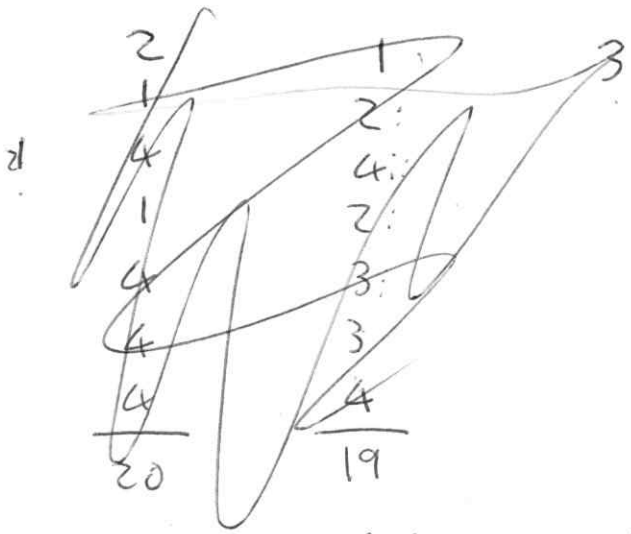
Combination of relative factors

	Early replacement	Late replacement	Remanufacture of pit &/or HEU	No replacement
Reliability	2nd most reliable	Most reliable	3rd most reliable	Least reliable
Warhead Accident	Lowest risk	2nd lowest risk	Highest risk	Highest risk
Radiation risk to workers	Highest risk	Highest risk	2nd lowest risk	Lowest risk
Beryllium risk	Lowest risk	2nd lowest risk	Highest risk	3rd lowest risk
Cost	Highest cost	3rd lowest cost	2nd lowest cost	Lowest cost
US dependence	Most dependent	3rd least dependent	2nd least dependent	Least dependent
International impact	Worst effect	Worst effect	2nd least effect	Least effect



	Early	Late	Reman	No
Safety Total	6	8	10	8
↓	1	2	4	3

	Early	Late	Reman	No
Reliability	2	1	3	4
Safety No ws	1	2	4	3
Cost	4	3	2	1
	7	6	9	8
Addas dp	4	3	2	1
	11	9	11	9

Projected analysis of options

The following is an estimate of what the MoD may be thinking.

The basis question is:

"What is the *best* way to provide warheads for nuclear submarines until 2055"

The key factors determining the best option are:

a. Reliability
b. Safety
c. Cost
d. Dependence on US support
e. International impact

The analysis below considers a number of basic options:

1. Early replacement (2024)
2. Late replacement (2035-2040)
3. Remanufacture of plutonium pit and/or HEU secondary
4. No replacement and no remanufacture of plutonium pit or HEU secondary

a. Reliability

Reliability is defined in terms of the probability of producing the desired yield on the target.

High reliability requires:

Low risk of a major problem which would affect reliability
Surveillance programme which can detect reliability problems
Infrastructure which can deal with reliability problems by modifying or replacing components and warheads

The ability to develop a new design that is more reliable than the current design is highly questionable. The table below assumes that the objective of designing and manufacturing a more reliable warhead is achievable, but that the new warhead would be more reliable if its development was delayed.

Reliability	**Option**
Most reliable	Late replacement
	Early replacement
	Remanufacture of pit and HEU
	Remanufacture of pit or HEU
Least reliable	No replacement

b. Safety

Safety includes the risk of a nuclear warhead accident and the radiological, explosive and toxic hazards to workers.

Nuclear Warhead Accident Risk

The table below compares the risk of the accidental explosion of a warhead during transport, storage or in service.

Risk of accidental explosion	**Option**
Lowest Risk	Early warhead replacement
	Late warhead replacement
Highest Risk	Pu/HEU remanufacture and No Warhead Replacement

There is a particular risk of an explosion when explosive is attached to pits and removed from pits at Burghfield. The table below is an estimate of the number of explosives operations that would be carried out on the stockpile. It assumes that HE and IHE would both need to be replaced after 16 years.

	Early Warhead Replacement	**Late Warhead Replacement**	**Pu or HEU Re-manufacture**	**No Warhead Replacement**
HE				
Remove	2	3	4	4
Install	1	2	3	3
Total ops	3	5	7	7
IHE				
Remove	2	1	-	-
Install	2	1	-	-
Total ops	4	2	-	-
Total ops	7	7	7	7

HE operations are significantly more hazardous than IHE operations. So the risk ordering of the options is the same as for warhead transport, storage and service.

Radiological risks to workers

The table below considers the radiation risks to workers. This is based on the number of times plutonium and HEU components would be built and dismantled.

	Early or Late Replacement	**Pu pit Remanufacture**	**HEU Remanufacture**	**No Replacement**
Pu Pit				
Build	1	1		
Dismantle	2	2	1	1
Total ops	3	3	1	1
HEU				
Build	1		1	
Dismantle	2	1	2	1
Total ops	3	1	3	1
All ops	6	4	4	2

On this basis the order of risk of options is

Radiation risk to workers	**Option**
Lowest risk	No replacement or remanufacture
	Remanufacture of pit or HEU
Highest risk	Early or Late replacement and Remanufacture of both pit and HEU

Beryllium risk to workers

The manufacture and dismantling of Beryllium is a toxic hazard to the workforce. This table assumes a small level of ongoing Beryllium operations while warheads containing Beryllium are in service.

	Early Replacemnt	**Late Replacemnt**	**Pu pit Remanuftr**	**HEU Remanuftr**	**No Replacemnt**
Assemble Be shell	-	0.1	1	0.2	0.2
Dismantle Be shell	1	1	2	1	1
Total ops	1	1.1	3	1.2	1.2

On this basis the order of risk of options is

Beryllium risk to workers	**Option**
Lowest risk	Early warhead replacement
	Late warhead replacement
	No warhead replacement and remanufacture of only HEU
Highest risk	Remanufacture of pit

c. Cost

Relative cost	**Option**
Lowest cost	No replacement
	Remanufacture of pit or HEU
	Remanufacture of pit and HEU
	Late replacement
Highest cost	Early replacement

d. Dependence on US support

Greatest dependence	**Option**
Least dependent	No replacement
	Remanufacture of pit and/or HEU
	~~No~~ Late replacement
Most dependent	Early replacement

e. International effect

Negative international effect	**Option**
Least effect	No replacement
	Remanufacture of pit and/or HEU
Greatest effect	Early or Late replacement