generated in China's planned version of the AP1000, the CAP1400, which China plans to deploy domestically and to export.

(c) Of course, some nuclear industry supporters have argued that light water reactors (LWR) cannot be used to make nuclear weapons-grade plutonium or tritium. This, however, is misleading. It is true that light water reactors have not ever been used for this purpose but they could be so used. In fact, the Reagan Administration proposed buying an unfinished light water power reactor from Washington Power Supply System in the late 1980s to produce weapons-grade plutonium as well as tritium (see http://books.google.com/books?id=pQYAAAAAMBAJ&pg=PA25&dq=wppss+weapons+plutonium+production+doe&hl=en&sa=X&ei=yISkU7mvB9froAS5_YKoCQ&ved=0CCQQ6AEwAQ#v=onepage&q=wppss%20weapons%20plutonium%20production%20doe&f=false and http://babel.hathitrust.org/cgi/pt?id=pst.000014315848;view=1up;seq=1). Merely by increasing the frequency of refuelings, China could make very good weapons-grade plutonium from its LWRs. Alternatively, it could use boosting to overcome the relatively minor weapons design problems the reactor-grade plutonium presents to an advanced nuclear weapons state for efficient, reliable yield weapons).

3. Who Benefits from the 123 More: The US or China?

A. The nuclear industry argues that the US-PRC 123 is critical to secure US jobs and export revenues. It wants to secure America's share of a market the US Commerce Department believes is worth $750 billion. Commerce's rule of thumb, which industry spotlights, is that 5 to 10 thousand US jobs are generated for each $1 billion in exports (see http://www.nei.org/Issues-Policy/Exports-Trade). Industry also argues that nuclear

exports to China are worth "billions" to Westinghouse (which is headquartered in the US) and lesser amounts to companies supplying canned coolant pumps (by Curtiss-Wright and Enertech), squib valves (SPX Corporation), design and engineering services (Fluor, Chicago Bridge and Iron), and advanced reactor concepts (TerraPower). It is quick to point out that Russia, Canada, and France are competing for this reactor business in China (see http://www.nei.org/CorporateSite/media/filefolder/Policy/Trade/China.pdf?ext=.pdf). The underlying assumption for not "messing" with the US-PRC 123 is that the US has much more to lose from uncertainties Congress might introduce than the PRC might lose.

B. This pitch, however, is misleading on several counts:

i. First, the very largest "American" nuclear export firm and key beneficiary of any PRC reactor sales, Westinghouse Electric LLC, although registered and headquartered in the US, is entirely foreign controlled: All of its shares are owned by Toshiba (87% http://gulfnews.com/business/technology/toshiba-confirms-it-will-buy-shaw-stake-in-westinghouse-1.862938), IHI, a Japanese firm (3%), and Kazakhstan (10%; see http://en.wikipedia.org/wiki/Westinghouse_Electric_Company). Reactor exports to the PRC, then, may be worth billions to Westinghouse, but those dollars are going to Toshiba, IHI, and Kazakhstan, not into creating more full-time US jobs manufacturing 123 nuclear controlled goods. Almost all of the nuclear controlled items necessary to make the Westinghouse-designed AP1000 reactor, in fact, are made overseas, not in the US. URENCO, meanwhile, is the only firm still enriching uranium in the US but is entirely foreign-owned.

ii. Second, the very canned pumps and squib valves that the US firms still make for the AP1000 have experienced technical difficulties that have caused major construction delays. As a result, Westinghouse is suing the relevant US vendors and the Chinese are angling to get these components to be made in China (see http://www.wsj.com/articles/china-moves-to-keep-nuclear-work-local- 1418669373). Thus, it's unlikely that the few US vendors now supplying the initial four AP1000 reactors will be doing so in the future. As *The Wall Street Journal* has noted, "Chinese companies are really growing and basically squeezing out the international suppliers."

iii. Third, what nuclear technology China has been unable to buy, it has been stealing. As noted earlier, in May of 2014, the Justice Department indicted five members of the People's Liberation Army for hacking into Westinghouse Nuclear Division computers and stealing an estimated $100 billion in trade secrets (see http://www.beyondnuclear.org/security/2014/5/22/chinese-military-cyber-attack-hacks-westinghouse-nuclear-sec.html and http://mobile.nytimes.com/2014/05/20/us/us-to-charge-chinese-workers-with-cyberspying.html?referrer=&_r=0). With such theft, China will eventually be able to manufacture more and more of whatever is left of US design.

iv. Finally, the design and engineering services now being supplied to China legally can and have been transferred to weapon states like China without a 123. They are controlled by

the Department of Energy under a Part 810 administrative procedure. This procedure does prefer transfers of nuclear services and information to states that have 123 agreements with the US but this is not a binding or legal requirement per se. Thus, such services and information have historically been transferred to states lacking a 123 agreement with the US (e.g., Russia). If Congress or the Executive wants to clarify which services or information it would favor forwarding to China, it may do so at any time.

v. In fact, the completion of the four AP1000 reactors now under construction is likely to be possible even without a renewed 123 with the PRC since most or all of the few US-controlled manufactured items needed to complete these reactors have already been licensed (or could be before 31 December when the current 123 runs out) and the nuclear technical know-how can be transferred under Part 810 procedures without a 123 in place.

C. The nuclear industry nonetheless is concerned about interference with US exports to the PRC but not primarily because of any loss or gain to US manufacturing firms. Increasingly, "the industry's" interests concerning nuclear export controls, as presented to Congress, are less reflective of the key interests of US nuclear utilities (e.g., on regulatory, nuclear waste management, and energy subsidy policies) than they are of foreign firms registered in the US and of foreign firms that are represented by US-based lobbying firms. Thus, Westinghouse, Toshiba, TEPCO, KEPCO, Mitsubishi and Mitsubishi-GE, AREVA, and a large number of Japanese utility companies are all paying members of the Nuclear Energy Institute, which is the single most visible opponent to nonproliferation legislation or conditioning of nuclear cooperation (see http://www.nei.org/CorporateSite/media/filefolder/NEI-Membership-Roster.pdf?ext=.pdf).

D. In fact, the US manufactures and exports less and less that is controlled by 123 agreements, which is listed on the NRC 110 Nuclear Trigger List (items controlled because they are especially significant from a nuclear explosive standpoint). In fact. The last US reactor export deal (which was to China) was made over seven years ago; b. US shares in the global nuclear fuel market declined from 33% in 1994 to less than 10% today (NEI, see http://www.nei.org/Issues-Policy/Policy-Resources/Testimony/Testimony-for-the-Record,-Marv-Fertel-before-the-S); nuclear fuel >80% of US nuclear exports (GAO, see http://www.gao.gov/assets/320/311924.pdf); and c. All US nuclear exports are <4% of US nuclear revenues, reactor exports <1% (NEI; GAO cited above).

E. Perhaps the most important export from the US today is of intangible technology and services to Japan, Korea, and the PRC that are necessary to complete the first four US-designed reactors. Such technology transfers are also important to assure best nuclear safety technology and practices are shared. These technology exports, as already noted, however, can be made without a 123 agreement. In fact, even countries that do not have full scope safeguards agreements with the IAEA and lack a 123 agreement with the US are listed by DoE as being able to receive Part 810 controlled information and data if they are granted a "specific" authorization of the Secretary of Energy under the newest 810.8 regulations. Having a 123 agreement with the US makes transfers administratively much more likely, but, strictly speaking, they can and have been made legally without a 123.

F. Finally, although nuclear boosters argue that when it comes to striking a nuclear cooperative agreement with China the US-headquartered nuclear firms, such as Westinghouse, have a tremendous amount to gain, they are silent about how China's nuclear program is in dire need of additional US technical nuclear assistance.

i. French officials have publicly voiced their concerns about how lax China is with regard to its construction quality standards, how non-communicative its safety officials are with AREVA, how overwhelmed the Chinese nuclear workers and regulators are, and how overambitious the Chinese nuclear program is in general (See http://www.bloomberg.com/news/2014-06-18/french-nuclear-regulator-says-china-cooperation-lacking.html and https://www.chinadialogue.net/blog/6932-Concerns-over-China-s-nuclear-power-expansion/en; p. 106 ff. at http://www.worldnuclearreport.org/WNISR2014-Online.html).

ii. In September of 2011, China only had roughly 40 national-level, dedicated nuclear safety officials (http://www.world-nuclear-news.org/RS_Chinas_pause_for_thought_1609113.html). They now have perhaps five times or more as many but they lack experience and they're playing severe catch up. It's for this reason that the US NRC is sending officials on a routine basis to shore up what might otherwise be catastrophically shoddy construction of the Westinghouse AP1000 design (http://www.scmp.com/business/china-business/article/1325973/china-nuclear-plant-delay-raises-safety-concern).

G. China, meanwhile, needs more time and help to master AP1000 technology not only to complete the four reactors now under construction, but to assure a smooth way forward with its own version of the AP1000, the CAP1400, which it hopes to build numerous copies of in China and for export (see http://mobile.reuters.com/article/idUSKBN0M20ID20150306?irpc=932). China, in short, may have all the data it wants but it still needs US expertise and help to makes sense of the technology it has and to build and operate safe versions of the AP1000 reactor—a machine the US is still sorting out and does not yet have operating anywhere in the world.

H. As for Washington's lack of leverage regarding French, Russian, Korean, and Japanese reactor export competition in China, this is easy to exaggerate.

i. France was hoping that Westinghouse's difficulties in getting the AP1000 reactors completed on time would benefit AREVA's future sales of its EPR reactor system. Recent discovery of flaws in the head and base pressure vessel steel components of the EPR being worked on in France, however, forced French nuclear regulators to warn China that AREVA's two EPRs under construction at Taishan may be subject to the same flaws. Construction on all of these projects in France and China are now likely to be delayed (see, e.g., http://www.scmp.com/news/china/article/1762861/french-warning-nuclear-reactors-being-built-guangdong; http://www.independent.co.uk/news/uk/home-news/uk-nuclear-strategy-faces-meltdown-as-faults-are-found-in-identical-french-project-10186163.html; and http://m.france24.com/en/20150417-french-nuclear-company-faces-major-setbacks/). Finland just announced that it was canceling its previous order for a second AREVA EPR reactor (see

http://www.theecologist.org/News/news_analysis/2859924/finland_cancels_olkiluoto_4_nuclear_reactor_is_the_epr_finished.html).

ii. France, moreover, is in no position to finance additional exports. Its nuclear exporter, AREVA, has a –BB credit rating, i.e., "junk bond status" (see http://www.reuters.com/article/2015/03/06/areva-ratings-idUSL5N0W81MR20150306). AREVA's greatest hope now is to sell reactors to the UK but it lacks financing and is hoping the Chinese might help out. With the latest crisis of confidence over AREVA's faulty pressure vessel forgings for reactors in France, Finland, the UK, and the PRC, though, it is now feared that the Chinese may back out of financing the UK Hinckley Point C project (see e.g., http://www.bbc.com/news/uk-32365888).

iii. Another possibility is China might buy ten percent of AREVA in order to get free access to all the French nuclear technology it wants to build its own Chinese version of AREVA's EPR reactors (see http://bsoft.fr/us/pfgv). A concern here is that as part of any such deal, AREVA might let China have whatever technology it might want or sell it the large, commercial reprocessing plant that currently is under discussion for a much lower price. In either case, the prospects for further French reactor sales to China are now far lower than those for Westinghouse.

iv. As a consequence of these developments, AREVA has decided to focus less on building or exporting reactors and more on the safer supply-chain markets (https://uk.finance.yahoo.com/news/areva-studying-chinese-capital-investment-090029983.html and http://theenergycollective.com/dan-yurman/2208496/areva-struggles-dig-out-debt). As already noted, though, China is primarily focused on successfully absorbing AP1000 Westinghouse reactor technology to build up to 40 AP1000 Westinghouse machines and a large number of CAP1400 reactors based on AP1000 technology. Bolstering AREVA, Westinghouse's key competitor, is unlikely to be the PRC's preference.

v. As for Russia, it too is strapped—with the drop in oil prices and Western sanctions linked to Crimea. This growing financing problem has been recently spotlighted as a potential reactor export showstopper (see http://nucleardiner.com/2015/02/18/can-russia-afford-its-reactor-exports/). Early in April, it was reported that Rosatom is now so financially stretched it has been forced to dip into Russian government sovereign social security funds just to stay in the running for a proposed Finland reactor project (http://bsoft.fr/us/km2h). Finally, Russian reactors have had a decidedly mixed reliability record (see, e.g., http://www.nyoooz.com/thiruvananthapuram/125500/koodankulam-nuclear-plant-a-failure ; http://www.scientificamerican.com/article/russias-nuclear-reactors-could-take-over-the-world-safe-or-not/ ; http://www.rferl.org/content/russia_nuclear_power_plants_unsafe_criticisms/2342630.html

vi. A more basic problem is the uncertain character of Chinese-Russian relations through 2045. Russian, Chinese, and American security analyst believe military and economic competitions between Russia and China are just as or more likely than they are between China and the US (see, e.g., http://thediplomat.com/2015/03/china-and-russia-vs-the-united-states/; http://www.theasanforum.org/cold-war-in-asia-china-russia-and-asian-

security/; http://www.npolicy.org/books/Next_Arms_Race/Ch2_Kipp.pdf; http://www.theguardian.com/world/2009/aug/02/china-russia-relationship). Russian experts believe this will limit Russian technology transfers to China in a decade or less.

vii. As for Japan and the RoK, they cooperate with the US on Westinghouse, GE, and Combustion Engineering-designed reactors and need US technology transfers to support their own exports. As a consequence neither Japan nor the RoK are likely to undercut US nonproliferation conditions.

viii. Thus, nuclear industry experts, including Steve Kidd, the former key analyst for the World Nuclear Association, have concluded that China's future domestic reactor will be the AP1000 or reactors based on the AP1000 design (see http://ecc.rjdigital.co.uk/wp-content/uploads/2013/05/Argentina-Seminar_0413.pdf). This, again, suggests that the US has leverage with China that it is unlikely to lose to its nuclear competitors.

4. Possible Congressional fixes to the PRC 123

A. stipulate the US cannot proceed with any subsequent arrangements for reprocessing of spent reactor fuel generated in U.S. designed reactors as required by Article 6, paragraph 2 of the new 123 with the PRC until the President certifies to Congress that the US has secured an agreement with China for case-by-case consent rights (the requirement to get US permission each and every time China wants to reprocess spent fuel from US-designed reactors—i.e., consent rights equal to those the US secured with Russia).

B. Demand that the Executive Branch clarify what is a reactor or major reactor component of "US-design" that might be subject to retransfer consent right under the PRC 123 by defining the term in US regulation or law.

C. Call for a routine report from the Director of National Intelligence on how China might exploit its civilian nuclear infrastructure to bolster its military nuclear mobilization base. Part of this report would also assess what China's nuclear weapons requirements might be and what might drive them in the future.

D. Have the President certify that any subsequent arrangements called for in the agreement to create "pre-approval lists" for the transfer of US nuclear technology or goods will not interfere or supersede the existing licensing and authorization review processes. Ask that the intelligence community included in the existing Part 810 reviews and that the appropriate committees of Congress receive all requests to transfer US nuclear technology and goods to China before they are reviewed.