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India and the Impending FMCT

Interview with Prof. R. Rajaraman

CBRN Report

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Prof. R Rajaraman is Emeritus Professor of Physics at the Jawaharlal Nehru University, New Delhi. He is also co-Chair of the International Panel on Fissile Materials. He got his PhD in theoretical physics from Cornell University in 1963. He has taught and done research in physics for four decades at, among other places, Cornell, Princeton, the Indian Institute of Science, Harvard, Stanford, MIT, and CERN, Geneva.

After the Indian nuclear tests in 1998, he has enlarged his research interests to include research on nuclear policy issues. He has written on, amongst other things, on Fissile Material production in South Asia, prospects for Civil Defense and Early Warning systems in India, and radiological effects of nuclear weapon accidents. He has analyzed the Indo-US nuclear deal extensively in journal articles, newspaper op-eds, conferences and public lectures. His current interest is on the new initiative towards a nuclear weapon free world.

The FMCT Debate

President Barack Obama's speech on nuclear disarmament in Prague, in particular, underlined the commitment of his administration to non-proliferation goals including the Comprehensive Test Ban Treaty (CTBT) and the Fissile Material Control Treaty (FMCT).

While the debate in India regarding both the CTBT and the FMCT is varied, the lack of international consensus on the FMCT is likely to affect India's position on the same, if the treaty comes into force at least in 2-3 years time from the 2010 RevCon. Whatever be the final outcome of the scope of the FMCT, India has to prepare accordingly especially on seminal matters such as its minimum credible deterrence, the existing stockpiles of plutonium, its fast breeder reactor programme etcetera.

Prof. R Rajaraman, an expert on Fissile Materials, clarifies the contentious issues regarding the FMCT and explains how it affects India's position on the treaty.

*The Institute of Peace and Conflict Studies has been working extensively on nuclear security in Asia and is now partner organization of the **Nuclear Security Project** supported by the Nuclear Threat Initiative (NTI).*



India and the Impending FMCT

Interview with Prof. R Rajaraman, Emeritus Professor of Physics, School of Physical Sciences, Jawaharlal Nehru University, New Delhi

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There are three contentious issues concerning the FMCT. First is regarding the definition of the term fissile material. Second is the scope, (what materials, facilities and countries will be covered under the treaty) and the third is the verification process. What is the present situation regarding these issues?

As far as defining fissile material is concerned, there is not much dispute on that. There are technical definitions which our IPFM (International Panel on Fissile Materials) panel website provides for. However, for simplicity and policy purposes the term fissile material refers to highly enriched uranium (HEU, with more than 20 per cent of U-235) and basically all forms of plutonium, with some technical exceptions, for example, material with high Pu-238 content is exempt since it is very difficult to weaponise it.

What is the difference between “reactor grade” and “weapon grade” plutonium?

What is conventionally called “weapon grade plutonium” contains a high fraction (90-95 per cent) of Pu-239. However, one can make a weapon using an isotopic mixture with less Pu-239 and more Pu-240 and Pu-241, as is found in the spent fuel of typical thermal reactors. The only shortcoming is that the efficiency of the weapon and its yield would be less reliable. Mostly countries have been using weapon grade plutonium because it is available but if it is not available, one can, in a pinch, make weapons from the reactor grade plutonium also. The yield may be less and efficiency may not be 100 per cent but it has been done before. Therefore, if the objective is to prevent people from getting weapon usable material, then one has to look at reactor grade plutonium as well. This is a very important issue for India because it has tons reactor grade plutonium.

Can you elaborate on the scope of the treaty?

The definition of fissile material is not considered a controversial part of the scope of the treaty. The major issues regarding the scope of the treaty are: (i) Will all **existing** fissile materials be covered by the treaty? (ii) Will verification be included? These are the two major issues.

“Existing” material is what countries have accumulated before the day the treaty comes into force.

“Cut-off” is the most basic thing the treaty hopes to do and that simply means- produce no more. In other words, stop production immediately. That is all that that the word cut-off demands. One of the reasons why some countries do not like to call it FMCT (Fissile Materials Cutoff Treaty), with the word ‘cut-off’ in it, is because they want more than a mere cut-off.

Some countries want the existing stocks to be included. That is something more than stopping production. Cut-off stands for just shutting off production. Even when we say cut-off nuclear weapons, we mean stop producing more. It does not mean to throw away the existing ones. However, many countries, in the fissile material context, would like to include the non-usability of existing stocks. Inclusion of existing stocks is one of the most contentious issues today vis-à-vis the treaty. Moreover, if existing stocks are taken into account, then it is more than a cut-off treaty, although it may retain that name.

Similarly for verification. Many countries, particularly the non-weapon NPT countries, feel that without verification the treaty is really pointless. A lot of comprehensive verification is already going on in majority of these countries, as part of the NPT safeguards agreements, whereas it is not going on for the weapons countries. The FMCT is not just a treaty between weapon states alone but it includes all the countries. Many non-weapon countries participating in the Geneva discussions want verification because they feel that the nuclear powers are imposing restrictions on them while there would be no checks on the nuclear weapon states. So there are a large number of non-powerful nations who want verification. Moreover, many countries are of the opinion that the treaty would be toothless without verification being included. The US objected to verification until recently and it submitted a draft to the CD which had no verification; however, President Obama has now changed the US position. He has explicitly called for a verifiable treaty in the draft. This is a big change and it is what has got Geneva excited; the negotiation may begin soon, although it is still a long way ahead.

Anticipating all this, our Panel (IPFM) has prepared a full draft of the FMCT treaty document which includes various options like verification (see www.fissilematerials.org).

Does the cut-off level also include the existing fissile material stocks of the P-5?

Cut-off refers only to stopping further production. It means you do not use any centrifuges to enrich uranium and you do not use any reprocessing units to separate plutonium from the spent fuel rods. What you have already separated, you are not producing it any longer -- that is already produced and is part of your existing stocks. Whether you include that stock or not is really the point. If you do not include the stocks then weapon countries have an excess of fissile material lying around which do not come under the purview of the treaty. They can use it to make weapons. Even countries like Japan which is not a weapon state but has excess of plutonium lying in stock, can make weapons with that and it is not violating the treaty if existing stocks are not taken into account.

Who according to you, will be in charge of the verification process?

The IAEA in all likelihood, because it is the only body in the world which is technically competent and has developed the expertise, the bureaucracy and so on.

There are many questions directed at the autonomy of the IAEA. Skeptics say that El-Bardaie is taking a middle position, he neither wants to lose the US influence nor can he allow the US to take over the IAEA agenda. Do you think the autonomy of the IAEA is a big question?

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For most of the NPT non-weapon countries, which form the majority of the countries in the world, the FMCT does not introduce more restraints and therefore does not require any further verification than what is already there. It is the weapon-countries for whom verification is going to be a new

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That is a larger issue, not limited to just the FMCT. To keep things in perspective, one should remember that the IAEA does not come under the US or the NATO, it comes under the UN. As of now you cannot get something more internationally objective than the UN. We don't have anything better. The UN has been criticized on several grounds, that it is a toothless organization because the P-5 countries with veto power can do what they like and all that is partly true. However, if there is a better alternative than the UN under whose aegis the verification agency can come under, fine. Otherwise the IAEA will have to be in charge for the same.

For the record, it has still not been decided whether the IAEA or some other agency would be in charge of the verification process. But who else can do this? Our panel has, incidentally, recommended the IAEA.

What is the structure or the procedure which will be in place once the IAEA is given the mandate?

The IAEA has to be given more budgets because it will have more things to do. As far as the non-weapon NPT members are concerned there are really no further requirements arising from the FMCT. There are minimal things like some country using highly enriched uranium for non-weapon purposes and the IAEA has to see that it is not diverted for weapons. These are minor things. For most of the NPT non-weapon countries, which form the majority of the countries in the world, the FMCT does not introduce more restraints and therefore does not require any further verification than what is already there. It is the weapon-countries for whom verification is going to be a new thing. That will require added facilities, more inspectors and so on. So the IAEA needs expansion to cope with that extra load.

What about the nuclear weapon countries which are not party to the NPT?

The FMCT has nothing to do with the NPT directly. So when the treaty comes into effect India, which is not party to the NPT, can join it if it wants to. It does not matter if India is not a member of the NPT. But every signatory of the FMCT will come under the purview of the requirements under the treaty.

Coming back to stocks, how will the past stocks issue be tackled? If they are to be left out, then countries like Pakistan and, perhaps, even India, might not come on board.

By existing stocks we mean the following. Suppose the FMCT comes into force tomorrow, signatories will certainly stop producing further fissile material. The question is: what about the stocks that countries already

have today? Does it have to be fully declared? How much of it can be used for producing more weapons? These are the issues involved under the heading of stocks.

It is not clear as yet as to what India's position would be on the issue of existing stocks. It all depends on when it has to make that decision and how much weaponisation has already happened.

The argument of those countries who want the stocks to be in, (apart from countries like Pakistan who are worried because India has more fissile material) is the confusion that can arise when there is already a certain amount of existing material which is unsafeguarded and meanwhile one can produce new material that is safeguarded. There must be clear distinction between these two. Otherwise, the act of verification gets messy. So these nations want all of the stocks to be properly accounted for.

This is a much bigger issue for the US and Russia who are disarming heavily and every dismantled weapon leaves behind more fissile material. What is going to happen to that? They have to declare that this material is in excess of weapons needed. The US has already declared some amount of material, which it says, will not be used for weapons.

So the status of "existing stocks" will be a very nuanced kind of thing and difficult negotiations at Geneva would be needed to find an acceptable formula.

What is the position of establishing global repositories for the supply of fissile material especially for countries that have civilian programmes?

The intention is that nations can buy fuel required for civilian nuclear energy from a reliable non-proliferating source rather than allow everybody to make their own fissile material. The latter scheme is where proliferation problems can arise. Instead there are these internationally recognized bodies, say, one under the UN, one under the IAEA, one in the US, one in Europe and so on, so that there can be 4 or 5 places from where countries can buy fuel. Since these will be just a few major installations it will be easy to keep checks. If there are four or five places of supply, and not just one as in the US GNEP proposal, and if there is a profit motive, then there is no particular reason to fear withholding of fuel or blackmail. If one source does not provide fuel, another will, provided countries really want to use it only for civilian purposes.

One of the problems with that argument, as was proposed in the Global Nuclear Energy Partnership (GNEP) plan of 2006, is that it will lead to a creation of an exclusive group of

states who have the right to enrichment and trade in enriched uranium. Don't you think that countries like Australia and New Zealand who supply raw uranium would like to join ranks with those who enrich uranium?

I think it will be consortiums, not individual states. So there are various propositions up in the air. There is this issue of surrendering the freedom of a country to make its own fissile material, but when they sign the FMCT, or the CTBT, they are surrendering some freedom in the interest of safety of the world. If they don't believe in that, they don't sign it.

When it comes to global repositories of fissile material, the freedom that countries may surrender is the following: Let us say, a country wants to run a civilian programme and it has no desire to make weapons or make more weapons. So it may be willing to buy its civilian requirements from outside, if given at a reasonable price. That is the aim behind it.

On the commercial aspects of it, surely they will find a way out. Australia has raw uranium and not enriched uranium, so the issue for them could be about who will buy their raw uranium? Australia may be invited to join a US consortium. There can also be EU consortium. These are all commercial issues. The serious issue is one of non-proliferation and material getting into the hands of dangerous people.

What about countries that want to produce nuclear weapons? There is still no guarantee that even if you establish such a consortium it would stimulate non-proliferation.

That's right, but then either the champions of the FMCT have to persuade them or the treaty has to live without them. Like India. Right now India produces weapon usable fissile material, but what is it going to do in the future? That depends on the judgment of India's national security strategists and the political leadership. As of now, India does not produce enriched uranium for the civilian reactors. Its enriched uranium is for military purposes only. So India may well be happy to buy Low-Enriched Uranium for light water reactors from an outside consortium.

With Iran, I don't know what their ultimate motive is. I won't be surprised if their motive from the beginning was to make bombs. Given the extent of nuclear weaponisation around the world, it is possible that they too wanted to make a bomb, but it is also possible that they never wanted to make bombs. If they really do not want to make weapons or if they have changed their minds, and there is guaranteed fuel supply from outside, they may be willing to buy it.

You cannot tell them to accept outside nuclear fuel sources right now, just like you cannot tell the Indians

to cut off their weapon production right now. There is a turnaround time in all these matters. Similarly, just as a matter of technological acquisition and pride Iran may not want to stop indigenous efforts now but they may be willing later. No solution will be 100 per cent acceptable. There are always going to be exceptions. The NPT was not acceptable to all, but it came into being anyway and was fairly effective.

If Iran and North Korea, by the time the FMCT comes in, have some amount of enriched uranium, do you think the treaty is going to induct them without looking at their existing stocks?

It depends; if you are going to include existing stockpiles in the treaty then it holds good for everybody. It will be demanded of Iran as well. Once the treaty is signed and ratified by enough countries for it to come into force, anyone wanting to join, including Iran has to obey all of the treaty or none of it. Israel, Pakistan and India will also pose a problem and India more than Pakistan because if existing stocks removed from weapon use, then India will come down to the level of Pakistan. Right now, our existing stocks are greater than that of Pakistan. Certainly Israel is going to be the most difficult country to deal with. It is completely opaque on nuclear issues as a matter of policy.

What is your take on recent reports that Pakistan is building plutonium reactors?

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The security dilemma in the subcontinent is a much larger matter than just the nuclear equations. But certainly it would help if both India and Pakistan join the FMCT. That is the idea. Whether the FMCT sponsors will succeed in getting Pakistan to sign it or India or Israel to sign it, I don't know.

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They are building them, no question about it. We have known about it for two years. My colleagues Drs. Zian Mian, AH Nayyar and I have just submitted for publication detailed calculations on Pakistan's stocks of fissile material and future production rates in the journal *“Science and Global Security.”*

There are also questions as to why Pakistan, which has had a uranium bomb production line, is shifting to plutonium?

Plutonium is better. It requires smaller amounts and for implosion devices, plutonium is definitely a better bomb material. Besides their uranium supply is restricted. As part of our work about Pakistan's fissile materials, we looked at its uranium position. Pakistan is running out of uranium. It does not have much and so far it has primarily just enriched and enriched it with AQ Khan's centrifuges. Since its uranium supply is very limited. It will be better for Pakistan to convert that uranium to plutonium rather than enrich it to make uranium based bombs.

Plutonium bombs are smaller and compact. If a missile has to carry the weapon to great distances, the smaller and more compact and lighter the weapon is, the easier it is to deliver that payload.

Do you think that the FMCT is a better way of solving the perennial security dilemma in the sub-continent at least in restraining the proliferation of nuclear fissile material?

The security dilemma in the subcontinent is a much larger matter than just the nuclear equations. But certainly it would help if both India and Pakistan join the FMCT. That is the idea. Whether the FMCT sponsors will succeed in getting Pakistan to sign it or India or Israel to sign it, I don't know.

That stage is a little far away now. Let the treaty be negotiated, let the negotiations at least begin, even that is not happening yet. When the negotiations begin, India has conveyed that it will participate in the negotiations. So far India has not been asked to give up anything in the pre-negotiation stages. Hopefully a stage will come when many countries are ready for the FMCT. But they may have to settle for just a cut-off treaty. It is hard to tell which way it will go.

If inclusion of existing stocks does develop strong supporters, then India and Pakistan will have to decide about their existing stockpiles.

Don't you think there is a dilemma over here? The point is that if Pakistan looks at India and says there is a gap in the amount of fissile material balance, and India looks at China and says there is a gap and China looks at the US and Russia and says there is a gap, how this is

going to be resolved?

Yes, that is right. Unless countries grow up a bit and show some wisdom there is no end to this. The strategists of nations must realize that one need not compete on the nuclear weapon front in a way armies used to compete for horses, elephants or tanks or guns or armory during the old days. No, not when it comes to nuclear weapons. That is not needed. Nuclear weapons are different. All nations now agree that nukes are not meant for fighting wars, they are for deterrence. If the aim is only minimum deterrence then one is not competing in numbers. That is elementary logic. What you should worry about is not how many weapons but how many anti-weapons the enemy has, so that one can ensure some chance of getting there. This is what nations should worry about.

Will India's efforts to get a Missile Defence System have a destabilizing effect in the region?

Yes, this is a problem. In my view we are getting on a slippery road by acquiring ABM capabilities. Luckily, BMD is not that well developed in the world. Most attempts have been imperfect, including the US' anti-ballistic missile Patriot. It may appear that in seeking missile defence system nations are only protecting themselves and not attacking anyone. Nevertheless, it escalates the arms race.

The FMCT debate is fragmented in India. Opinion varies regarding the fissile material stock India possesses. There is section that believes that signing the FMCT will not affect India because its un-safeguarded reactor capacity is massive and therefore, by the time the treaty comes into effect (say in two years time from the 2010 RevCon), India will have more than adequate stock of plutonium. There is also a section that believes otherwise. What is your take on this?

There cannot be too much disagreement on how much India will produce. That is pure physics. If one runs a reactor with a certain megawatt capacity at certain efficiency, then automatically physics tells you how much fissile material will be produced. So there is not much room for subjective opinion here, although some people, largely out of ignorance, make it a matter of opinion.

What can be a matter of opinion is whether the fissile material produced is sufficient or not. Here too, not every aspect is subjective. That you want minimum deterrence by threatening unacceptable damage is not subjective because that is what India has declared in its Nuclear Doctrine. How much damage a weapon dropped on a major city would do is also not very

subjective. The tragic examples of Hiroshima and Nagasaki, plus the numerous over-the-ground tests give us enough data to estimate the damage. Also, how many weapons you need to possess in order to have certain amount of survivable weapons is also not subjective. These are things that can be calculated by taking the ratios used by the US at various times.

However, what is subjective is how much damage the adversary would consider as un-acceptable. Therefore, while how much we are producing is fairly easy to estimate well, how much would be required to shake up the adversary may be subjective.

I personally have argued for years that the fissile material that India already has is more than sufficient for any reasonable requirement of credible minimum deterrence.

Fissile material is classified into two categories –fissile material in weapons and fissile material in headstock, and the quantity of the latter is considered to be important. The P-5 are said to have adequate fissile material in stock and therefore the FMCT will not affect them. Where does India stand on this issue?

The US for instance has declared a certain amount of fissile material as excess of stock i.e. excess stock not needed for weapons. So countries can, if they have a large amount of fissile material, declare the excess and put them under safeguards. India can also do the same; however, it has to decide how many weapons it wants to have.

Roughly speaking, India has about 50-100 weapons now, or more accurately, about 100 weapons worth of fissile material is there although all of it may not have been assembled as weapons. There is also 12 tons of reactor grade plutonium, which is still lying in the reactors and not reprocessed. In addition to that there is the weapons grade plutonium making reactor- the Fast Breeder Reactor- which is the biggest weapon making reactor because it produces pure weapon grade plutonium. What it breeds happens to have a very rich mixture of Pu-239. Here again physics tells if you run the PFBR reactor at about 70 per cent efficiency, it will produce 100 kilograms of weapon grade plutonium a year. This has been worked out in detail by Alex Glaser and MV Ramana.

India's capacity to reprocess is said to be inadequate. How does this affect its position on the FMCT?

I believe the reprocessing capacity we have has been adequate for the weapons grade material that has been made so far. However, our capacity to reprocess the huge amount of reactor grade plutonium is not adequate. Our reprocessing units have been running inefficiently. Even if we had no designs to make weapons, we may want to

recover the reactor grade plutonium anyway to run breeder reactors for civilian purposes. At present, not all of the 12 tons of reactor grade plutonium that India has is usable. How much of this has been actually reprocessed is confidential, something that the government will not reveal. In a sense, this could affect our position on the FMCT either way. You can take the view that India has more stock than it will ever reprocess and so why not put it under safeguards. The contrary view is that it may all be needed someday for the weapons programme.

The Fast Breeder Reactor Programme is an ambitious project and it is going to expand considerably in the near future. With the possible establishment of the PFBR in Kalpakkam in 2010, India is looking forward to install 4 additional breeder reactors by 2020. But the credibility of our fast breeder programme is under scrutiny from many quarters. The technology is considered to be nebulous as well as cost-intensive. How far do you think that the FBR programme would influence our decision making in regard to the signing the FMCT?

I don't think there is any harm in pursuing it at present as long as India can afford it. Whatever money is available to spend on the breeder programme can be used. Partly out of respect for Dr. Bhabha who thought of it, and partly because it is scientifically not a bad idea. But I should mention

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that many people who know and understand breeders say that this is not going to work, they mean it in a different sense; in an economic sense, it's increased safety problems, the cost of overcoming them, its proliferation dangers and so on. That is why they are against breeders.

If India wants to build breeders, I think it should continue to work on it but, on the side as it were. However, if India had relied solely on breeders as the long term solution as was the case until the nuclear deal came, that would have been suicidal because the chances of success are small. A lot of obstacles may have to be overcome and unknown problems will arise. That is not a reason for not going ahead; however, India should not put all its eggs in that Breeder-Thorium cycle basket. One may recall that in the early stages of the debate on the nuclear deal, those who opposed the deal used to say “we have a breeder programme, why do we need uranium?” I am glad that sanity prevailed and the deal was successfully negotiated and signed.

India has also declared the FBR as a part of its weapons programme. However, it is not operational as yet?

In all fairness, 2010 is the date the Department of Atomic Energy (DAE) had said it would be commissioned. Even if it comes in 2011, that would be much faster than the past record.

What if the FMCT comes into play before that?

It will not come into force that early. Not in 2010. If and when the FMCT does come, then in those facilities, like the Fast Breeder, any further production for weapons purposes will have to stop. India will have to put it under safeguards.

So in a sense India is moving fast enough to keep pace with these developments?

Even if the FMCT takes five years to fructify, the breeder will not be of much use before that as a source of weapons grade plutonium. Even if breeder comes alive in 2011 it takes time to produce enough new plutonium in its fuel rods and then those rods have to be cooled for about three years before they can be reprocessed. So the first batch of reprocessed fuel is at least five years away. So if the FMCT comes into play in those five years and India decides to join it, the breeders' role as a producer of weapon usable material will definitely be negated by the FMCT. Of course, the breeder can still continue to function. It can breed plutonium for India's civilian purposes, which is also important.