Conference on Disarmament

26 June 2012

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Letter dated 25 June 2012 from the Permanent Representatives of Germany and the Netherlands to the Conference on Disarmament addressed to the Secretary-General of the Conference transmitting the report of the meeting of scientific experts on technical issues related to a fissile material cut-off treaty (FMCT), held in Geneva on 29 and 30 May 2012

We have the honour to transmit to you a report on a Scientific Experts Meeting on *Technical Issues Related to a Fissile Material Cut-Off Treaty (FMCT)*, which was organized by Germany and the Netherlands in Geneva on 29 and 30 May 2012.

Based on UN GA Resolution 66/44 of 12 January 2012 entitled *"Treaty banning the production of fissile material for nuclear weapons or other nuclear explosive devices"*, which i.a. *"encourages interested Member States (…) to continue efforts, including within and on the margins of the Conference on Disarmament, in support of the commencement of negotiations, including through meetings involving scientific experts (…)"* the meeting examined ways of ensuring the principle of irreversibility in a future treaty banning the production of fissile material for nuclear weapons and other nuclear explosive devices. Specifically it addressed the following questions:

How can facilities for the production of fissile material for nuclear weapons be decommissioned in a verifiable and transparent manner?

How to deal with facilities in nuclear weapon states that were originally not designed for safeguards and how to handle the transformation of military into civilian facilities?

These issues are of relevance to the Conference's agenda item 1 *"Cessation of the nuclear arms race and nuclear disarmament"* and its agenda item 2 *"Prevention of nuclear war, including all related matters."*

Representatives of around 45 states attended the event, including experts from capitals, as did representatives of the United Nations Office for Disarmament Affairs (UNODA), the International Atomic Energy Agency (IAEA), the European Commission (Euratom), and the United Nations Institute for Disarmament Research (UNIDIR). The total of participants was nearly one hundred.

The Delegations of Germany and the Netherlands to the Conference on Disarmament would be grateful if you could issue this letter together with the attached report as an official document of the Conference on Disarmament and distribute it to all Member States to the Conference, as well as Observer States participating in the Conference.

The Delegations of Germany and the Netherlands intend to propose at the appropriate time that the submission of the report be duly reflected in the Report of the Conference on Disarmament to the General Assembly of the United Nations.

(signed) Hellmut **Hoffmann**
Ambassador
Permanent Representative of Germany
to the Conference on Disarmament

(signed) Paul **van den IJssel**
Ambassador
Permanent Representative of the Netherlands
to the Conference on Disarmament

Germany-Netherlands FMCT Scientific Experts Meeting

Federal Foreign Office of Germany and Ministry of Foreign Affairs of the Netherlands

Technical Issues Related to a Fissile Material Cut-Off Treaty (FMCT)

Report of the Co-Chairs
Ambassador Hellmut Hoffmann, Permanent Representative of Germany to the Conference on Disarmament
Ambassador Paul van den IJssel, Permanent Representative of the Netherlands to the Conference on Disarmament

I. Introduction

About the event

1. On May 29th and 30th, 2012, Germany and the Netherlands co-hosted a two half days **FMCT Scientific Experts Meeting** in Geneva. The meeting was chaired by Mr. Hellmut Hoffmann, Ambassador and Permanent Representative of Germany to the Conference on Disarmament, and Mr. Paul van den IJssel, Ambassador and Permanent Representative of the Netherlands to the Conference on Disarmament, assisted by Ms. Annette Schaper, Dr., Peace Research Institute Frankfurt, who served as moderator and rapporteur.

2. Representatives of around 45 States attended the event, including experts from capitals, as did representatives of the United Nations Office for Disarmament Affairs (UNODA), the International Atomic Energy Agency (IAEA), the European Commission (Euratom), and the United Nations Institute for Disarmament Research (UNIDIR). The total of participants was nearly one hundred.

3. The purpose of the event was to describe and illustrate in some detail the technical nature of the problems identified, rather than to enter into a discussion on potential positions and/or possible disagreements for future negotiations. From that perspective a key objective of the meeting was to demonstrate the importance of preparatory technical work to assist negotiators once they start to engage in devising concrete verification scenarios.

4. The topics of the meeting were a number of salient technical problems that may arise in the verification of a treaty banning the production of fissile material for nuclear weapons or other explosive devices, commonly known as Fissile Material Cut-Off Treaty (FMCT).

5. The event consisted of four sessions, that is: on 29 May an introductory session and panel presentations followed by a discussion session; and on 30 May panel presentations and discussions and a wrap-up session (annex I).

6. The meeting was opened by the Co-Hosts, Mr. Hellmut Hoffmann, Ambassador and Mr, Paul van den IJssel, Ambassador and by the moderator Ms. Annette Schaper., Dr. Explaining the rationale of the event, Mr. Hoffmann expressed the conviction that the

persistent deadlock in the Conference on Disarmament should not prevent work on technical questions of an FMCT, a project which had for good reason featured high on the international agenda for many decades and which enjoyed wide and strong support in the International Community. Pointing to the useful role scientific experts had played in various disarmament efforts in the past, Mr. Hoffmann referred to the General Assembly resolution 66/44 dated 12 January 2012, which "encourages interested Member States (…) to continue efforts, including within and on the margins of the Conference on Disarmament, in support of the commencement of negotiations, including through meetings involving scientific experts…". Furthermore he clarified that the meeting would not represent a negotiation, nor a pre-negotiation, but an opportunity to exchange views under Chatham House rule so as to deepen knowledge and understanding of the complex issues involved with a view to helping build confidence (annex II).

7. Mr. van den IJssel, Ambassador, expressed the hope that the meeting would contribute to further understanding on the technical issues related to an FMCT. He reiterated that the goal of these joint seminars was to prepare the ground for future negotiations and to make use of the views of experts.

8. In the introductory session, the political and technical background of efforts to start negotiations on ending the production of fissile material for nuclear weapons or other explosive devices was highlighted. Mr. Tim Caughley (UNIDIR) gave an overview on the history of the FMCT project, the diverging views on its scope, the attempts to start negotiations, and the present situation.

9. Mr. Ramamurti Rajaraman, Prof., Co-Chair International Panel on Fissile Materials, gave an introduction on the technical background of an FMCT, especially on nuclear materials that can be used for explosive purposes, namely highly enriched uranium (HEU) and plutonium, their production methods and respective quantities presently available around the world.

10. The first panel- and discussion session dealt with the question "How can facilities for the production of fissile material for nuclear weapons be decommissioned in a verifiable and transparent manner?"

11. Mr. Jacques Ebrardt, Directorate for Military Applications, Commissariat à l'Energie Atomique et aux Energies Alternatives (CEA), France, described the complex project of decommissioning the former French plutonium and HEU production facilities and the transparency measures which France has applied since the dismantlement was completed.

12. The second presentation was given by Mr. Neil Tuley, IAEA Safeguards Department, who explained the decommissioning of reprocessing plants and the IAEA safeguards that accompany this process.

13. Mr. Joachim Lausch, Dr., (retired from WAK GmbH, Karlsruhe Reprocessing Plant Decommissioning and Waste Management Company, Germany), presented the technical work on decommissioning the pilot reprocessing plant in Karlsruhe and the accompanying implementation of safeguards.

14. The second panel- and discussion session addressed two related questions: "How to deal with facilities in nuclear-weapon states that were originally not designed for safeguards?", and "how to handle the transformation of military into civilian facilities?"

15. Mr. Peter Schwalbach, Dr., European Commission, DG for Energy (Directorate Nuclear Safeguards), talked about the experience made with subjecting the reprocessing facility B205 in Sellafield/UK to Euratom safeguards, a facility which had formerly been producing plutonium for both nuclear weapons and civil purposes, and was later converted to exclusively civilian production.

16. Mr. Zia Mian, Dr., Program on Science and Global Security, Princeton University (IPFM), elaborated on the future of military fissile material production facilities in South Asia under an FMCT.

17. Finally, Mr. Neil Tuley explained the IAEA's experience with safeguards for civilian and former military facilities.

18. In the wrap-up session, the moderator, Ms. Annette Schaper, Mr. Zia Mian, and Mr. Matthias Englert (University of Darmstadt, Germany) summarized findings and entered into a discussion which was joined by participants from the floor.

19. The meeting was concluded by Ms. Susanne Baumann, Head of Division for Nuclear Arms Control, Disarmament and Non-Proliferation, Federal Foreign Office, Germany.

About this report

20. This report reflects the personal summary of the two Co-Chairs of the presentations and discussions, both of them being fully aware of the difficulty to do justice to all points made by participants. The content of this report is therefore their sole responsibility. The purpose of this report is to inform and support the work of the CD and to stimulate further substantive exchanges on the topics discussed.

II. Presentations

1. Where do we stand on negotiating a fissile material treaty?

21. Mr. Tim Caughley explained the history of the fissile material treaty project and the current situation. He advocated using a neutral name such as “Fissban” or “Fissile Material Ban Treaty (FBMT)” in the interest of building trust.

22. The idea of banning the production of fissile materials goes back to 1946 and the Baruch Plan. After the end of the Cold War, the idea was revived and consultations started in the Conference on Disarmament with the goal of agreeing on a mandate. This work was coordinated by Ambassador Shannon of Canada. The outcome of these endeavors was the so called Shannon mandate (CD/1299 of 24 March 1995), which, i.a., left open the scope of the negotiations in relation to stocks of fissile materials, by making it clear that delegations were free to raise this issue for consideration in future negotiations. An Ad-hoc Committee was established for a short period in 1998; since then no agreement has been possible in the CD to re-establish such a body.

23. The speaker drew several conclusions: (a) One other Ad Hoc Committee was established by the Conference in 1998, namely on Negative Security Assurances (NSAs), whose mandate was not woven into any programme of work. (b) All subsequent programmes of work have so far been of a multi-mandate kind, in contrast to the stand-alone mandates on fissile material and NSAs in 1998. (c) Achieving consensus on a multi-mandate work programme has meant trying to accommodate 65 members on all four core issues, and this in a situation where just one single delegation can block any progress making use of the rule of consensus. (d) Compromises are needed if the CD is both to remain credible and wishes to be the host of such a negotiation. (e) All of the programmes of work have incorporated, in one way or another, a reference to the Shannon Mandate, which would appear to indicate that its constructive ambiguity has been enduring.

24. Mr. Caughley went on to say that work on the technical issues in parallel with efforts to resolve the political issues might offer progress. But with no agreement on how to

sequence or characterize work on the four core issues of the CD agenda, the challenges facing the CD extend beyond the complexities of negotiating a fissban.

25. If, however, some of the technical issues under discussion at this experts meeting could e.g. be clarified in parallel with efforts to resolve the political issues, it should be possible to explore creative approaches to a treaty with or without stocks. For instance, trust could be built towards an outcome under which existing stocks would not directly be dealt with in the negotiation of a treaty, but would be subject to a phased multi-faceted approach, entailing binding unilateral or plurilateral declarations or other binding commitments by the nuclear weapons states. Compromises are the prerequisite for progress.

2. Fissile materials, their production, current stocks and an introduction to the basics of verification

26. Mr. Rajaraman, Prof., gave an introduction to the technical background related to verification of FMCT. He acknowledged that his presentation drew its information mainly from IPFM publications.

27. He began by explaining what fissile materials are. Only a few materials can sustain a fission chain reaction which is the mechanism behind a nuclear explosion. The major examples are plutonium and highly enriched uranium (HEU). They are not directly available on earth but must be produced artificially. He then described their production methods and their stocks around the globe in quantitative terms.

28. Natural uranium is composed of two isotopes, 0.7 % U-235 and 99.3 % U-238. But the HEU used in nuclear weapons requires an isotope mixture with about 93% of U-235. The process for obtaining such a mixture from natural uranium is called *enrichment*. Today, the most common enrichment method uses gas centrifuges. Enrichment is a sophisticated industrial process, requiring thousands of centrifuges and occupying a lot of space. Enrichment is also needed to produce fuel for civilian water-moderated nuclear reactors, most commonly in the form of low enriched uranium (LEU) which contains 3-4 % U-235.

29. Plutonium is automatically generated in the fuel of nuclear reactors, as long as the fuel contains uranium. The method to retrieve the plutonium from spent fuel is called *reprocessing*. It is a mechanical and chemical process combined with radiation protection technologies. Plutonium from reactor spent fuel comes in mixtures of several isotopes. While a mixture with high (>90%) Pu-239 content is ideal for making a reliable warhead, most isotopic compositions generated in reactors could in principle be used to generate a nuclear explosion.

30. The speaker gave an overview of the quantities of fissile materials that exist today in different countries, and their designated uses. He pointed out that there are more than 1500 tons of HEU and 440 tons of separated plutonium in the world. He pointed out that if one compared this with the amount of fissile material needed for one warhead (about 25 kg of HEU or 5 kg of Pu) the compelling need for securing, and verifiably accounting for all the fissile material globally is evident. Since the FMCT will allow production of fissile materials for civilian energy use, verification must ensure that none of it is diverted to other undeclared purposes.

31. He also discussed HEU used for naval reactors and summarized the levels of enrichment and quantities of such naval fuel that different countries use. The total quantities involved are large. He concluded with the recommendation that all countries shift as far as possible to LEU fuel for naval reactors, as France has done.

3. Decommissioning of the former French plutonium and HEU production facilities and the related transparency measures

32. Mr. Jacques Ebrardt explained the decommissioning of the former French plutonium and HEU production facilities and the transparency measures France applies in this regard.

33. In 1992 France terminated the entire production of plutonium for its nuclear weapons program and took a similar step in 1996 with regard to highly enriched uranium. Since then France abides by a moratorium on the production of fissile material for nuclear weapons. France closed down and started to dismantle its fissile material production facilities for nuclear weapons in Pierrelatte in 1996 and in Marcoule between 1986 for the reactors and 1993 for the reprocessing plant.

34. The reprocessing plant in Marcoule ended all activity regarding fuel for defense purposes in 1993. It was definitively closed down at this date and the first phase of dismantling ended in 1996. Dismantling operations have now been completed. The decision to close and dismantle the uranium enrichment plant in Pierrelatte was made and put into effect in 1996. Pierrelatte used gaseous diffusion technology. Dismantling operations are fully completed. France also dismantled several plutonium production reactors. The dismantling of all these facilities is irreversible. France has invited representatives of the CD, non-governmental experts and journalists to view the situation at these facilities.

35. The speaker explained several technical aspects of dismantling and clean-up, and gave both timelines and cost estimates. Although the processes were rather complex, he concluded that irreversible dismantlement and clean-up is possible.

4. Decommissioning of fissile material production plants and the accompanying IAEA safeguards

36. Mr. Neil Tuley explained the decommissioning of reprocessing plants and the IAEA safeguards that accompany this process.

37. Safeguards apply throughout the life-cycle of a facility. The guidance was defined in 1992. A facility should submit design information as soon as the decision for construction is taken. The IAEA has right of access until the decommissioning is completed. After fissile material has been removed, the access rights of the IAEA are based on the Additional Protocol.

38. For each facility there exists an Essential Equipment List (EEL), which contains the equipment that may have an impact on the facility's operational status, function, capabilities and inventory and which is relevant for the safeguarding process. According to the Additional Protocol a decommissioned facility is defined as follows: "Decommissioned facility or decommissioned location outside facilities means an installation or location at which residual structures and equipment essential for its use have been removed or rendered inoperable so that it is not used to store and can no longer be used to handle, process or utilize nuclear material." This definition is somewhat ambiguous, and in a future FMCT it must be clarified at which time which EEL items may be applied. A termination point of verification could be the moment when the resources needed to reactivate a plant are similar to or greater than those needed to build a new one.

39. There are several relevant examples taken from practical experience, among them the reprocessing plants Ningyo-Toge/Japan (pilot plant) and Eurochemic in Mol/Belgium.

40. Verification measures include unannounced visits. The major method how to deal with sensitive information is managed access which means shrouding sensitive parts before inspectors enter. The IAEA allows a certain time for such shrouding.

5. Safeguards experiences during decommissioning of a pilot reprocessing plant

41. Mr. Joachim Lausch, Dr., made a presentation on the technical aspects of decommissioning the pilot reprocessing plant in Karlsruhe/Germany and the accompanying safeguards.

42. The plant used the Purex reprocessing process. Its key equipment were dissolvers, tanks and extractors. Its key measurement points were points for accounting nuclear material, at which bypass and transfer back was not allowed. Examples are an input accountancy tank, transfer tanks to product storage, and transfer tanks to liquid waste storage.

43. The legal basis of safeguards changed during the various phases (planning, hot operation, dismantlement). Euratom and IAEA safeguards were applied also during decommissioning and dismantling. Safeguards measures include three material balance areas similar as during operations, four routine inspections per year, information by activity programme, invitations to inspectorates for verification of nuclear material removal, maintenance of attached seals, and normal nuclear material accountancy.

44. The plant came under NPT safeguards after the Verification Agreement INFCIRC 193 was ratified in the late 1970s. It was already operating and had been under Euratom safeguards from the beginning, as the Euratom Treaty was in force since 1957. Lessons learnt when the IAEA came in to jointly safeguard the facility could be useful for a future FMCT verification scheme.

45. The speaker discussed how the Karlsruhe experience can be transferred to other reprocessing plants. Each reprocessing plant is unique. Plants previously not under international safeguards will initially not fulfill all the requirements. A good co-operation between inspectorate, state and operator is needed. A special problem is the initial presence of military material.

46. The speaker listed several requirements for the verification of already operating reprocessing plants: Precise design information especially around key measurement points, a few plant visits before first routine inspection, flow verification around key measurement points, and – at least partial – verification of the initial inventory.

47. Examples for technical questions related to nuclear material accounting in converted reprocessing plants are: Which quality of analytical methods and process instrumentation is needed? What should be the quality of operational procedures? Are modifications of existing procedures needed? Is it possible to introduce containment and surveillance measures for more transparency? Which additional training of operators for safeguards is needed? What is needed to verify a shut-down reprocessing plant during dismantling? Is the plant still intact and/or can components be replaced remotely? Can the quality of nuclear material in solid waste be determined?

48. The speaker concluded with several observations: Reprocessing plants are the most difficult facilities in the nuclear fuel cycle. Each plant is unique, but key components and key measurement points are similar. A complete verification is impossible but not necessary. Co-operation of state and operator is needed for credible verification. Verification of dismantling should be easier than introducing international nuclear safeguards at plants not designed for it

6. Safeguarding Reprocessing plants – Challenges in new and old facilities

49. Mr. Peter Schwalbach, Dr., spoke on safeguarding reprocessing plants and the challenges of the implementation of safeguards in an older plant which was formerly not under safeguards. There are three types of control: compliance control, performance control, and credibility control.

50. The legal framework of Euratom is the Euratom Treaty which is binding European law and applies to all EU member states, including the nuclear weapons states. Euratom safeguards cover all civilian nuclear material and installations in all member states. The cooperation between Euratom and the IAEA in the EU non-nuclear weapon States (NNWS) is regulated in the Verification Agreement INFCIRC193.

51. Euratom has the experience of subjecting the reprocessing facility B205 in Sellafield/UK to safeguards. This facility had formerly been producing plutonium for both nuclear weapons and civil purposes, and later converted to exclusively civilian production. When the UK joined the EU, the plant was running mixed campaigns for civil and military purposes. Such a large and complex facility is difficult to access in its active parts, some of the nuclear materials and chemical processes must be considered as “black boxes”. Safeguarding is much easier when it starts already in the design phase of a plant.

52. The safeguards approach is based on flow verification, inventory verification, containment & surveillance measures, and “material unaccounted for”-evaluation (MUF). The speaker explained the challenges and complexity of safeguards in large reprocessing plants. Normally, there is a quasi continuous presence of inspectors and an on-site laboratory. Various methods are being used, based on long time experience by Euratom and the IAEA. It is important to keep an approach dynamic.

53. It cannot be avoided that there will be material unaccounted for (MUF), because accuracy has its limits. Therefore this requires thorough analysis and resolution.

54. If a plant like Sellafield B205 is to be verified under a future FMCT, several problems are to be expected: During construction there was no design verification. It is probably impossible to do this later. The plant has not been designed for safeguards and might be lacking special features such as an accountancy tank. Existing nuclear material accountancy and control is possibly not suitable for safeguards purposes. It might happen that operator measurement equipment is not state of the art, and initial inventory differences may be large. It must be clarified whether additional equipment could be installed. In addition to technical problems there might be problems of operator awareness and “safeguards culture”: Initially, the operators might not be convinced to accept safeguards as they might perceive them as an additional burden. Euratom experience shows however that operators appreciate several benefits later, such as more rigorous quality control, improved operation and process control, or synergies with safety and security.

55. The speaker stressed that any approach will be very plant-specific. Questions which must be analysed include: Which parts of the design declaration can(not) be verified? Could flow sheet verification provide added assurance? Can historic operation records be reviewed? Could tracers be used? Could containment/sealing/surveillance reduce open questions? Can short notice random inspections be agreed to cover certain scenarios? Can a baseline inventory be established? Can material in product stores be verified? Can the hold up in hot cells, tanks, vessels, pipes etc. be estimated? Can the uncertainty on the mass balance (flow in, flow out) be estimated?

56. The speaker stressed that existing plants under safeguards require detailed in-depth review, individual development of an approach, cooperation from the operator, expert knowledge inspectors, additional measures for satisfactory conclusions, time and resources, and continuous work on improvements.

7. The Future of Military Fissile Material Production Facilities in South Asia Under an FMCT

57. Mr. Zia Mian, Dr., of the Program on Science and Global Security, Princeton University and the International Panel on Fissile Materials (IPFM) talked about current status and possible future of military fissile material production facilities in South Asia. He gave an overview on the quantities of plutonium and highly enriched uranium in Pakistan and India. The source of this information is the International Panel of Fissile Materials (IPFM) which is an international academic non-governmental organization that researches and analyses information on fissile materials and publishes studies and reports. There is almost no official information.

58. Pakistan has operating enrichment and reprocessing facilities, as well as a growing number of production reactors. Pakistan has operated an enrichment program since the 1970s and its current estimated stockpile is about 2700 kg HEU. The reprocessing program is more recent, starting only 1998, but the scale of the investment is huge. India also has both operational enrichment and reprocessing facilities, and production reactors. The core of India's weapon program is plutonium production. Its plutonium stocks are estimated of about 500 kg. In the US-India deal, all of India’s existing stocks of fissile materials have been kept outside safeguards. India's enrichment effort is largely for naval nuclear submarine fuel, estimated to be highly enriched uranium of 30-45 %. There is debate in Pakistan about developing a nuclear-powered submarine to respond to India.

59. In case of an FMCT, military production facilities would have to be converted to civilian production or shutdown. Conversion will require implementation of safeguards. The enrichment and reprocessing plants were not designed with safeguards in mind. Moreover, there is no experience with safeguards on enrichment plants in these countries, and there is no experience with reprocessing safeguards in Pakistan and only limited experience in India. If these facilities are to be converted, it is likely that standard safeguards will be used.

60. Pakistan and India have kept many key details of their fissile material production facilities secret. Converting these facilities to civilian use and opening them to safeguards inspections may reveal various kinds of information: including production capacity and history, the isotopics of fissile material, the genealogy of technologies, and problems of safety and security.

61. Conversion may not be viable for several reasons. The enrichment and reprocessing facilities are small by current commercial standards and conversion would make little economic sense: civilian production standards include cost, efficiency, and reliability. Pakistan’s four plutonium production reactors - two are operating and two are under construction - are too small for significant electricity production at reasonable cost. The current military enrichment plants may be too small to provide the tens of tons of low-enriched uranium fuel (typically up to 5% enriched) required annually by modern light water reactors (PWRs). There is also no obvious requirement: India’s indigenous power reactors use natural uranium fuel and imported PWRs in both India and Pakistan come with low-enriched uranium fuel supply. As for converting from military to civilian reprocessing, international experience shows that producing plutonium for use as mixed uranium-plutonium (MOX) fuel in PWRs and plutonium fuel for breeder reactors is costly and often unreliable.

62. The speaker listed questions that should be clarified as part of the FMCT process: What does it mean to “convert” from military to non-weapons purpose? What level of technical reversibility or irreversibility should be required? What facility and technology characteristics need to be kept secret during and even after conversion? What would be an

appropriate timing and level of transparency of facility conversion in relation to the signing and entry into force of an FMCT? How to deal with the naval fuel cycle, which will be an issue for India under FMCT, and possibly for Pakistan too if it goes ahead with a nuclear naval propulsion program? The naval HEU problem exists also under NPT and will need to be resolved regardless of an FMCT.

8. Safeguarding operational civil and former military facilities

63. Mr. Neil Tuley talked about safeguarding civilian and former military facilities.

64. He focused on those facilities that were not designed with international safeguards in mind. But also in those facilities, operators still have accountancy requirements. Verification equipment (e.g. cameras, seals) can be added retrospectively. Inspector presence, material balance evaluation, containment and surveillance and process monitoring could be applicable. What is important and difficult is design information verification (DIV).

65. Currently, there are no former military reprocessing plants under Agency inspection. Such plants may not have accurate accountancy on input. More accurate figures for the product may be possible, with destructive analysis sampling. The importance of the various verification techniques and measures will depend on technical objectives, namely goals of quantities and timeliness. It must be ensured that there is no undeclared feed.

66. The experience with former military enrichment plants is limited. There is a British plant (Capenhurst A3, which only produced LEU), but its verification regime is similar to other gas centrifuge enrichment plants. There are several methods to detect undeclared HEU production. An inspector is permanently on site, and there is limited-frequency unannounced access. Details of verification that protect commercial and nonproliferation secrets have been worked out in the Hexapartite process. There is only limited experience with diffusion plants.

III. Discussion

67. Discussions took place after each session and in the course of the wrap-up session. These are summarized in the following.

68. There were different views expressed whether the techniques of nuclear archeology should be applied. Nuclear archeology is a tool to measure the quantities of previously fabricated materials, which means that the disagreement is a reflection of the disagreement on the scope of a treaty.

69. The topic of sensitive information played an important role. It was noted that red lines must be defined in order to protect such information. Possibly, a plant must be cleaned out before the inspectors come in. It was also unclear which kind of information is sensitive. Among those that intervened there was agreement, however, that proliferation risks must be avoided. The extent of confidentiality of other information varies between countries.

70. It was argued that it is worthwhile studying the managed access procedures in IAEA and Euratom safeguards, as well as in other treaties and learn from this experience for FMCT verification. The British experience with safeguards in sensitive installations is very valuable and worth a study.

71. It was also noted that the timing of the conversion will have a major impact. No nuclear weapon state is ready to put a facility under verification as long as it is still military.

The facilities in the UK are good examples to study. Apparently the UK did not have major problems with confidentiality. It would be interesting to learn more about security concerns with mixed campaigns at Sellafield, and to get more information. It was noted that there are no general answers to the question of which secrets need to be concealed, the solutions must be studied individually. Former operators and inspectors with experience of the facilities discussed should be invited to participate in such studies.

72. It was also discussed whether there should be a difference in the safeguards burden for nuclear weapons states and non-nuclear weapons states. It is clear that there will be initial problems which will have to be solved early on. In the long run, according to several participants there should be the same regulation for every member. Each state party needs a State System of Accountancy and Control (SSAC), and it would be valuable if common standards for the SSACs could be developed.

73. It was mentioned that the verification system should be flexible to adapt to future new technologies. An example is laser enrichment, which, if applied in the future, will pose technical problems, especially for detecting clandestine enrichment.

74. It was noted that a Group of Scientific Experts (GSE) would be very useful. Such a GSE would study the discussed problems without being under pressure to agree on positions. Experts would list various options and describe respective technical consequences. A GSE would refrain from negotiating. Many problems can be dealt with in a scientific manner without taking any decisions about which option should finally be laid down in a treaty. A historic example is the GSE which worked for years before the CTBT negotiations got under way and which provided very useful input for the diplomats when they negotiated the CTBT verification system.

75. Some participants highlighted the difference between the political aspects regarding FMCT- negotiations and the related technical aspects. Even if there was political will to start with negotiations, there would be many technical problems to solve. Some noted in that respect that it would be useful if experts could already start work on specific problems of verification. Such work would not replace negotiations, it would not entail taking decisions. It would however clarify technical problems and further scientific and technical work would be necessary to overcome them. These technical activities could also result in overviews on various options on which the negotiators later have to decide.

IV. Concluding remarks, acknowledgements and announcement of further meeting

76. Ms. Susanne Baumann, Head of Division for Nuclear Arms Control, Disarmament and Non-Proliferation, Federal Foreign Office, Germany, pointed out that progress on disarmament continues to be an important goal for the German Government. An FMCT would be an important and the next logical step towards further disarmament and non-proliferation.

77. The meeting had looked at some clearly defined important technical problems negotiators will be faced with when dealing with an FMCT in the future. To cope with these requires a continuous exchange between diplomats and experts. Technical experts could do useful preparatory work to facilitate and accelerate negotiations.

78. Ms. Baumann thanked all who had contributed to the meeting, in particular the panelists and experts who travelled to Geneva from capitals and Vienna for this event. She thanked in particular Ms. Annette Schaper, Dr., for her preparatory work and in her capacity as moderator.

79. Finally, Ambassador Paul van den IJssel, Permanent Representative of the Netherlands to the Conference on Disarmament, announced that a further experts meeting chaired by Germany and the Netherlands will be held in Geneva by the end of August 2012, which will be organized under the lead responsibility of the Netherlands.

Annex I

Programme
FMCT Scientific Experts Meeting
Tuesday 29 May (3.00 – 6.30 p.m.) and
Wednesday 30 May 2012 (2.30 - 5.30 p.m.)

WMO Building, Conference Hall,
Avenue de la Paix 7, Geneva/Switzerland

Technical Issues Related to a Fissile Material Cut-off Treaty (FMCT)

29 May 2012
Introductory Session **3.00 p.m.**

Welcome and Introduction by the Chair and Co-Chair

Mr. Hellmut Hoffmann, Ambassador and Permanent Representative of Germany to the Conference on Disarmament

Mr. Paul van den IJssel, Ambassador and Permanent Representative of the Netherlands to the Conference on Disarmament

Remarks by the Moderator

Ms. Annette Schaper, Dr., Peace Research Institute Frankfurt (PRIF), Germany

Negotiating an FMCT – Where Do We Stand?

Mr. Tim Caughley, United Nations Institute for Disarmament Research (UNIDIR), Geneva

Technical Issues Related to an FMCT

Mr. Ramamurti Rajaraman, Prof., Co-Chair International Panel on Fissile Materials

Coffee Break *4.00 p.m.*

Session 1 **4.30 p.m.**

How can facilities for the production of fissile material for nuclear weapons be decommissioned in a verifiable and transparent manner?

Panel

Mr. Jacques Ebrardt (Directorate for Military Applications, Commissariat à l'Energie Atomique et aux Energies Alternatives, CEA, France)

Mr. Neil Tuley (IAEA, Department of Safeguards)

Mr. Joachim Lausch, Dr., (WAK GmbH, Karlsruhe Reprocessing Plant Decommissioning and Waste Management Company, Germany)

Reception by Ambassador Hellmut Hoffmann
Residence, Petit-Saconnex *6.30 p.m.*

30 May 2012

Session 2 2.30 p.m.

How to handle the transformation of military into civilian facilities? How to deal with facilities in nuclear-weapon states that were originally not designed for safeguards?

Panel

Mr. Peter Schwalbach, Dr., (European Commission, DG for Energy)

Mr. Zia Mian, Dr., (Program on Science and Global Security, Princeton University; IPFM)

Mr. Neil Tuley (IAEA, Department of Safeguards)

Coffee Break *4.00 p.m.*

Wrap-up Session
Open Questions, Way Forward **4.15 – 5.30 p.m.**

Ms. Annette Schaper, Dr., (Moderator)

Mr. Zia Mian, Dr., (Representative of IPFM)

Mr. Matthias Englert, Dr., (Technical Expert, University of Darmstadt, Germany)

Concluding Remarks

Ms. Susanne Baumann, Head of Division for Nuclear Arms Control, Disarmament and Non-Proliferation, Federal Foreign Office of Germany

The meeting will be held under the Chatham House Rule.
The working language is English.

Annex II

Introduction by Ambassador Hellmut Hoffmann Permanent Representative of Germany to the Conference on Disarmament

1. Mr. Hellmut Hoffmann welcomed the participants to the scientific experts meeting devoted to *"technical issues related to a fissile material cut-off-treaty"*. The meeting on FMCT was hosted by the Federal Foreign Office of Germany and the Ministry of Foreign Affairs of the Netherlands as the first part of a two-events-series. The second meeting will be held under the lead responsibility of the Netherlands probably in the last week of August.

2. Mr. Hoffmann made the following general observations about the background and purpose of the meeting from a German perspective:

3. The objective of a treaty which would encompass a ban on the production of fissile material for nuclear weapons or other nuclear explosive devices and related questions has for good reasons featured high on the global disarmament and non-proliferation agenda for many decades and has received wide and strong support in the international community.

4. He underlined the fundamental point that after the Non Proliferation Treaty and the Comprehensive Nuclear Test Ban Treaty, banning the production of the key components required for nuclear weapons in a verifiable way would indeed appear to be the next *obvious* step on the road to a world free of nuclear weapons, one of the fundamental goals the international community has quite rightly set for itself.

5. Whatever priorities States may have in seeking to realize the objective of "general and complete disarmament under strict and effective international control" (to use the language of a key provision of the NPT), it stands to reason that it would make eminent sense in any event to establish such a ban as quickly as possible as a major goal post on the way forward to free the world of nuclear weapons. To those who maintain that nuclear disarmament in the form of starting negotiations on a nuclear weapons convention should have the highest priority, Mr. Hoffmann said that in such cases all would be well advised to heed the old wisdom that one should not make the *best* the enemy of the *good*.

6. He believes it is fair to say that there exists indeed strong support in the Conference on Disarmament and in the General Assembly of the United Nations, for that matter, for starting negotiations on an FMCT, or, as some call it, a fiss-ban.

7. Unfortunately, however, for many years this support could not be translated into practical action because of differences of opinion which have varied in form and substance over the years.

8. As is well known, more recently it is the open objection of only **one** single member State, which has made the beginning of negotiations in the CD impossible.

9. Germany has always been a staunch supporter of negotiations seeking a ban on the production of fissile material for nuclear weapons and related matters. At the same time Germany has always underlined its strong interest in dealing with other items on the CD's agenda in a substantive manner, not excluding negotiations.

10. In the fall of 2009, when after the adoption of a programme of work in the CD on 29 May, that is the famous CD/1864 which included negotiations on FMCT, hopes were running high that the project would at long last get under way, the German Federal Foreign

Office organized a workshop on FMCT in Berlin, which hopefully made a useful contribution to the then ongoing political and technical debate on FMCT issues.

11. Germany continues to feel that the persistent deadlock in the Conference on Disarmament should, however, not prevent *further technical* work on the issues at hand.

12. It is for this reason that Germany once again took the initiative for the seminar on FMCT, and was delighted to have the Netherlands, with whom it shares many disarmament and non-proliferation convictions, as a partner.

13. In view of the useful role scientific experts have played in various disarmament endeavors in the past, Germany took the initiative in the run-up to last year's session of the General Assembly of the United Nations to lay a basis for meetings of scientific experts in the FMCT context.

14. Germany was therefore much pleased that this proved indeed possible in General Assembly Resolution 66/44, which "encourages interested Member States, without prejudice to their national positions during future negotiations on such a treaty, to continue efforts, including within and on the margins of the Conference on Disarmament, in support of the commencement of negotiations, including through meetings involving scientific experts on various technical aspects of the treaty, drawing on available expertise from the International Atomic Energy Agency and other relevant bodies, as appropriate".

15. The meeting of scientific experts built of course on the most useful side events on FMCT hosted by Australia and Japan in the first half of 2011.

16. What was pointed out for these side events at the time applies to this meeting as well, namely that such events do not represent a negotiation, nor a pre-negotiation, but an opportunity to exchange views. Germany hoped that such exchanges will not only deepen the knowledge and understanding of complex issues, but help build the confidence needed to make progress elsewhere.

17. The discussions were held under Chatham House rule. That means in practice that in the report, participating States and/or individuals will not be identified and positions taken will not be attributed. The report was prepared under the authority of the Chair and the Co-Chair, that is, Mr. Hellmut Hoffmann, Ambassador of Germany to the Conference on Disarmament and Mr. van den IJssel, Ambassador of the Netherlands to the Conference on Disarmament. It represents their personal summary of the discussions and they will request for its circulation as a CD document.

18. The meeting of scientific experts dealt with very specific and technical issues. In a nutshell the meeting examined ways of ensuring the principle of irreversibility in a future FMCT with regard to some specific points. These issues belong, in their judgment, to a host of questions which will need to be clarified in one way or another in the course of any future negotiations on an FMCT.

19. Participants were encouraged to focus interventions on these issues and to make active contributions. Everybody should feel free to make points seen as relevant with regard to a proper treatment of the subject matter under discussion.

20. Germany pointed out that it was very welcome that the schedule of activities of the CD foresaw a discussion on FMCT in the plenary of Thursday 31 May 2012 which provided the venue for a broader political discussion. The same applies to the second plenary discussion on FMCT scheduled for 26 June.

21. The meeting was held in the classical format of introductory presentations first, followed by presentations from two panels, followed in turn by discussions, that is questions and interventions from the floor. The moderation of the entire event was in the

hands of Ms. Annette Schaper, Dr., of the Peace Research Institute Frankfurt, who has been an adviser on nuclear issues to the German delegations over many years.