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**INFCE**

**International  
Nuclear  
Fuel  
Cycle  
Evaluation**

**INFCE/DEP./WG.4/28**

QUESTIONNAIRE ISSUED BY THE CO-CHAIRMEN

# International Nuclear Fuel Cycle Evaluation

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INFCE/WG.4/18 (A,B)

21 March 1978

Working Group 4

REPROCESSING, PLUTONIUM MANAGEMENT AND RECYCLE

QUESTIONNAIRE ISSUED BY THE CO-CHAIRMEN

1. The Chairmen of Sub-Groups A and B of INFCE Working Group 4 enclose a questionnaire concerning plans for reprocessing of spent fuel, plutonium management and recycle. You are invited to assist the work of Group 4 by providing the information requested in the questionnaire.
2. The questions cover spent fuel arisings, reprocessing plant capacity, products separated from reprocessed fuel, plutonium storage and recycle in thermal reactors. The Chairmen also require information on installed and projected nuclear electrical capacity, but for this intend to rely on question 1 of the questionnaire issued by INFCE Group 1A/2A. If any countries have not been invited to fill in the Group 1A/2A questionnaire, their assistance in completing the table attached as an annex would be appreciated.
3. Where forecasts are requested, space has been allowed for high, low and reference estimates. If national forecasts have not specified high or low estimates, the reference case alone need be completed.
4. Question 4 requests information on capital and runnings costs. The Chairmen of Group 4 would be grateful if costs could be expressed in U.S. \$ as calculated for December 1977.
5. You are requested to send your answers to Mr. Robert Najar, Conference Service Section, International Atomic Energy Agency, P.O. Box 590, Kärntnering 11, A-1011 Vienna, Austria. A response by 1 May 1978 would be greatly appreciated. Alternatively, participants in the Group 4 meetings to be held from 15-19 May 1978 may find it convenient to hand replies to the Technical Secretariat then.
6. This questionnaire is being distributed to all INFCE participants.

- 2 -

The following abbreviations have been used:

GW(e)	Gigawatts (electric)
p.a.	per annum
ref	reference case
SWU	separative work unit
te	metric tonne

1 **SPELT FUEL ARISING FROM THERMAL REACTORS**

TABLE 1.1

Unreprocessed spent fuel stored at present (1977) (te of heavy metal)	
Estimated fissile Pu content (te)	

1. The figures requested in line A of table 1.2 from the beginning of 1978: i.e. columns 2, 3 fuel arisings accumulated from January 1978 columns 5,6 and 7 to arisings accumulated from
2. In line A the figures inserted should be the fuel expected to be produced up to the end of
3. The information requested in lines B and D is quantity of fissile plutonium contained in the spent fuel given in lines A and C respectively
4. The information requested in line C is the spent fuel expected to be held in storage at specified.

TABLE 1.2

line	Column 1	FORECASTS						
		2	3	4	5	6	7	8
		High	1985 Ref	Low	High	1990 Ref	Low	High
A	Cumulative spent fuel arisings (te of heavy metal)							
B	Estimated fissile Pu contents (te)							
C	Estimated quantity of spent fuel in storage. (te of heavy metal)							
D	Estimated fissile Pu content (te)							

Figures requested in line A of table 1.2 are cumulative from the beginning of 1978: i.e. columns 2,3 and 4 refer to spent arisings accumulated from January 1978 to December 1985, columns 5,6 and 7 to arisings accumulated from 1978 to 1990, etc.

In line A the figures inserted should be the quantity of spent fuel expected to be produced up to the end of the year specified.

Information requested in lines B and D is the estimated quantity of fissile plutonium contained in the quantities of spent fuel given in lines A and C respectively.

Information requested in line C is the estimated quantity of spent fuel expected to be held in storage at the end of the year specified.

5            6            7            8            9            10            11            12            13

**F O R E C A S T S**

1990			2000			2025		
High	Ref	Low	High	Ref	Low	High	Ref	Low

## REPROCESSING PLANT CAPACITY

- 1 Tables 2.1 and 2.2 request information on present and planned reprocessing plant capacity, su
- 2 The name of each reprocessing plant should be inserted in column 1 of each table. If one si  
type of fuel, the fuel types, capacity and throughput for each fuel type should be entered on  
Double counting should therefore be avoided. **Separate totals should be given (in lines E and**
- 3 Both the capacity - the maximum throughput for which the plant is designed - and the expected
- 4 Column 6 of table 2.2 requests information on the current status of the plant. Please indic
- a in operation in 1977
  - b currently under construction
  - c plants for which a decision to proceed has been taken, but construction not yet
  - d under consideration
  - e other - please give details in this case.
- 5 All years refer to end of year.
- 6 Quantities of spent fuel should be measured in tonnes of heavy metal.

TABLE 2.1 REPROCESSING PLANTS IN OPERATION 1977

column	1	2	3	
line	Name of reprocessing plant	Type of fuel	Capacity te p.a. spent fuel (heavy metal)	Th te (h
A				
B				
C				
D				

anned reprocessing plant capacity, subdivided into fuel type handled.

a column 1 of each table. If one site deals with more than one

each fuel type should be entered on separate lines in the tables.

als should be given (in lines E and F) for each fuel type in table 2.2.

plant is designed - and the expected actual throughput are requested.

nt status of the plant. Please indicate categories as follows:

een taken, but construction not yet begun

heavy metal.

3

4

	Capacity te p.a. spent fuel (heavy metal)	Throughput 1977- te p.a. spent fuel (heavy metal)

TABLE 2.2

REPROCESSING PLANTS (INCLUDING THOSE IN OPERATION 1977) PLANNED TO BE OPERATI

Column 1                      2                      3                      4                      5                      6                      7                      8                      9

Line	Name of Reprocessing Plant	Type of Fuel	FORE					
			High	1985 Ref	Low	High	1990 Ref	Low
A		Capacity (te p.a. spent fuel)						
			Throughput (te p.a. spent fuel)					
B		Capacity (te p.a. spent fuel)						
			Throughput (te p.a. spent fuel)					
C		Capacity (te p.a. spent fuel)						
			Throughput (te p.a. spent fuel)					
D		Capacity (te p.a. spent fuel)						
			Throughput (te p.a. spent fuel)					
E	Total	Capacity (te p.a. spent fuel)						
			Throughput (te p.a. spent fuel)					
F	Total	Capacity (te p.a. spent fuel)						
			Throughput (te p.a. spent fuel)					

**SECTION 1**





TABLE 3.1

Line A	Separated fissile plutonium stocks held at present (Dec 1977) (te)	
Line B	Indicate quantity of fissile Pu stocks shown in line A which is in the form of fabricated fuel pins (te)	

- 1 Plutonium stocks in this case (whether in stores or as fuel) separated to the time it is ...
- 2 For line A in Table 3.2 the quantity of Pu expected to be separated by the date specified. The quantity in 1977 (as given in Table 3.1)
- 3 The figure requested in line B is equal to the figure in line A of Pu returned for use as fuel in research up to the date specified.
- 4 All years refer to end of year.
- 5 Table 3.3 requests information in stores. Estimates should be not cumulative.

TABLE 3.2

Column	1	2	3	4	5	6	7
		High	1985 Ref	Low	High	1990 Ref	Low
Line A	Cumulative separation (te)						
	Fissile Plutonium						
Line B	Pu stocks (te)						

1 Plutonium stocks in this case refer to all Pu held in any form  
(whether in stores or as fuel pins etc) from the time the Pu is  
separated to the time it is placed in a reactor.

2 For line A in Table 3.2 the figure inserted should be the quantity  
of Pu expected to be generated in reprocessing plants up to the  
date specified. The quantity of Pu held in stock at the end of  
1977 (as given in Table 3.1) should not be included.

3 The figure requested in line B in table 3.2 is the quantity of Pu stocks held  
is equal to the figure in line A after subtraction of the quantity  
of Pu returned for use as fuel in thermal or fast reactors or for use  
in research up to the date specified.

4 All years refer to end of year.

5 Table 3.3 requests information concerning the use of Pu not held  
in stocks. Estimates should be given for the years specified:  
is not cumulative.

4 5 6 7 8 9 10 11 12 13

FORECASTS

Low	High	1990 Ref	Low	High	2000 Ref	Low	High	2025 Ref	Low

TABLE 3.3

line	coluan	1	2	3	4	5	6	7
			CURRENT SITUATION 1977	High	1985 Ref	Low	High	1990 Ref
A		Fissile Pu being used in research (Kg)						
B		Fissile Pu being recycled as fuel in thermal reactors (te)						
C		Fissile Pu being recycled as fuel in fast reactors (te)						
D		Other use : please specify in this case						

SECTION 1

200

5      6      7      8      9      10      11      12      13      14

**FORECASTS**

Low	High	1990 Ref	Low	High	2000 Ref	Low	High	2025 Ref	Low

**SECTION 2**

4 STORAGE OF PLUTONIUM

- 1 This table requests information about Pu stores, existing or planned.
- 2 The information requested in columns 2-8 should be provided separately for each store listed in column 1.
- 3 In column 1 individual stores should be named or numbered. A number should be entered if the location of the store cannot be given.
- 4 Column 5 requests information on the form of Pu (eg as oxide, nitrate solution etc)
- 5 Column 6 of table 4.1 requests information on the status of the stores. Please indicate as follows:
  - a in operation
  - b currently under construction
  - c stores for which a decision to proceed has been taken but not yet started
  - d under consideration
  - e other - please give details in this case.

TABLE 4.1

Line	Column 1 Store	2 Capacity (te heavy metal, all isotopes)	3 Current stocks (te heavy metal, all isotopes)	4 Form of Pu stored or to be stored	5 Completion date if not yet built	6 Capital cost \$US (
A						
B						
C						

**SECTION 1**

ing or planned.

ended separately for each store

ed. A number should be entered if for security reasons

oxide, nitrate solution etc).

as of the stores. Please indicate categories

proceed has been taken but construction not yet begun.

this case.

5

6

7

8

Pu er to red	Completion date if not yet built	Capital cost \$US (Dec 1977)	Operating costs \$US (Dec 1977) per kg heavy metal per annum (assuming store full)	Status

**SECTION 2**

5 PU RECYCLE IN THERMAL REACTORS

1. Does your country have any plans for Pu recycle in thermal reactors ? \_\_\_\_\_
  
2. If so, (i) when is recycle scheduled to begin ? \_\_\_\_\_  
 (ii) in which reactor types is Pu recycle planned ? \_\_\_\_\_
  
3. Table 5.I requests information on the quantity of Pu expected to be recycled in thermal reactors, the quantity of Natural Uranium and Separative Work, which this is expected to achieve. Es of the years specified.

TABLE 5.I

	CURRENT SITUATION 1977	FORECASTS								
		1985			1990			2000		
		High	Ref	Low	High	Ref	Low	High	Ref	Low
Quantity of fissile Pu used in thermal recycle. (te)										
Consequent savings in Natural Uranium (te)										
Consequent savings in separative work ( 10 <sup>9</sup> SWU )										



181

Plans for Pu recycle in thermal reactors ? \_\_\_\_\_

Scheduled to begin ? \_\_\_\_\_

For types is Pu recycle planned ? \_\_\_\_\_

on the quantity of Pu expected to be recycled; and on the savings in requirements for  
re Work, which this is expected to achieve. Estimates should be cumulative up to the end

F O R E C A S T S											
1985			1990			2000			2025		
High	Ref	Low	High	Ref	Low	High	Ref	Low	High	Ref	Low

Projection of Nuclear Electrical Capacity, by reactor Type  
 (Installed Capacity, net GW (e), of plants in commercial  
 operation by the end of the year stated)

YEAR	LWR		HWP		AGR		GG		HTR		FBR		TOTAL	
	High*)	Low*)	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
1977														
78														
79														
1980														
81														
82														
83														
84														
1985														
86														
87														
88														
89														
1990														
95														
2000														

(\*) The terms "High" and "Low" pertain to estimates of nuclear power growth

Question 1 b.

Projection of Nuclear Electrical Capacity, by reactor Type

(\* ) The terms "High" and "Low" pertain to estimates of nuclear power growth

Question 1 b.

Projection of Nuclear Electrical Capacity, by Reactor Type

(Installed Capacity, net GW (e), of plants in commercial operation by the end of the year stated)

YEAR	LWR		HWR		AGR		GG		HTR		FBR		TOTAL	
	High <sup>*</sup> )	Low <sup>*</sup> )	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low
2000														
2005														
2010														
2015														
2020														
2025														

(\* ) The terms "High" and "Low" pertain to estimates of nuclear power growth