Report on Session 1: 
*The Need for Cooperation on the Back-End of the Nuclear Fuel Cycle*

INPRO Dialogue Forum on Cooperative Approaches to the Back End of the Nuclear Fuel Cycle: Drivers and Legal, Institutional and Financial Impediments

IAEA, Vienna: 26-29 May 2015
Session 1 addressed perspectives on:

- Overview of past initiatives on multilateral cooperation on the back-end: what, why and when?
- Sustainable cycle solutions
- Overview of USSR international cooperation in the nuclear fuel cycle
- Argentine experience in the back-end of the NFC
More than 50 countries have spent fuel stored in temporary sites, awaiting reprocessing or disposal - not all countries have the right geology to store waste underground and, for many countries with small nuclear programmes the costs of such a facility are prohibitive.

Considerable advantages - in cost, safety, security and non-proliferation - could be gained from international co-operation in the back-end of the nuclear fuel cycle …
different States may develop different approaches to fuel supply security and spent fuel management and disposition

each State has the right to decide on all matters regarding its nuclear fuel cycle options
Report on Session 1
MNAs: what, why, when

- **Repository**
  - spent nuclear fuel in the disposal system is considered as waste and treated accordingly, in line with standard IAEA definition >> no intent to retrieve the waste, although retrievability may remain technically feasible

- **Multinational Repository**
  - waste originating from more than one country is disposed in a common repository
  - country in which repository is located (“host country”) accepts waste from one or more “partner countries”, “customer countries”, “client countries”

- **International Repository**
  - organised under the authority of a supra-national body -- IAEA, UN

- **Regional Repository**
  - in a multinational context, the “host country” and the “partner countries” located in the same geographical region
• **Add-On**
  - Host country accepts added wastes for disposal from other countries – assumes political will, technical and financial resources, suitable geology – acceptance of foreign waste major challenge – driver: host country

• **Cooperation**
  - Joint repository involving several countries to dispose waste in host country – partnership of countries with small nuclear programmes or small quantities of waste – drivers: partner countries

• **International / Supranational**
  - Multinational repository – with supervisory or oversight role by the IAEA or other international entity – drivers: partner countries
storage of spent fuel could be a suitable candidate for a multilateral approach, primarily at the regional level

small countries with only a few NPPs could benefit economically from large joint facilities

storage of SNF in a few safe and secure facilities could also enhance safeguards and physical protection

final disposal of spent fuel and high level radioactive waste may be the best candidate for a multilateral approach

this could offer major economic benefits and substantial non-proliferation benefits despite legal, political and public acceptance challenges to be expected in most countries
transfer of nuclear waste from the user country to the host country of an interim storage facility or of a final repository could be done under bilateral or multilateral agreements at the commercial and governmental levels, in accordance with the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management
such monitoring could cover the adequacy of the technical design, safety features, environmental impact, physical security of nuclear materials and possibly the financial management of the joint venture.

after the initial choice of multilateral arrangements, appropriate bilateral or international oversight of facilities could be arranged, as needed, to provide confidence to partners regarding safety and physical security of the storage facility.

the IAEA could fulfil such a function.
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Comparison of Western/USSR Reprocessing Services

**Western Model:**
Customer responsible for:
- capital costs,
- operating costs
- reprocessing costs,
- storage costs,
- RW storage costs,
- transportation costs (incl. through third companies),
- penalties for violations of the terms
+ obligations at the State level

**USSR Model:**
Customer not responsible for:
- capital costs,
- technology transfer/training,
- project management,
- reprocessing
- RW • • •
USSR Model:
Supplier:
- covers CAPEX 20-25 year loan/low interest,
- covers payments for initial fuel load,
- integrated approach: NPP, front-end, SNF,
- personnel training,
- nuclear security,
- non-proliferation: NPT
Full service package

Customer:
- ownership of NPP,
- technology access
- training,
- Provides own management,
- NFC services
Global nuclear capacity is expected to increase significantly by 2030.

Availability of deep geological repository capacity will remain a scarce resource.

Optimizing the use of scarce resources is critical for the sustainability of nuclear power.

This will require:

- A smart mix of proven and evolving technologies tailored to stakeholders’ priorities and constraints.
- Management of long term storage to avoid saturation of storage capacity.
- Increase worldwide recycling capability and develop advanced solutions.
- Support key nuclear industry in implementing practical “industrial strategies.”
Options for management of used nuclear fuel are sustainable if they:

- Cover all the steps of used fuel management until final disposal, in accordance with an acceptable, practical plan
- Prove to be feasible with an acceptable impact level
- Include a realistic and balanced financing plan
- Do not impose undue burdens on future generations

- Deep disposal with encasement in glass is a safe and acceptable option
SNF storage consideration / decisions in major nuclear countries take place without any definite plans on the final solution

Continuing public discussion on correctness of previous decisions / options

Construction of large-scale industrial sites for SNF management face challenges

Technological solutions are under development
Session 1: Conclusions

- Direct disposal and recycling does not necessarily have to be competitive
- Fairness: «SNF solutions should be devised where SNF accumulates»
- Most SNF stored in the US and Western Europe (80% of world inventory)
- Regional solutions suitable for regional expansion in nuclear energy
- Applicable law and regulations can be updated if these are not helping to address the challenges of SNF
- Convergence of INPRO with IFNEC
Session 1: Conclusions

✓ Convergence of INPRO with IFNEC >> goal:

- to find a long-term and socially-acceptable solution to the challenges of the back-end
- modification of current NFC/NPPs > thermal neutron solutions
- create new NES = NPP + NFC
Session 1: Conclusions

✓ Specific specialized solutions:

- ITER
- new technologies / solutions > regenerated materials (MOX for FB, REMIX)
- regional/technology partnerships for reprocessing SNF
- build on USSR experience of complex support NPP customers, provide full NFC services
Session 1: Case Study - Argentina

✓ Legal and regulatory framework:

- Import of radioactive waste prohibited
- Nuclear Regulatory Authority responsible for regulation and control of radiological and nuclear safety
- National Atomic Energy Commission (CNEA) responsible for management of radioactive waste, spent nuclear fuel and decommissioning of nuclear facilities
- National Programme for Radioactive Waste Management > CNEA to develop strategic plan and annual status report to National Congress
Temporary Storage of SNF

- temporary storage of SNF on-site at NPPs:
  - Atucha I SNF storage: 2 pools
  - Embalse storage: initially in decay pools, then in not less than 6 years, SNF transferred to dry storage silos at the plant site
Final Storage of SNF:

1980s: CNEA feasibility study and engineering draft for construction of deep geological repository >> stable granite formations considered in areas of low seismicity and little hydraulic conductivity >> possible sites: town of Gastre, province of Chubut >> report submitted to National Congress >> public opinion opposed -- studies suspended, not possible to prospect in other favourable regions
✓ storage and/or disposition of spent fuel could be a *suitable candidate for a multilateral approach*, primarily at the *regional level*

✓ *Final disposal* of spent fuel and high level radioactive waste may be a *candidate for a multilateral approach*

✓ *Bundled fuel cycle services* >>> NPP, nuclear fuel, SNF take-back *provide assurance of supply at both the front-end and the back-end*