INFCE

International
Nuclear
Fuel
Cycle
Evaluation

INFCE/DEP/WG.2/18

MINUTES OF THE WG.2 MEETING, 18 OCTOBER 1978

I N F C E

WG 2 B

MINUTES OF THE WG 2 B MEETING
HELD IN VIENNA ON OCTOBER 18,1978

This meeting was attended by delegates from 14 countries, the OECD/NEA and the IAEA (Appendix 1).

I/ - Opening -

The meeting was opened by the acting chairman Mr COATES (France) assisted by the two co-chairmen MM. KREWER (Germany FR of) and SAMII (Iran).

II/ - Adoption of agenda -

The agenda was adopted as proposed by the chairman (Appendix 2).

III/ - Minutes of the september 14-15 meeting -

Several remarks have been made of the minutes of the preceeding meeting : CO-CHAIRMEN/WG 2/3 (B) - 6 october, 1978.

- The answer made by Australia to the questionnaire should be mentioned.
- In account of their differences, even though they both are "aerodynamic", the nozzle and helikon pocesses shall be kept separate.

IV/ - Projection of enrichment capacities -

Based on the data received in the answers to the questionnaire as well as additional informations from the technology holders, a projection of enrichment capacities has been compiled (Appendix 3).

Some data have to be corrected and/or updated to read :

FRANCE	: 1981.....	8.5 MSWU
USA diffusion	: 1978.....	12.6 MSWU
	1982.....	21.6
	1983.....	21.6
USA centrifuge	: 1987.....	.6
	1988.....	0.9
	1989.....	2.8
	1990.....	4.0
	1995.....	8.8
JAPAN	: New data as given, in table 4.1	

As this information is to be transmetted officialy to WG 2 A group, in order that a comparison between offer and demand be established, any correction should be made speedily.

Moroever, the wording of the front page and the presentation of the table should take into account the various statues of the plants examined and state whether they are "in operation", "under construction" or in the "planning stage".

V/ - Report on WG 2 B -

The text of the report (Appendix 4) to be made by the acting chairman to coming WG 2 meeting was approved by the group after a short discussion.

In view of future tasks organisation, the extension of the mandate of WG 2 B will be submitted to the approval of WG 2 to cover the study of :

- Safeguards
- Proliferation risks
- Multinational centers

VI/ - Documents -

The documents : "Uranium enrichment, present position" (WG 3) and "Contribution to assessment of Proliferation Resistance" (WG 8) prepared by the US delegation were made available to WG 2 B members as was requested during the preceeding meeting.

VII/ - Schedule of future activities -

The final report being in the offing it was decided that the cochairmen from France and Germany would submit a draft proposal for discussion by the group. Japan, UK and the USA will be invited by the cochairmen to participate during the writing of this report.

The written draft proposal should be received by the group members no later than January 26, 1979 in order to allow discussion of the report during the next plenary meeting of WG 2 B which is scheduled in Vienna on February 8 and 9, 1979.

- APPENDIX 1 -

LIST OF PARTICIPANTS

WG 2 B - VIENNA - OCTOBER 18, 1978

A. COUNTRIES

AUSTRALIA

Hardy, C.J.

BELGIUM

Huguet, M.
Neve de Nervergnies, M.
Verbeek, P.H.M.

FRANCE

Coates J.
Mézin M.

GERMANY, FED. REP. OF

Gerstler, R.W.
Krever, K.H.
Krey
Schubert

IRAN

Samii, C.

ITALY

Gallone, S.
Scuriccini G.B.

JAPAN

Kato, Y.
Nomura, A.

NETHERLANDS

Joseph, C.J.

SPAIN

Rojas, J.L.

SWEDEN

Martensson, M.

U.K.

Buck
Gresley, J.A.B.
Hughes, H.A.

U.S.A.

Quinn G.
King, L.M.
Rosenthal, M.D.

B. ORGANIZATIONS

OECD/NEA

Royen, J.

IAEA

Hartley, F.
Larson, C.
Skjoeldebrand, R.

- APPENDIX 2 -

WG 2 B

PROVISIONAL AGENDA FOR THE OCTOBER 18, 1978 MEETING

1/ Approval of agenda.

2/ Remarks on minutes of september 14-15 meeting.

3/ Projection of enrichment capacities.

4/ Report of WG 2 B activities to WG 2.

5/ Draft of WG 2 B final report.

6/ Schedule of WG 2 B future activities

- APPENDIX 3 -

PROJECTION OF ENRICHMENT CAPACITIES

The attached table contains estimated projections of enrichment capacities and yearly growth rates of installed capacities until the year 1995.

Basis for this compilation are the answers to the INFCE WG 2B - Questionnaire INFCE/WG 2/5 (B) dated from 10.04.78 and some additional information by the technology holders.

The following notes on comparaison of installed enrichment capacities should be regarded :

1) Nozzle Nustep :

Further projected capacity is not yet defined.

2) Diffusion Coredif :

Additional information for yearly projected growth rates of installed capacities provided by CEA.

3) Centrifuge PNC :

Data in ( ) estimated.

4) Helicon UCOR :

No commercial plants for supplying separation work to the international market in the foreseeable future.

5) Centrifuge Urenco :

Additional information for annually projected growth rates of installed capacities provided by Troika.

6) According to demand

7) Techsnab Diffusion) Data from Uranium Enrichment
DOE Diffusion) Present Position
DOE Centrifuge) Co Chairmen/WG 3/23, 31.03.78

8) Extrapolated to 1995.

It can be generally stated for enrichment capacities that expansion of world wide capacities can take place in such a way and so early that every provisionable demand can be satisfied.

Table 4.1

Enrichment Capacity (10^3 t sw/a) in operation, under construction, planned

Technology Holder	Brazil/Germany	France		Japan	South Africa	Troika	USSR	USA		Total
Facility	Nuclei Nustep	Eurodif	Coredif	PNC	UCOR	URENCO	Techsnab	DOE	DOE	
Process	Nozzle	Diffusion	Diffusion	Centrifuge	Helicon	Centrifuge	Diffusion	Diffusion	Centrifuge	
End of year										
1978						0,3	2,4	12,6		15,3
1979		2,2				0,4	3,9	16,7		23,2
1980		6,0				0,5	3,9	19,9		30,3
1981		8,5				0,7	4,1	21,2		34,5
1982		10,8				1,0	4,0	21,6		37,4
1983		10,8				1,5	4,4	21,6		38,3
1984		10,8		0,1		2,0	3,4	23,5		39,8
1985	0,22	10,8		0,3		2,5	3,4	25,6		42,8
1986	0,22	10,8	2,0	0,5		4,0	3,2	25,6		46,3
1987	0,22	10,8	4,0	0,5		5,5	3,3	25,6	--	50,3
1988	0,22	10,8	6,0	1,3		7,0	3,2	25,6	0,9	55,0
1989	0,22	10,8	8,0	1,9		8,5	2,5	25,6	2,8	60,3
1990	0,22	10,8	10,0	2,5		10,0	2,4	25,6	4,0	65,5
1995	0,22	10,8	10,0	5,5		17,5-20 6)	2,4 8)	25,6 8)	8,8	83,3
2000										

- APPENDIX 4 -

REPORT on WG 2 B

Since the last WG 2 meeting last june, the progress made by WG 2 B is the following :

1) Answers given to the questionnaire on technical, economical, commercial and sefeguards/proliferation characteristics of enrichment processes have been given by most of the technology holders, the main exceptions being South Africa and the USSR. An extensive synopsis of the answers has been established as well as a summary which has been reviewed and checked by the authors of the answers.

2) Based on the data referred to above, the table of contents of WG 2 B final report was decided upon as follows :

1/ Scope of report

2/ Base data collected on enrichment techniques

3/ State of enrichment technologies

4/ Availability of enrichment services

5/ Safeguards and proliferation implications

6/ Conclusions

This table of contents is submitted to WG 2 for remarks and/or approval.

The subgroup has given mandate to its two co-Chairman to call on necessary assistance in order to prepare a draft of the final report. This draft should reach the WG 2 B participants on January 26 at the latest in order to discuss the report during a WG 2 B plenary meeting scheduled on February 8 and 9 in Vienna. In such condition the final report should be well advanced by the end of February 79, even if it were not formaly approved before April.

3) Proposals have been made by delegations inside the subgroup either to extend the mandate of WG 2 B to the terms of reference set to WG 2 which have not been studied yet (i.e. safeguards, proliferation risks and multinational centers) or to create a similar structure for that same purpose.

4) There are no special recommandations from the subgroup concerning WG 2's report to TCC.

INFCE - WG 2

MINUTES OF THE MEETING

HELD IN IAEA HEADQUARTERS, VIENNA

ON OCTOBER 18-19, 1978

I/ PARTICIPANTS -

This meeting attended by representatives from fourteen nations and two international organisations (See appendix I) was chaired by Mr B. GOLDSCHMIDT, France (acting chairman), M. POPP, Germany F.R of and Mr C. SAMII, Iran.

II/ AGENDA -

The agenda is given in appendix 2. It was approved , the working group members.

III/ MINUTES OF JUNE 5-6, 1978 MEETING -

In document INFCE/WG 2/8 Australia is to be added to the list of countries which have answered the questionnaire (IV page 1) and to the list of delegates which indicated they could carry calculations (7 page 5).

A corrigendum (INFCE/WG.2/8 Corr.1) has been submitted by Iran for page 6, Section VI, point 4.

IV/ REPORT OF SUB GROUP 2.A -

Mr J.H. COATES cochairman of WG 2 A presented a report on the subgroup activities including participation in joint 1 A/2 A subgroup.

The data aggregated from the answers to the questionnaire for installed nuclear capacity in GWe is given below for two cases, the high and the low one. It does not include centrally planned economy countries.

	DATE	1985	1990	1995	2000	2010	2025
CASE	HIGH	272	460	770	1 200	2 150	3 900
	LOW	243	374	550	850	1 300	1 800

.../...

This data will be introduced into the IAEA model which, after being examined and discussed by a group of experts and compared to the results of parallel computations performed by several delegations, proved to be operational in its present state.

Under these conditions output data on the various steps of the fuel cycle can be produced for the four scenarios chosen for after 1995 :

- LWR once through
- LWR with Pu recycle
- All the FBR possible
- HWR once through

and presented for a breakdown into three regions :

- Comecon countries
- Non OECD countries
- OECD countries

These informations will be included in the final report, the summary of which is as follows :

1) Preamble
2) Base forecast for nuclear energy demand
3) Reactor and fuel cycle scenarios
4) Calculational methods
5) Fuel cycle requirements
6) Sensitivity analysis.

A first draft of the final report will be written by the co-chairmen at a joint 1 A/2 A meeting to be held in early december in view of a discussion at a plenary WG 1 A/2 A session on January 8-9, 1979 in Vienna.

V/ REPORT OF SUBGROUP 2 B -

Mr J.H. COATES, acting chairman of WG 2 B presented a report on the subgroup activities, concerning essentially the results on the enrichment questionnaire and the september 14-15, 1978 meeting (cf appendix 3).

The answers received from the technology holders to the technico-economic questionnaire have been collected and summarized in a comprehensive manner (cf co chairmen WG.2/3 (B) appendix 3), but in some cases, data is lacking as no answer was received (USSR for instance).

In order to enable a comparison between demand for enrichment (WG 1 A/2 A) and offer, a projection of enrichment capacities was made on the basis of the most recent data available (cf appendix 4). This information having been approved in WG 2 B shall be transmitted to WG 2 A. A thorough comparison should be completed by mid March 1979.

.../...

Work on the final report has been initiated and a preliminary report is being prepared by a drafting committee including France, Germany (Federal Republic of), Japan, UK and USA in view of a first group discussion on February 8-9, 1979. However, the questions relative to non proliferation and multinational centers require further probing and discussing. Papers on these subjects are being prepared by several delegations :

- US delegation on gaseous diffusion and gas centrifuge. Will be ready by December.

- UK delegation announced a troïka paper on multinational centers based on Urenco's experience.

- French delegation distributed at this meeting a short paper entitled "Proliferation risks of uranium enrichment" (Appendix 5) and is writing a paper on Eurodif's experience towards multinational centers. Due for next meeting.

It must be noted that for INFCE, the only real experience on the multinational center concept can be found in WG 2 exclusive of other groups which renders the above experience the more so valuable.

VI/ CONTENTS OF WG 2 FINAL REPORT -

After discussion of several proposals, the group agreed on the following headings for the table of contents (appendix 6) :

A) Technical and economic assessment of the different enrichment technologies.

B) Enrichment demand and availability according to various fuel cycle strategies.

C) International safeguards aspects specific to enrichment.

D) Assessment and comparison of the proliferation of the supply of enrichment services.

E) Discussion of possible improvements for the development of enrichment services capabilities.

F) Special needs of developing countries.

G) Conclusions.

The draft of the final report shall be submitted to TCC by June 1st, 1979 after receiving the "blessing" of the group.

.../...

The French and German co-presidents have been charged with the writing of a first draft to be discussed at a February 12-13, 1979 group meeting in Vienna. A second draft will be dispatched by April first for written comments to be discussed at a May 11-12 meeting in Vienna so that the final draft including the necessary amendments be ready by June 1St.

It has been recommanded that the report be concise, comprehensive and exhaustive, and conclusions be limited to 10-20 pages. Pertinent information contained in the subgroups reports shall be appended to rather than incorporated into the main text.

VII/ FUTURE MANDATE AND ORGANIZATION OF SUBGROUPS -

Mandates and organization of subgroups 2 A and 2 B seems well defined in view of the final reports and of the TCC June 1979 deadline.

The subgroup 2 C concerned with the special needs of developping countries has not yet been able to meet.Due to time pressure,it was therefore decided to ask any delegation to INFCE who would like to contribute to send in writing to the cochairmen in exercise (M. GOLDSCHMIDT) its comments on the subject, as well, if it be the case, to state its desire to see the subgroup actually meet.

VIII/ WORKING PROGRAM OF WG 2 -

The milestones of WG 2 tasks and meetings are summarized below :

- February 12-13, 1979 (in Vienna) : Discussion of first draft of final report.
- April 1st, 1979 : Dispatch of revised draft.
- May 11-12, 1979 (in Vienna) : discussion and WG 2 final drafting of report.
- June 1st, 1979 : Transmission of final WG 2 report to TCC.

IX/ REPORT TO TCC -

The report to TCC will describe the progress made within WG 2 and its subgroup and to the future schedule of activities, essentially directed to the managing of the final report.

Division of External Relations
Conference Services Section

INFCE

Date: 78-10-18
Issue No. 2

NOTIFICATION OF A MEETING HELD AT HEADQUARTERS

Title of Meeting: International Nuclear Fuel Cycle Evaluation (INFCE)
Working Group II on Enrichment Availability
Sub-Group B on

Opening Meeting: 10.30
Enquiries: INFCE OFFICE
Ext. 551 or 276

Dates, inclusive: 18-19 October, 1978

Place: Meeting Room D IAEA Headquarters, Ext. 500

Note: A list showing names of participants is at tached. The names appear in alphabetical order and the Delegation Leader is underlined.

Co-Chairmen:	France	Mr J. COATES
	F.R.G.	Mr K.H. KREWER
	Iran	Mr C. SAMII (Actingp
Scientific Secretary	IAEA	

- APPENDIX 1 -

- APPENDIX 1 -

LIST OF PARTICIPANTS

WG 2 B - VIENNA - OCTOBER 18, 1978

A. COUNTRIES

AUSTRALIA

Hardy, C.J.

BELGIUM

Huguet, M.
Neve de Nervergnies, M.
Verbeek, P.H.M.

FRANCE

Coates J.
Mézin M.

GERMANY, FED. REP. OF

Gerstler, R.W.
Krewer, K.H.
Krey
Schubert

IRAN

Samii, C.

ITALY

Gallone, S.
Scuriccini G.B.

JAPAN

Kato, Y.
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Joseph, C.J.

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Hughes, H.A.

U.S.A.

Quinn G.
King, L.M.
Rosenthal, M.D.

B. ORGANIZATIONS

OECD/NEA

Royen, J.

IAEA

Hartley. F.
Larson, C.
Skjoeldebrand, R.

- APPENDIX 2 -

Agenda for the Working Group 2 meeting at I.A.E.A. head quarters in Vienna, Room A, 18-19 October, 1978 at 10:30 a.m.

1 - Approval of the agenda

2 - Approval of the minutes of June 5-6, 78 meeting

3 - Report of the subgroup 2A on supply and demand forecast and results of the London meeting on July 10,78.

4 - Report of the sub-group 2B on results of enrichment questionnaire and the 14-15 Sept., 78 meeting.

5 - Contents of the WG.2 final report.

6 - Future mandate and organization of sub-groups of group 2 in the light of completion of tasks by sub-groups 2A and 2B.

7 - Working program of WG.2

8 - Report to TCC.

9 - Other matters

- APPENDIX 3 -

REPORT ou WG 2 B

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2/ Base data collected on enrichment techniques

3/ State of enrichment technologics

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5/ Safeguards and proliferation implication

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4) There are no special recommandations from the subgroup concerning WG 2's report to TCC.

- APPENDIX 4 -

PROJECTION OF ENRICHMENT CAPACITIES

The attached table contains estimated projections of enrichment capacities and yearly growth rates of installed capacities until the year 1995.

Basis for this compilation are the answers to the INFCE WG 2B - Questionnaire INFCE/WG 2/5 (B) dated from 10.04.78 and some additional information by the technology holders.

The following notes on comparaison of installed enrichment capacities should be regarded :

1) Nozzle Nustep :

Further projected capacity is not yet defined.

2) Diffusion Coredif :

Additional information for yearly projected growth rates of installed capacities provided by CEA.

3) Centrifuge PNC :

Data in ( ) estimated.

4) Helicon UCOR :

No commercial plants for supplying separation work to the international market in the foreseeable future.

5) Centrifuge Urenco :

Additional information for annually projected growth rates of installed capacities provided by Troika.

6) According to demand

7) Techsnab Diffusion) Data from Uranium Enrichment
DOE Diffusion) Present Position
DOE Centrifuge) Co Chairmen/WG 3/23, 31.03.78

8) Extrapolated to 1995.

It can be generally stated for enrichment capacities that expansion of world wide capacities can take place in such a way and so early that every provisionable demand can be satisfied.

Table 4.1

Enrichment Capacity (10^3 t sw/a) in operation, under construction, planned

Technology Holder	Brazil/Germany	France		Japan	South Africa	Troika	USSR	USA		Total
Facility	Nuclei Nustep	Eurodif	Coredif	PNC	UCOR	URENCO	Techsnab	DOE	DOE	
Process	Nozzle	Diffusion	Diffusion	Centrifuge	Helicon	Centrifuge	Diffusion	Diffusion	Centrifuge	
End of year										
1978						0,3	2,4	12,6		15,3
1979		2,2				0,4	3,9	16,7		23,2
1980		6,0				0,5	3,9	19,9		30,3
1981		8,5				0,7	4,1	21,2		34,5
1982		10,8				1,0	4,0	21,6		37,4
1983		10,8				1,5	4,4	21,6		38,3
1984		10,8		0,1		2,0	3,4	23,5		39,8
1985	0,22	10,8		0,3		2,5	3,4	25,6		42,8
1986	0,22	10,8	2,0	0,5		4,0	3,2	25,6		46,3
1987	0,22	10,8	4,0	0,5		5,5	3,3	25,6	--	50,3
1988	0,22	10,8	6,0	1,3		7,0	3,2	25,6	0,9	55,0
1989	0,22	10,8	8,0	1,9		8,5	2,5	25,6	2,8	60,3
1990	0,22	10,8	10,0	2,5		10,0	2,4	25,6	4,0	65,5
1995	0,22	10,8	10,0	5,5		17,5-20 6)	2,4 8)	25,6 8)	8,8	83,3
2000										

- APPENDIX 5 -

Contribution from the delegation of France to INFCE WG2

PROLIFERATION RISKS OF URANIUM ENRICHMENT

SUMMARY

The main ideas which are presented in the paper are the following :

1) Attaining nuclear weapon capacity based on highly enriched uranium involves the availability of low grade uranium and the mastership of an appropriate enrichment technique. The second condition is by far the most difficult to achieve and this is where resistance to proliferation is to be found.

2) Enrichment techniques are by themselves more or less adapted to the production of highly enriched uranium and it is possible to identify a number of criterias which allow to build a judgement on the proliferation potential of each of the enrichment techniques.

3) It would be unrealistic to ignore the state of development attained by such techniques which offer high proliferation potential, however, it would be appropriate to take their lack of resistance to proliferation into account in order to make suitable the engagements to be taken, the international controls to be applied, as well as the business organizations to be set up.

October 11, 1978

1. Attaining weapon capacity based on highly enriched uranium involves the availability of low grade uranium and the mastership of an appropriate enrichment technique.

   Low grade uranium is quite abundant under natural form and only relatively small quantities are needed to attain weapon capacity. Thus, although it is widely under control, the availability of nuclear material does not oppose strong resistance to proliferation.

   On the contrary, the enrichment technique which is needed to bring the material under enriched form offers technical difficulties which are so many obstacles to proliferation. In fact, these difficulties are such that few countries have been able to master them until now. Therefore this is where the main resistance to proliferation is to be found.

   Reviewing all cases, the question arises regarding the availability of preenriched uranium . The analysis would then appear as follows :

   a) If concentration in U_{235} is higher than roughly 20 %, the material may be used as such for explosion purposes. The military value of the corresponding devices increases with U_{235} assay and becomes excellent above 90 %. Obviously, the risk of proliferation is high for that category of material and it increases with U_{235} concentration.

   b) If concentration in U_{235} is below 20 % and, in particular, if the enrichment attained corresponds to LWR grade material, then it cannot be used for explosion purposes unless further enrichment is applied. This means that an appropriate separation technique would have to be available for further upgrading. But then having such a process would allow direct enrichment from natural material and therefore would reduce noticeably the advantage of having preenriched material save perhaps for attaining lower decrasing SW regts ., faster & easier costs or allowing better concealment of the HEU plant.

2. Enrichment techniques are by themselves more or less adapted to the production of highly enriched uranium, and it is possible to identify a number of criterias which allow to build a judgement on the proliferation potential of these techniques.

Such criterias are the following :

a) The difficulty encountered in bringing the technique to the level of possible utilization. It is well known that most enrichment processes rely on advanced technology and meet numerous problems such as corrosion, mechanical constraints, and so on. These are obstacles which have to be overcome by R & D or transfer of know how and which in any case call on time, skills and means.

b) The difficulty encountered in manufacturing the high enrichment plant components which brings forth such questions as wether these components are specific to HEU production or standard for all assays.

c) The difficulty encountered in starting up the HEU plant and, in particular, the time needed to bring it to isotopic equilibrium which depends on the stage dynamics and enrichment factor.

d) The difficulty encountered in operating the plant which may result from criticality limitations, process stability, etc ...

e) The difficulty in concealing a clandestine plant which depends on the necessary ground work, the process compacity, the ancillaries, the importance of power supply, ...

f) The difficulty in converting an existing LEU into a HEU plant either by rearranging the cascade or by applying batch recycling.

In making an appropriate assessment of proliferation risks thus involved by various techniques, care should be taken not to overlook the risk of crude technologies which are more likely to be applied for military purposes than for commercial purpose since the former only need small plants without constraints regarding competitivity.

Based on CEA experience, a tentative comparison between processes is presented in Appendix.

3) It would be unrealistic to ignore the state already attained by a number of countries in the development of those techniques such as centrifuge, aerodynamic processes, and laser which offer less resistance to proliferation. But attention should be given to a number of precautions in line with the following :

a) Observance of confidentiality. This covers :

- non disclosure of sensitive information through articles, conferences, hearings, patents, etc...
- adequate protection and surveillance of technical activities.

b) Watchfulness on industrial agreements liable to increase the risks of proliferation. In particular :

- no exports of sensitive techniques or of their components
- preference to multinational ventures for industrial applications.

c) Application of specific safeguards measures in order to avoid any miscuse of declared facilities such as

- cascade reorganization
- batch recycling.

etc...

When no development has been undertaken on any specific technique, then other means of solving the enrichment problem should be envisaged such as participation in multinational centers or development of less proliferant techniques such as chemical exchange.

APPENDIX - PROLIFERATION POTENTIAL OF VARIOUS ENRICHMENT TECHNIQUES

In view of HEU production :	G. diffusion		Centrifuge			Aerodyna. processes	Chemical exchange	LIS	Plasma
	commerci	crude	HOM	LOM	crude				
a. Difficulty to reach process application	+	=	+	=	-	-	-	+	+
b. Difficulty to manufacture components	+	=	+	=	-	=	=	=	+ ?
c. Difficulty to start up	=	=	-	-	-	-	+	-	-
d. Difficulty to operate	=	=	-	-	-	-	+	-	-
e. Difficulty to conceal	+	+	=	-	-	+	+	-	-
f. Difficulty to convert LEU plant	+	+	-	-	-	=	+	-	-
TOTAL	+	=	=	-	-	-	+	-	-

HOM : high output machines

LOM : low output machines

\+ : proliferation resistance

\- : proliferation hazard

= : intermediate.

- APPENDIX 6 -

PRELIMINARY OUTLINE FOR THE
FINAL REPORT OF INFCE WORKING GROUP 2

A/ Technical and economic assessment of the different enrichment technologies

1. State of enrichment technologies

   a) List of technologies and thier owners
   b) Caracteristic (economies, power requirements)

2. Availability of enrichment services

   a) List of enrichment service contractors
   b) Present and planned capacities
   c) Flexibility and responsiveness to demand forecast
   d) Main contracting conditions

B/ Enrichment demand and availability according to various fuel cycle strategies

1. Enrichment demand

   a) High-range forecast
   b) Low-range forecast
   c) Sensitivities, including various tails assays

2. Enrichment availability

   a) Firmly committed capacity
   b) Planned capacity
   c) Flexibility and responsiveness to demand forecast

3. Observations on the balance between demand and availability

C/ International safeguards aspects specific to enrichment

1. International safeguards implications in general
2. International safeguards aspects of existing technologies

) Crude commercial

3. International safeguards aspects of advanced technologies
4. Research and development to improve international safeguards at enrichment facilities
5. General conclusions as to effective safeguards strategies, facility design, and implementation.

D/ Assessment and comparison of the proliferation aspects of ~~the supply of~~ enrichment ~~services~~

1. Proliferation aspects of existing technologies
2. Proliferation aspects of advanced technologies
3. Institutional perspectives, including multinational or regional fuel cycle centers.

.../...

APPENDIX 6 (Cont.)

E/ Discussion of possible improvements for the development of enrichment services capacilities

1. Reduction of proliferation risk
2. Assurance of supply
   a) Joint planning of future capacities
   b) Opportunities for cross-investment
   c) Freedom of choice for customers in an open market

F/ Special needs of developing countries

G/ Conclusion
