Pu Stocks

~~OFFICIAL USE ONLY~~

II. MATERIALS (Continued)

44. The quantity of plutonium separated, or otherwise modified, to other forms (such as oxide or metal) at the Savannah River Plant during any time period. (94-9)

45. Plutonium quantities at the Savannah River Plant for any time period, *provided other classified information such as weapons design are not revealed.* (94-9)

46. The total quantity of plutonium involved in all nuclear weapons tests performed by the United States. (94-11)

47. As part of the 1958 United States - United Kingdom Mutual Defense Agreement, there have been three barter agreements. The United States received plutonium totaling 5,366 kilograms from the United Kingdom under the Barter A, B, and C Agreements during the period 1960 - 1979. The United States gave the United Kingdom 6.7 kilograms of tritium and 7,500 kilograms of highly enriched uranium for the plutonium. (94-15)

    a. During the period of 1960-1979, the following materials were exchanged: (97-3)

        Barter A: 480 kg UK plutonium for 6 kg of U.S. tritium
        Barter B: 4,073 kg UK plutonium for 7,500 kg of U.S. HEU
        Barter C: 813 kg UK plutonium for 0.7 kg of U.S. tritium

48. The fact that plutonium combined with <u>any</u> stated weight percent gallium exists: (1) stabilized as an alloy in the delta phase in nuclear weapons, providing neither weapon or alloy nickname (other than Headwind) is specified, and (2) as an oxide in the weapons program, providing the source of the plutonium is not specified by weapon or alloy nickname (other than Headwind). (95-1)

49. The sum of the quantity of plutonium at the Pantex site and in the nuclear weapons stockpile was 66.1 metric tons on September 30, 1993. (95-6)

50. "Palmolive" which was replaced by "Birchbark" which was replaced by "Brandywine" which is the material nickname for Plutonium (Pu^{238}). The association of any of these nicknames with either of the others is also unclassified. (96-2)

51. "Olive" which was replaced by "Bark" which was replaced by "Wine" which is the material nickname for Pu^{238}. The association of any of these nicknames with either of the others. (98-13)

52. The total forecast or actual quantity of plutonium transferred in either direction under "the loan." (The mere fact of an arrangement under the 1958 Mutual Defense Agreement, which provided for the loan of plutonium to the United Kingdom during the period 1980-1985, and the fact that there was a plutonium loan

Annex A Transfers of plutonium to and from Aldermaston 1952-1999

1	2	3	4	5	6	7	8	9	10	11	12
Year	From Sellafd	To Sellafd	From Winfrith	To Winfrith	From Dounry	To Dounry	From Harwell	To Harwell	Total	To US	Total
1952/53	20.3								20.3		20.3
1953/54	89.9	6.7							103.5		103.5
1954/55	72.9	4.6							171.8		171.8
1955/56	75.0	8.8							238.0		238.0
1956/57	90.6	11.2							317.4		317.4
1957/58	115.2	20.0					10.9	9.8	413.7		413.7
1958/59	155.2	19.7				0.1	19.2		568.3		568.3
1959/60	150.3	17.6				6.9			694.1		694.1
1960/61	271.5	17.2			3.1	3.0	0.0	6.0	942.5	50.0	892.5
1961/62	436.2	39.5		15.3	0.2	3.4		6.4	1314.3	50.0	1214.3
1962/63	486.1	236.7		0.1	127.6	5.5		4.8	1680.9	50.0	1530.9
1963/64	289.4	186.1	2.0	104.0	0.3	3.6	3.8	8.9	1673.8	50.0	1473.8
1964/65	437.4	108.8	24.9	122.9	0.9	4.9	3.4	9.3	1894.5	50.0	1644.5
1965/66	776.4	161.3	144.6	248.4	0.5	7.9	0.5	0.4	2398.5	50.0	2098.5
1966/67	920.1	223.6	1.2	16.6		10.6	0.2	0.2	3069.0	1075.0	1694.0
1967/68	1527.2	251.2	0.1	0.1	0.1	4.6	0.4	2.3	4338.6	1075.0	1888.6
1968/69	1963.4	416.7	0.6	0.0		2.2		0.8	5882.9	1075.0	2357.9
1969/70	1314.6	174.2	89.8	0.6	2.7	3.2	0.0	2.2	7109.8	1075.0	2509.8
1970/71	713.3	211.2	118.3	561.9	2.8	1.4	0.1	0.1	7169.7		2569.7
1971/72	799.8	241.9	0.2	1163.8	5.5	1.7	0.0	0.0	6567.8		1967.8
1972/73	420.4	291.0	4.0	255.8		4.2	0.4	0.1	6441.5		1841.5
1973/74	217.6	237.8	70.0	256.4		33.2	1.8	0.1	6203.4		1603.4
1974/75	293.9	120.4	82.1			20.0	5.4	3.8	6440.6		1840.6
1975/76	184.1	130.4	110.7	43.4		4.5	0.1	1.0	6556.2	160.0	1796.2
1976/77	183.7	83.0			0.0	100.6	0.4	0.0	6556.7	160.0	1636.7
1977/78	257.2	146.7					4.4	0.5	6671.1	160.0	1591.1
1978/79	410.1	37.7						0.0	7043.5	160.0	1803.5
1979/80	186.8	24.7	0.1				0.0	1.3	7204.4	160.0	1804.4
1980/81	0.0	10.7					0.0	5.0	7188.7		1788.7
1981/82	0.0	109.2					0.9	15.7	7064.7		1664.7
1982/83	169.3	72.5		25.1			97.4	147.4	7086.4		1686.4
1983/84	95.7	203.2		8.2			265.6	239.6	6996.7		1596.7
1984/85	155.4	107.4					4.4	3.6	7045.5		1645.5
1985/86	124.8						5.8	4.9	7171.2		1771.2
1986/87	0.0						10.4	5.5	7176.1		1776.1
1987/88	0.0						2.5	13.3	7165.3		1765.3
1988/89	0.0						18.1	3.6	7179.8		1779.8
1989/90	180.9						5.5	11.9	7354.3		1954.3

E1 page 2

Reassessment of Plutonium Price for Year 1962/63
on the assumption that sales of surplus
limited to 120 Kg instead of 134 kg
(The Balance of 14 kg being sold to MoA in 1963/64)

		Kg	Price / kg £	Value £,000
Opening Stocks				
AWRE Working Stocks:				
(1) Production		22		
(2) Research & Development		95		
Unsold Surplus B/F		124		
		241	57000	13737
New make during year		370	60000	22200
		611		35937
Less Civil Requirements	178			
Less Civil Reserve	30	208	60000	12480
		403		23457
Reprocessing Charges				
Say 185 kg @ £4150 per kg				768
Balance due re Hinckley Point				130
Under Recovery from 1961/62				102
Allowance for creation of dross, say				250
		403		24707
Less - Closing Stocks				
(1) Production	22			
(2) Research & Development	172			
(3) Unsold Surplus	14	208	57000	11856
		195		12851
PRICE PER KG (say)			66000	
USAGE				
A.M. Barter		60		
Research & Development including Safety		15		
Surplus		120		
		195		

ASSESSMENT OF PRICE OF PLUTONIUM FOR YEAR 1963 /64

COMPARISON OF TWO DIFFERENT BASIS.

	BASIS 'A'			BASIS 'B'		
	Kgs	Price per kg £	Value £ 000	Kgs	Price per kg £	Value £ 000
Opening Stocks						
AWRE Working Stocks:-						
(1) Production (Total 132 kg out of which 12 kg MoA material)	120			120		
(2) R&D	98			98		
Tritium Barter material	17			17		
	235	57,000	13,395	235	57,000	13,395
New Make during year (military only)	145	100,000	14,500	145	100,000	14,500
	380		27,895	380		27,895
Less Overproduction of Tritium Barter material @ 31.3.63 to be sold to military @ valuation of 31.3.63	17	57,000	969			
	363		26,926	380		27,895
Reprocessing Charges						
Say 90 kg @ £4,000 per kg			360			360
Under recovery from 1962-63			260			260
Allowance for the creation of dross - say			105			111
	363		27,651	380		28,626
Less Closing Stocks:-						
(1) Production (Total 130 kg out of which 10 kg MoA material)	120			120		
(2) R&D (Total 108 kg out of which 10 kg MoA material)	98	57,000	12,426	98	57,000	12,426
	145		15,225	162		16,200
PRICE PER KG		105,000			100,000	
USAGE			£M1			£M1
Tritium Barter	43	105,000	4.5	60	100,000	6.0
Military Sales	102	105,000	10.7	102	100,000	10.2
	145			162		
Tritium Barter	17	57,000	1.0			
TOTAL SALES	162		162	162		162

NOTE - After due consideration it was decided that Basis 'B' should be used for the current year.

E46 page 1

Note from Bradley to Hudspith. Dated 4 May 1963.

Charging for fissile material.

1. One of the actions left with us at the meeting at the Treasury on 22 April was to calculate a price which could be used by Ministry of Aviation when disposing of returned weapons material to the Admiralty or to ourselves. (See "X" and "Y" of Mr Lester's letter of 23 April).

2. The returned weapons material available for "sale" will relate to Red Beards which will be made available from 1966-67 up to about 1971-72; Green Grass which should have been already returned and in stock, and Red Snow which will be gradually coming back up to and including 1971-72. To ascertain the historical average cost of the material contained in these returned weapons I have gone back as far as 1957-58 in the case of U235 and 1958-59 in the case of plutonium - I think any delving into earlier years would be unrealistic since fissile prices in the very early years were very high indeed. I have listed the sales of material which can be attributed in each year to the three weapon systems and have calculated average cost per kg for the two materials which result in prices of £79,500 per kg for plutonium in £19,500 for U235. The calculations are as follows:-

3. (a) Red Beards

						£M
1958-59	Pu	88 kg	@	£108,000	=	9.5
1959-60		152		92,000	=	14.0
1960-61		83		70,000	=	5.8
1961-62		77		64,000	=	4.9
		400				34.2

(Average cost per kg = £85,000)

(b) Green Grass

1957-58	U235	262 kg	@	£24,000	=	6.3
1958-59		407		21,000	=	8.5
1959-60		827		18,500	=	15.3
1960-61		683		19,000	=	13.0
		2179				43.1

(Average cost per kg = £20,000)

(c) Red Snow

1960-61	U235	432 kg	@	£19,000	=	8.2
1961-62		852		19,000	=	16.2
		1284				24.4

Less Surplus not used for Red Snow program and carried on P(R)S Vote at 31.3.62	U235	142 kg	@	£19,000	=	2.7
		1142				21.7

Red Snow						
1960-61	Pu	35 kg	@	£70,000	=	2.5
1961-62		158		64,000	=	10.1
		193				12.6
Less Surplus not used for Red Snow program and carried on P(R)S Vote at 31.3.62	Pu	16	@	£64,000	=	1.0
		177				11.6

(Average costs per kg -U235 = £19,000; and Pu = £65,000)

(d) SUMMARY	kg	£M	Av price per kg
(1) Plutonium			
(a) Red Beards	400	34.2	
(c) Red Snows	177	11.6	
	577	45.8	£79,500
(2) U235			
(a) Green Grass	2179	43.1	
(b) Red Snow	1142	21.7	
	3321	64.8	£19,500

4. I have also recalculated the P(R)S Vote balances - see Appendix I attached, and estimated the charges out of the P(R)S Vote - see Appendix II attached. These assessments have been based on the usage priorities as listed in Dodd's letter to Henderson of 15 April which were subsequently agreed at the Treasury on 22 April. The Appendices are more or less in the same form as I supplied to Cuzner and Fordham in December last, and and I will send these revised schedules out in due course unless any revisions appear to be necessary.

5. However if we now consider the fissile material costs, prices and valuations position the picture obtained seems to be a most confused one. For example the following different range of prices are now "possibles" and it is up to the person carrying out each different calculation or assessment to sort out and use the correct price having first of all satisfied himself that there is sufficient material of that particular paper classification available:-

6(a) PLUTONIUM

(1) Material charged to Ministry of Aviation up to 31.3.64 and paid for out of P(R)S Vote - but held by AWRE on behalf of Ministry of Aviation:- in AEA books stands at NIL VALUE but for charging out of P(R)S Vote by Ministry of Aviation - £78,500 per kg.

(2) Returned weapon material owned by Ministry of Aviation but held by AWRE on behalf of the Ministry:-in AEA books stands at NIL VALUE but for charging out by Ministry of Aviation if AEA wants any for trials etc - £79,500 per kg.

NOTE FOR THE RECORD

Discussion at Risley on 15 February 1965 between:

Mr M. Parkin
Mr C. Bradley
Mr J. Jefferson
Mr G. Worthington

1. The main purpose of the discussion was to agree future charges for plutonium for Barter A, Barter B, and Military in the light of revised Program A requirements.

2. Plutonium deliveries against the three programs were agreed as:

Kgs

	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70
Barter A	80	80			60	60
Barter B		500	750	1125	1315	300
Military			160	300	125	50

3. The costs chargeable against these deliveries were agreed as:

£M

	1964-65	1965-66	1966-67	1967-68	1968-69	1969-70
Barter A		0.64			0.32	0.32
Barter B	4.40	5.00	9.47	5.80	4.39	1.81
Military (A Grade)	1.70	1.83	4.60	3.34	3.61	1.16

4. Whilst the totals of these charges were acceptable in that they were about the same (Military) or less (Barter B) than previous estimates, there were two features which might cause concern:

(i) the cost of £9.47M in 1966-67 four Barter B.

(ii) costs to the Military in 1964-65 and 1965-66 when there were no deliveries of the new plutonium.

In respect of (i) it was noted that if Military was charged a flat rate for U235 deliveries the excess recovery in 1965-66 (about £2.5M) would cover the shortfall of £2M in 1966-67. (It was also agreed that Military should not be advised that total cost of Barter B might be as low as £31M. It could be higher

E72 page 1

Note from F.D. Marshall to Mr A.E. Drake, copied to Mr Hudspith.

Tritium Barter.

One of the points raised by Exchequer and Audit Department on the 1964-65 accounts related to the costing of Plutonium produced to meet the Tritium barter. On being assured by Mr Harris and Mr Bundy that an adjustment could be made in 1965-66 or in later years, they decided not to press the point on the 1964-65 accounts. They have, however, now raised the matter a gained with me.

In the autumn of 1962 you ruled that the barter would be met wherever possible with Plutonium from non-concessionary fuel from the civil reactors. Only if this were not possible would suitable plutonium from Calder and Chapelcross be used as a result of this ruling it was assumed that the Tritium Barter fuel would be processed through the civil part of B.205 and would bear a proportionate share of the fixed reprocessing costs.

The above ruling was incorporated in a paper submitted by Mr Simone to the first meeting of the Magnox Reprocessing Working Group in April 1963. In the discussion on this paper the following points were made: -

(a) The Tritium Barter was essentially a military deal and it could therefore be argued that the plutonium should be be processed in the military part of the plant.

(b) Against this the last four years of the Barter (1966-67 to 1969-70) were optional. If the option were taken up the amount of plutonium available for civil purposes would be reduced by the amount involved; if it were not, this plutonium would be left in several hands.

The meeting considered that (b) above was the predominant consideration, and agreed that the material should be dealt with through the civil portion of B205.

In 1964-65 there was no suitable civil material available and therefore fuel from Calder was used to meet the Tritium Barter requirement. Exchequer and Audit Department are therefore arguing that:

(a) as the actual source of the material was Calder which was military standby capacity and:

(b) as the end use of this material was military:

the material should have been processed through the military part of the plant.

I have told them that I was prepared to refer this matter to you for further consideration. Unfortunately I have not been able to obtain from Mr Simone any background papers on which you based your ruling in 1962.

Can we please discuss.

Signed
F.D. Marshall.
Dated 17 December 1965.

E73 page 1.

Note from Mr Hudspith to Mr Marshall, 20 December 1965.

Tritium Barter.

1. We have not as yet been able to trace the background papers relating to Mr Drake's decision in 1962 that the plutonium required for the Tritium Barter should be regarded as derived from CEGB irradiated fuel. But I think the logic of this decision - which is still defensible - is: -

(i) In 1962, before the defence settlement, Calder and Chapelcross were operated to produce Grade 'A' plutonium only. Irradiation is certainly went above 600 MWD, but the limit was something like 1,000 MWD (I believe) because Aldermaston could get the right type of plutonium by a certain amount of averaging between different irradiations, although their ability here was limited.

(ii) In the SMD tables at that time the only distinction in plutonium quality was between military Grade 'A' (Calder and Chapelcross) and civil Grade 'O' (CEGB).

(iii) For the Tritium Barter the Americans were prepared to take plutonium which had been irradiated up to 1,100 MWD.

(iv) There was therefore every advantage, physically and financially, in safeguarding our supplies of Calder Grade 'A' plutonium and using for the Tritium Barter the "dirty plutonium" expected to arise from CEGB operations. (Some Grade 'O' was beginning to emerge from the Calder operations but, I think, this was relatively insignificant.)

2. Since 1962 we have had the terminal settlement and the operation of Calder and Chapelcross for electricity production. This has led to the production of considerable quantities of Grade 'O' material. This material is sold to Windscale at £500 per tonne of irradiated fuel and gives us Grade 'O' plutonium at a relatively small price. But this material and its price have only emerged as a result of the new basis of Calder/Chapelcross operation. We are entitled to make what use of this material we can on the civil side and, in my view, the Defence Departments have no right to it. All they are entitled to from Calder/Chapelcross is the production of Grade 'A' or other military material as necessary, chargeable at full extra costs.

3. It seems to me therefore that we are perfectly within our rights in maintaining that the subsequent defence settlement and civil operation of Calder/Chapelcross have no bearing on the perfectly right decision made in 1962 to use CEGB plutonium for the Tritium Barter. It might be slightly cheaper to the Defence Departments to use Grade 'O' material arising from Calder, but this is not in point because they have no claims to the material.

4. My argument so far has been directed to updating and re-establishing the reason for using CEGB plutonium for the Tritium Barter. Given that CEGB material is the proper material for this barter, there can surely be no question that the

reprocessing costs on it should relate to the civil/uranium barter streams of the B.205 plant. It would be wrong to put civil plutonium from the CEGB through the military (i.e. Calder/Chapelcross) stream of the plant where the capital charges have been written off. It is plutonium which we are selling and the source of the plutonium should, in my view, determine the stream of the B.205 plant to which it is allocated. If this plutonium did not bear its proper share of the civil/uranium barter cost streams some other customer for CEGB Grade 'O' plutonium would have the charges to him increased.

5. Finally, the third leg of the argument. Because CEGB plutonium has been slow to come out and because as a result of later decisions some Grade 'O' plutonium has been available from Calder/Chapelcross, material from the latter source has in fact been used for Tritium Barter purposes. But this is no more than a short-term borrowing on a quantity basis, and the "swap" should be regarded as restored when sufficient CEGB material is available.

6. Would you like jointly to have a shot at convincing the Exchequer and Audit Department on these lines?

Signed
H.C. Hudspith
20 December 1965.

END OF FILE.