A Fissile Material (Cutoff) Treaty and its Verification
Progress Report from the International Panel on Fissile Materials

Geneva, May 2, 2008
The Verification Challenge

“‘Effective verification’ of an FMCT cannot be achieved ... even with ... verification mechanisms and provisions ... so extensive that they could compromise the core national security interests of key signatories, and so costly that many countries will be hesitant to accept them.”

Bush Administration at Conference on Disarmament, May 17, 2006

But the FMCT would require of the weapon states the same thing that the IAEA is supposed to verify in NPT non-weapon states
Five Verification Challenges in Nuclear Weapon States

1. Shutdown status of enrichment & reprocessing plants
2. No undeclared enrichment or reprocessing in military nuclear facilities
3. Non-diversion of plutonium at previously operating reprocessing plants *(not designed for safeguards and without verified design information)*
4. Non-production of HEU at previously operating enrichment plants
5. Non-diversion of material declared excess for weapons purposes *(plutonium and HEU in classified form, and HEU to be used as naval fuel)*

Minimizing additional IAEA Safeguards costs
Challenge #1

Verifying Shutdown of Enrichment and Reprocessing Plants

- Satellite monitoring
- Remotely monitored video cameras and sensors and seals on key equipment
- Short-notice random inspections

Cost would not be high

Potential sensitivities about qualitative indicators of past production (e.g. HEU and plutonium isotopes)

The U.S. Portsmouth gaseous-diffusion uranium-enrichment plant stopped operating in 2001, but has not yet been decommissioned.
Challenge #2

Managed Access
(to confirm no undeclared enrichment or reprocessing in military nuclear facilities)

Managed-access procedures have been developed for OPCW inspections.

U.S. DOE has instructed its facilities and U.S. NRC has instructed its licensees to prepare for managed access in connection with possible IAEA questions about the completeness and accuracy of U.S. Additional Protocol declarations.

IPFM has been examining how managed access could be used to verify FM(C)T.
Many reprocessing and enrichment plants in the nuclear weapon states already are subject to international safeguards (Global Fissile Material Report 2007)
Challenge #3
Non-Diversion at Operating Reprocessing Plants

Design information cannot be verified for operating unsafeguarded facilities
By far, most costly facilities to safeguard

<table>
<thead>
<tr>
<th>Country</th>
<th>Facility</th>
<th>Safeguards Status</th>
<th>Capacity [tons/yr]</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>UP2/UP3</td>
<td>Yes (Euratom)</td>
<td>1000/1000</td>
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<tr>
<td>India</td>
<td>Trombay/Tarapur/Kalpakkam</td>
<td>No</td>
<td>50/100/100</td>
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<td>Japan</td>
<td>Tokai/Rokkasho</td>
<td>Yes</td>
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<td>Russia</td>
<td>Mayak</td>
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<tr>
<td>United Kingdom</td>
<td>B205/Thorp</td>
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<tr>
<td>United States</td>
<td>Savannah River</td>
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</tbody>
</table>

Measure plutonium flow at strategic points and random short-notice inspections
Annual cleanout and inventory
$20 million investment and $1 million/plant-year. Much less costly than Rokkasho safeguards because no resident inspectors and no on-site safeguards laboratory.
## Challenge #4

### Centrifuge Enrichment Facilities

(as currently expected for the year 2015)

<table>
<thead>
<tr>
<th>Country</th>
<th>Facility</th>
<th>Safeguards Status</th>
<th>Capacity [tSWU/yr]</th>
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<tbody>
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<tr>
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<td>Gronau</td>
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<td>Japan</td>
<td>Rokkasho</td>
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<td>The Netherlands</td>
<td>Almelo</td>
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<td>Non-weapon states</td>
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<tr>
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<td>George Besse II</td>
<td>Yes (IAEA/Euratom)</td>
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<td>Capenhurst</td>
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<td>3,000</td>
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<tr>
<td></td>
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<tr>
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<td>Pakistan</td>
<td>Kahuta</td>
<td>No</td>
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</tbody>
</table>

*uncertain values
Challenge #4

Verifying Non-Production of HEU in Previously Operating Enrichment Facilities

Installation/use of continuous (or portable) enrichment monitors
Already added to centrifuge facilities in the United Kingdom and in China

Swipe sampling techniques to detect HEU particles

Images of micron-sized uranium particles made with a Secondary Ion Mass Spectrometer
Left: U-235 Concentration
Right: U-238 Concentration

Pre-FM(C)T HEU particles may be identified with age-dating techniques (and isotopic analysis)
Challenge #5

Verifying Non-Diversion of Material Declared Excess for Weapon Purposes

(while in classified form)

1996-2002 Trilateral Initiative developed approach to determine that a container holds more than a threshold amount of weapon-grade plutonium

Results communicated by red or green lights through information barrier

*IPFM is working on corresponding approach for HEU components*
The United States, Russia, and the United Kingdom use HEU to fuel naval vessels (mostly submarines; the U.S. and U.K. vessels are fueled with weapon-grade uranium).

The U.S. fleet currently requires about 2000 kg of weapon-grade uranium per year.

The United States has reserved 128 tons of excess weapon-grade uranium (enough for 5,000 nuclear weapons) for future use in naval reactors.
Challenge #5
Non-Diversion of HEU Set Aside For Naval (and Tritium Production) Reactors

- Monitored HEU stockpile
- Fuel fabrication facility
- Container holding fabricated reactor core
- Installation of fuel in propulsion reactor

- Declared quantity of HEU metered out to fuel-fabrication facility
- Amount of HEU in fabricated fuel verified from outside container through information barrier
- Installation in reactor might be verified non-intrusively
Conclusion

The technical challenges of FM(C)T verification are significant but probably not as significant as the political challenges of FM(C)T negotiation.

The costs of FM(C)T verification could be less than the current IAEA safeguards budget.

The technical challenges and costs will come down as former military production facilities are shut down and dismantled.